ANNEXURE II - TECHNICAL REPORT

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1.1 BACKGROUND

National ***Highways Authority of India (NHAI)*** has completed the "Construction of proposed Narnaul Bypass (design length 24.0 km) & Ateli Mandi to Narnaul section of NH-11 from km 43.445 to Km 56.900 (design length 14.0 km) as an Economic Corridor & Feeder route in the state of of Haryana on Hybrid Annuity Mode". This Project was awarded to ***M/s H.G. Infra Engineering Ltd., Jodhpur*** by NHAI on 28.02.2019 for a Concession Period of 15years. ***M/s H.G. Infra Engineering Ltd.*** has incorporated the SPV ***M/s H.G. Ateli Narnaul Highway Pvt. Ltd.*** to act as the Concessionaire for the project. The Concession Agreement was signed on 27th May 2019 and the COD was issued on 11th March 2022.

M/s Resotech Consultancy Services Pvt. Ltd. has been engaged as Technical/Engineering Due Diligence Advisor for ***M/s Highway Concession One Pvt. Ltd. ("HC")*** for thepurpose of carrying out a Technical Due Diligence for the said Project.

1.2 PROJECT ROAD DESCRIPTION

The Project Road includes Ateli Mandi to Narnaul section of NH-11 which starts from Ch. 43+445 and ends at Ch. 56+900 (Design Length 14 km) & Narnaul Bypass ((Design Length 28.000 km) in the state of Haryana. The Project Road is a section which is heading towards the Industrial town of Narnaul. The Project Road has a length of 40.81 km. The location map of the project road is shown in fig. 1.1 below:

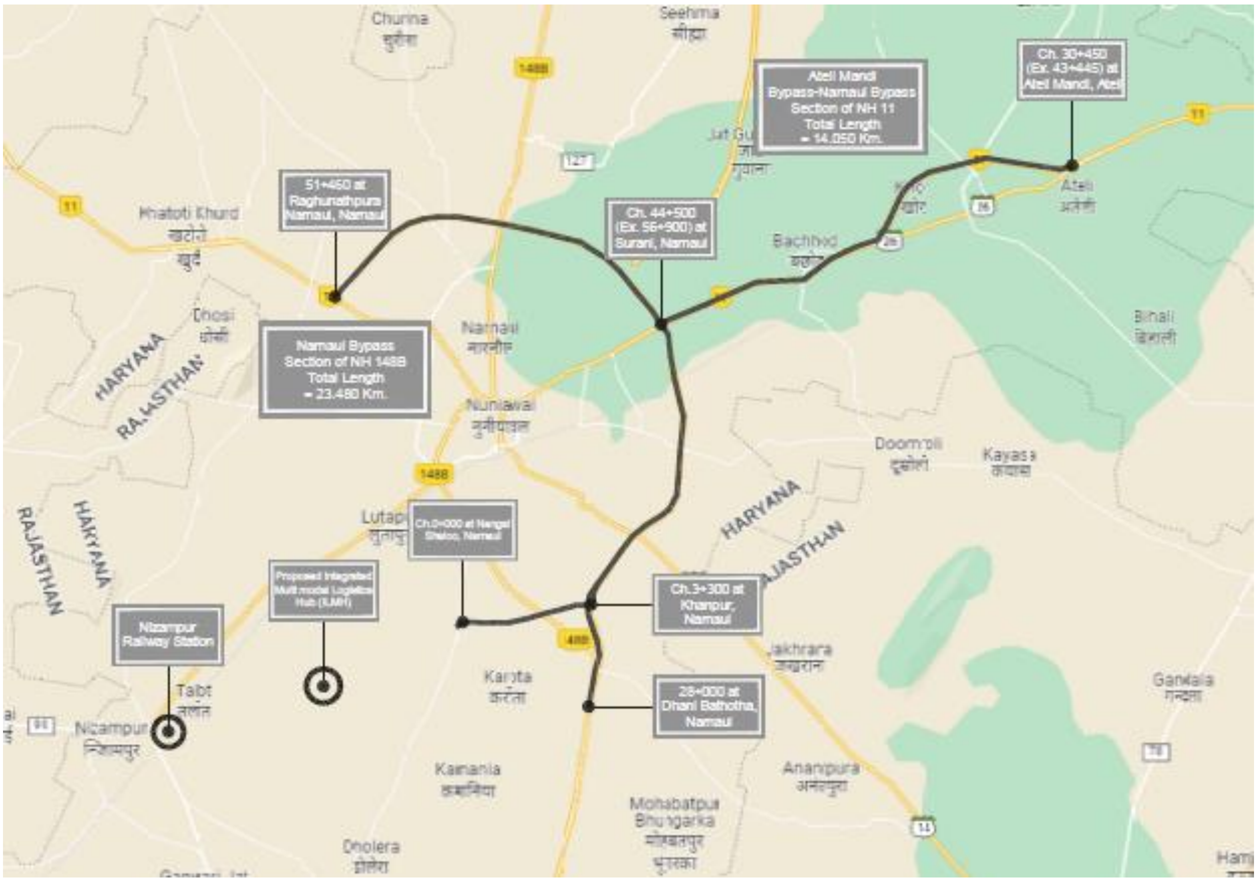

Fig 2.1: Project Road Map

1.3 SALIENT FEATURES OF THE PROJECT

Some of Sailent details of the Project as per the CA are mentioned in the Table 1.1 below:

Table 2.1: Salient features of the project

S. NO	PARAMETER	DESCRIPTION
A.	**Basic Details**	
1	Project Name	Construction of Narnaul Bypass & Ateli Mandi to Narnaul section of NH-11 from Km 43.445 to km 56.900 as an Economic Corridor & Feeder Route in the state of Haryana on Hybrid Annuity mode
2	State	Haryana
3	Client	National Highways Autority of India
4	Highway	NH -148 B & NH-11
5	Concession Period	15 years
6	Effective Length of the Project	40.810 km
B.	Contract Details	
1	Concessionaire	M/s. H.G.Ateli Narnaul Highway Private Limited
2	EPC Contractor	M/s H.G. Infra Engineering Limited
3	Bid Price	871.28 Cr.
4	Bid Project Cost	952.11 Cr.
5	Estimated Bid Project Cost	765.50 Cr.
6	First year O&M cost	5.00 Cr.
7	LOA	27.05.2019
8	Appointed Date	28.02.2020
9	Construction Duration	910 days
10	Construction Completion Certificate	11.03.2022
11	Concession Period End	10.03.2037
C.	Project Details	
1	Roadway	1. Six Lane with paved shoulder- 14.00 km; Four lane with paved shoulder-9.46 km (Narnaul Bypass) 2. Four lane with paved shoulder-14.05 km (Ateli-Narnaul feeder road) 3. Four lane with paved shoulder-3.30 km (ILMH feeder road)
2	Pavement Type	Flexible
3	Service Road/Slip Road	50.280 km
4	Railway Over Bridge	01 no.
5	Flyover	03 nos.
6	Vehicular Underpass	16 nos. (including Vehicular Overpass–1 no. & LVUP-1 no.)
7	Pedestrain Underpass	16 nos.
8	Major Bridge	01 no.
9	Minor Bridge	05 nos.
10	Culverts	Box Culverts - 61 nos. (including cross road culverts – 16 nos.)
11	Major Junctions	02 nos.
12	Minor Junctions	Nil
13	Rest Area cum Truck Lay Bye	02 nos. both side at Ch. 32+000
14	Bus Bay	13 nos.

1.4 SCOPE OF WORK FOR THE STUDY

1.4.1 GENERAL

a. Review of all documents related to Project including but not limited to Concession Agreement, Supplementary agreements, provisional completion certificates, punch list items completion certificate, clearances, monthly IE reports, correspondence etc.

b. Review of Change of Scope/ other Claims submitted and to be submitted to Authority / IC, comment on the veracity of the same and approval status.

c. Highlight any non-compliance of the terms of the CA or O&M manual and IC inspection reports etc.

d. Review of any pending issues related to Utility shifting, maintenance etc. in accordance with the Concession Agreement.

e. Comment on issues including any balance work that may have a potential impact on the maintenance costs going forward and which may warrant a one-time expense in future.

f. In general review the ATMS/HTMS and the hardware installed therein and comments on the adequacy and level of maintenance of the same to meet the requirement under CA.

g. Review of As-Built drawings.

h. Determine the appropriate level and frequency of routine and major maintenance activities required to keep the road assets in good condition and to meet the performance and O&M standards, specifications and requirements.

i. Review the major maintenance work undertaken, and prepare projections for future major maintenance expenses (incl. any hand-back requirements), so as to ensure compliance with the terms of CA.

j. Review of condition of SPV assets including all equipment and vehicles etc.

k. Report on balance acquisition of land if any and possibility of acquisition.

l. Report on current encroachments on the project stretch and future expected problems due to the same.

m. Report on the possibility of project augmentation.

n. Report on hydrological conditions of adjoining water bodies, rivers etc. and possibility of damage to project due to flood situations.

o. Review of all documents related to construction of project including correspondence exchanged between NHAI, IE, Concessionaire, pavement design report, mix design report for all layers, quality control and quality assurance plan, Work Programme, Methodology, O&M manual, design of structures, IC inspection repots etc.

1.4.2 ASSESSMENT OF ASSET CONDITION

a. Assessment of road assets in conformance with specifications, standards and codes stipulated in CA and O&M manual etc.

b. A detailed inventory survey of road assets including main carriageway, structures, service roads, lightings, drains, slope protection works, retaining walls, bus bays, bus shelters, truck lay byes, O&M center, road furniture including signages, MBCB, guard rails etc. other safety measures, plantation, vehicles and other objects.

c. Assessment of condition of the structures including but not limited to visual inspections of bearings, expansion joints, superstructure, substructures, foundations, associated components, pre-stress anchorages (if any), review of geotechnical assumptions, perform geotechnical due diligence, review as-built design and assess design assumptions and provide a detailed report thereon.

d. Assessment of condition of the road pavement including but not limited to visual inspections of the pavement, review as-built design and assess design assumptions and provide a detailed report thereon.

e. Assessment of physical dimensions/ condition of the infrastructure to determine useful lives of the materials and equipment requiring rehabilitation and/or replacement.

f. Assesssment of physical dimensions/condition of the infrastructure to determine useful lives of the materials and equipment requiring useful lives of the material and equipment requiring rehabilitation and/or replacement.

g. Assessment of variation/COS orders on the project, if any, and evaluate their impact on expenditure, time to completion, future O&M obligations.

h. Comments on the pavement crust composition (Design vs Actual) for Rigid/Flexible pavement as the case may be.

i. Recommendations for any major repair/ rehabilitation and strengthening based on the condition survey and design reports.

j. To provide a detail photographic report of the infrastructure assets and its condition to withstand till end of concession period. Suggestion and cost evaluation for any additional repair / rectification / modification required.

k. Review and reporting on (i) Quality (ii) Safety (iii) Environmental (iv) Timelines/Progress (v) Cost.

1.4.3 INVESTIGATIONS TO BE CARRIED OUT

a. Assessing maintenance needs and its valuation according to the level of deterioration.

b. Evaluation of overall condition of flexible pavement including PQC/ BT at toll plaza, BC, DBM, Base/Sub base and sub grade and drainage condition survey.

c. Carry out visual condition survey for rigid (toll plaza) and flexible pavement.

d. Carryout FWD test for entire road length along outer and inner lane to ascertain the adequacy of the pavement structure for expected traffic loads.

e. Carry out NSV in each lane of carriageway and carry out any other test required for Flexible pavement/Rigid pavement.

f. Carryout Axle load survey at Toll Plaza locations for the assessment of axle loading pattern and estimation of VDF. Assessment of traffic loading in terms of MSA based on VDF as obtained and Traffic Projection and comment on the road construction and design on the basis of the Traffic Volume Count (3 days).

g. NDT test on Major/Minor bridges if any required based on visual observations.

h. Carry out drainage survey to asses any potential future problems which will cause by moisture and runoff.

1.4.4 O&M ASSESSMENT AND SUBMISSION OF REPORTS

a. To Develop a detailed O&M cost forecast for each year of the concession period and a detailed major maintenance cost forecast along with estimation of costs towards handover requirements.

b. Provide detailed Due Diligence Report.

CHAPTER 2.0: DOCUMENT REVIEW

2.1 PROVISIONAL CERTIFICATE:

The Provisional Certificate for the Project was issued by IE with effect from 11.03.2022 vide letter dated 31.03.2022. The balance works were listed in the punch list Annexure -A & B. The Annexure-A contained the list of minor works to be completed within 90 days while Annexure-B contained balance works to be completed within 90 days of handing over of the land.The punch list-A contained minor items like kerb painting, completion of boundary wall gaps, repairing of chute drains, cleaning of drain, side slope, crash barrier painting, construction of median wall, providing high mast light etc. The details of items in annexure-B of punch list are provided the table no. 2.1 below:

Table 2.1: punch list for balance works to be completed within 90 days of handing of land

S. NO.	DESCRIPTION	STATUS AS ON 07.06.2022
1.0	Balance Length of Main Carriage Way	
A	40+000 to 40+500 LHS (U-turn _Loop Area) Narnaul Bypass	Complete
B	40+530 to 40+719 RHS (U-turn _Loop Area)- Narnaul Bypass	Complete
C	40+719 to 40+950 RHS (U-turn _Loop Area)- Narnaul Bypass	Complete
D	52+260 to 52+380 RHS (Trumpet RAMP-MCW)- Narnaul Bypass	Complete
E	0+000 to 0+900 BHS (ILMH)	Complete
2.0	Balance Length of Service Road	
A	51+380 to 51+460 LHS (NBP)	Complete
3.0	Balance (0.900km) for Road Sign, Marking pending in ILMH, UTURN, TRUMPET	
A	0+000 to 0+900 BHS (ILMH)	Complete

2.2 COMPLETION CERTIFICATE

The appointed date for the project was 28/02/2020 with stipulated date of completion as 25/08/2022 the date of completion has been extended to 21/11/2022 vide NHAI letter dated 25/01/2021 and extension of time was approved up to 26/12/2022 vide NHAI letter dated 13/11/2022

However , subsequent to completion of all balance items of work by the Concessionaire, the Completion Certificate for the project was issued for complete length of 40.810 Km by the IE Vide letter dated 09.09.2022.

2.3 BONUS ON EARLY COMPLETION:

NHAI has accorded the approval for bonus payment vide their letter dated 13.11.2022. The days for early computation of bonus have been worked out to 168. Extension of time have been approved 26.12.2022. The amount of Bonus worked out as per clause 23.5 has been worked out and recommended as Rs 18.87 Cr by the IE to the Authority vide dated 22.11.2022.

2.4 REVIEW OF CONCESSION AGREEMENT

Our observations on the significant relevant provisions of the Concession Agreement are brought out in the sub paras below**.**

2.4.1 SPECIFIC COMMENTS ON ARTICLES OF CONCESSION AGREEMENT

The Project has been provisionaly completed and is presently under the Operation & Maintenance Period. We have reviewed the major provisions of the Concession Agreement, and our specific comments on the same are indicated in table 2.2 below:

Table 2.2: Comments on Concession Agreement

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
1	Recital A	Scope of project	Construction of proposed Narnaul Bypass (design length 24.0 km) & Ateli Mandi to Narnaul section of NH-11 from km 43.445 to Km 56.900 (design length 14.0 km) as an Economic Corridor & Feeder route in the state of Haryana on Hybrid Annuity Mode which shall be partly financed by the Concessionaire who shall recover its investments and costs through payments to be made by the Authority in accordance with the terms and conditions of the Concession Agreement.	Construction work was completed, and COD was issued on 11.03.2022. The project is now in the O&M phase.
2	Recital E	Incorporation of Special Purpose Vehicle (SPV)	The sole purpose of the Concessionaire is to exercise the rights and perform its obligations and liabilities under the Concession Agreement.	The Concessionaire, ***M/s H.G. Ateli Narnaul Highway Pvt. Ltd*** was incorporated, exclusively for the project as a limited liability company under the Companies Act 2013 and has entered into the Concession Agreement with the Authority.
3	Article 3, clause 3.1,	Grant of concession, the concession period	Grant of the concession includes the exclusive right, license, and authority to construct, operate and maintain the Project (the "Concession.") during	The Appointed Date was 28.02.2020. Construction period commenced from the Appointed Date and the Operation period of 15 years commenced from COD i.e 11.3.2022

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
			the Construction period of 910 days and Operation Period of 15 years commencing from the Commercial Operation Date.	
4	Schedule G	Project Completion Schedule	Project Milestone -I /II/III shall occur on the date falling on the 225th/ 450th / 675th day from the Appointed Date, respectively. The scheduled completion Date shall occur on the 910th day from the Appointed Date. Upon extension of any or all of the aforesaid Project Milestones or the scheduled 4 laning Date, the Project Completion Schedule shall be deemed to have been amended accordingly.	Project Milestone I, II & III were achieved before the scheduled dates. The scheduled 4 laning was achieved within the rescheduled timeline.
5	4.2,4.3	Damages for delay by the Authority/Concessionaire	For the default of the Authority to procure fulfillment of any or all the Conditions Precedent outlined in Clause 4.1.2, the Authority shall pay to the Concessionaire damages in an amount calculated at the rate of 0.2% of the Performance Security for each day's delay until the fulfilment of such Conditions Precedent, subject to a maximum limit equal to the amount of bid security and upon reaching such limit the Concessionaire may terminate the agreement For the default of the Concessionaire to procure fulfilment of any or all the Conditions Precedent outlined in Clause 4.1.3, damages to be paid by the	No such damages have been imposed.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
			Concessionaire to the Authority shall be calculated @ 0.3% of the performance Security for each day if delay subject to a maximum limit equal to the amount of bid security and upon reaching such limit the Authority may terminate the agreement	
6	5.1.2	Applicable laws and permits	The Concessionaire shall comply with all Applicable Laws and Applicable Permits.	The Concessionaire shall be responsible for procuring and renewing all applicable licenses and permits required to execute works during the Construction and O&M period.
7	5.2.4	Substitution agreement provision	The Concessionaire shall procure that each of the project Agreements contains provisions that entitle the Authority and / or Lender's Representative to step into such Agreement in substitution of the Concessionaire in the event of termination or suspension.	The Authority or Lender's Representative can substitute the Concessionaire, if so required, by exercising this provision as per the terms and conditions of the Concession Agreement.
8	5.2.5	Selection / Replacement of EPC Contractor and an O & M Contractor	The Selection / Replacement of EPC Contractor and an O & M Contractor shall be subject to prior approval of the Authority.	The approval of the Authority shall be limited to national security and public interest perspective only.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
9	5.3, 7.1 (k)	Obligation related to Change in Ownership	The Concessionaire shall not undertake or permit any change in ownership except with the prior approval of the Authority. It shall at no time undertake or permit any Change in Ownership except in accordance with the provisions of Clause 5.3 and that the selected bidder, together with its Associates, hold not less than 51% of its issued and paid-up Equity as on the date of the Concession Agreement.	Acquisition of 25% or more equity of the Concessionaire and/or acquisition of any control directly or indirectly of the Board of Directors shall constitute a Change in Ownership. The requirement of the Authority's approval is limited to national security and public interest perspectives only. Default from the Concessionaire in complying with this clause entitles the Authority to terminate the Concession Agreement.
10	5.7	Branding of Project Highway	The Project Highway or any part thereof shall not be branded in any manner to advertise, display or reflect the name or identity of the Concessionaire or its shareholders.	The Project Highway shall be known, promoted, displayed, and advertised by the name of Construction of proposed Narnaul Bypass (Design Length 24 km) & Ateli Mandi to Narnaul section of NH-11 from km 43.445 to km 56.900 (Design length 14 km)
11	8.1.5	Project risk	Except as otherwise provided in this Agreement, all risks relating to the Project and performance of it's obligations shall be borne by the Concessionaire.	The Authority shall not be liable in any manner for risks, or consequences thereof, which are not explicitly attributed to the Authority in the Concession Agreement.
12	9.4 and 9.5	Deemed Performance Security	These Clauses are deleted in this Agreement	
13	10.3.2 and 10.4	Procurement of the site	It is the Authority's Obligation to grant vacant access and Right of Way such that the Appendix (Containing those parts of the Site to which vacant access and Right of Way has not been granted to the Concessionaire) shall not include land which shall prevent the Concessionaire from	The work has been completed in the entire length.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
			undertaking construction of the Project to the extent of at least 80 % of the length, on or prior to the Appointed Date. The site provided by the Authority is to be free from all encumbrances and occupations.	
14	10.3.6, 1.3 of Sch A	Procurement of Additional land	If required the Authority shall procure the additional land needed for Toll Plazas, Traffic Aid Posts, Medical Aid Posts, underpasses, and overpasses or construction of works specified in the Change of Scope.	Upon acquisition, such land shall form part of the site and vest in the Authority.
15	11.2	Shifting of obstructing utilities	The Concessionaire shall undertake to shift utilities that causes or shall cause a material adverse effect on the construction, operation, or maintenance of the Project Highway.	The cost of such shifting shall be borne by the Authority / the entity owning such utility. The Concessionaire shall not be held responsible for failure to meet any obligation on account of any delay is shifting of the utilities if the delay is on the part of the entity owning the utility.
16	11.3	New utilities	The Concessionaire shall allow access to, and use the Site to lay telephone lines, water pipes, electric cables, or other public utilities as per the conditions specified by the Authority.	Where such access or use causes any financial loss to the Concessionaire, it may require the user of the Site to pay compensation or damages as per Applicable Laws.
17	11.4	Felling of Trees	Authority shall assess the Concessionaire in obtaining the Applicable Permit for felling of trees	The cost of felling of such trees shall be borne by the Authority. The Concessionaire shall not be held responsible for failure to meet any obligation on account of any delay in felling of the trees for reasons beyond the control of the Concessionaire.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
18	12.2	Drawings	The Concessionaire shall prepare and submit all drawings specified in Sch. H for review of the Independent Engineer. Within 90 days of COD the Concessionaire shall submit complete set of As Built Drawings to the Authority and the IE.	Any review of drawings by the IE or it's failure to review the drawings shall not relieve the Concessionaire of it's obligations and liabilities under the Agreement.
19	12.3	Construction of The Project	The Concessionaire shall undertake Construction of the project as specified in Schedule B and Schedule C and in conformity with the Specifications and Standards set forth in Schedule D on or after the Appointed Date. The 910th day from the Appointed Date shall be the Scheduled Completion Date.	The Concessionaire shall construct the Project in accordance with Project Completion Schedule as per Sch G and in case of any delays in achieving any milestone beyond a period of 90 days the Concessionaire shall pay Damages to the Authority at the rate of 0.1 % of the Performance Security for each day of delay. However, such damages shall be refunded by the Authority if the Concessionaire is able to complete the project before the Scheduled Completion Date.
20	12.4	Maintenance during the construction period	During the Construction Period, the Concessionaire shall maintain the existing Project Highway to ensure that the road is in pothole free condition	The Concessionaire shall bear the cost of Maintenance. For Failure on the part of the Concessionaire to meet the obligations the Authority may recover damages @ 0.2 % of the Performance Security for each day of delay.
21	14.2 and 14.3	Completion Certification and Provisional Certificate	The Completion Certificate shall be issued to the Concessionaire by the IE on completion of Construction works and on determining the Tests for Completion to be successful. A provisional certificate may be issued even though certain works are yet to be completed. The	Provisional Certificate and Completion Certificate was issued on 11.3.2022.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
			list of outstanding items of work shall be appended thereto in the form of a Punch List. The Provisional Certificate can only be issued if the Concessionaire has completed construction of 100 % of the site made available to the Concessionaire up to 182 days from the Appointed Date.	
22	14.4	Completion of Punch List items	All items in the Punch List shall be completed by the Concessionaire within 90 days. This period can be extended for a maximum further period of 120 days. Failure on the part of the Contractor to complete the works shall entitle the Authority to terminate the Contract.	If any item of work mentioned in Punch List is delayed beyond the maximum specified period for reasons solely attributable to the Authority the completion date shall be decided by the IE as per good industry practice and for the purpose of damages the Provisional completion date shall be deemed to be the Date of Completion for such item of work.
23	15.1	Commercial Operation Date (COD)	The project shall be deemed to be complete when a Completion Certificate or a Provisional Certificate is issued. This date shall be the Commercial Operation Date of the project.	The Concessionaire shall be entitled to demand and collect Annuity payments in accordance with the provisions of the agreement on the COD. The COD as per the Provisional Certificate is 11.03.2022
24	16	Change of scope	If the Authority requires the provision of additional works and services not included in the project's scope, the Authority shall issue a change of scope notice.	Any Change of Scope shall be made according to Article 16 of the Concession Agreement. The costs thereof shall be expended by the Concessionaire and reimbursed by the Authority.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
25	16.2.3	Fixing Time and cost for COS implementation	IE shall assist the parties in agreeing upon the time and costs for implementing any change of scope. On reaching an agreement, COS Order shall be issued by the Authority requiring the Concessionaire to proceed with the performance thereof.	In the event, Parties are unable to agree; the Authority may require the Concessionaire to proceed with the performance pending resolution of the dispute.
26	16.3.1	Payment for change of scope	Within 7 days of issuing a Change of Scope Order, the Authority shall make an advance payment to the Concessionaire in a sum equal to 20% (twenty percent) of the cost of Change of Scope.	In the event of a Dispute, 20% (twenty percent) of the cost as assessed by the Independent Engineer shall be paid in advance. The advance payment made shall be settled with bills for payment regarding the work in progress or completed works.
27	16.4.2	Limit on Change of Scope order	The Concessionaire shall be entitled to nullify any Change of Scope Order if it causes the cumulative costs relating to all the Change of Scope Orders to exceed 10% of the Bid Project Cost in any continuous period of 3 years immediately preceding the date of such Change of Scope Order or if such cumulative costs exceed 25% of the Bid Project Cost at any time during the Concession Period.	The Cumulative Cost of the positive change of scope order approved by the Authority is Rs 86.44 Cr (9.1 % of the Bid Project cost approx.).
28	16.5	Power of the Authority to undertake works	After giving notice to the Concessionaire and considering its reply, the Authority may award any works or services contemplated under Change of Scope to any person based on open competitive bidding.	The Concessionaire shall have the option of matching the first ranked bid in terms of the selection criteria, subject to payment of 2% of the bid amount to the Authority. The option can be exercised only if the Concessionaire has participated in the bidding process and does not exceed the first ranked bid by more than 10%

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
29	16.6	Reduction in Scope of the project	In the event, the Concessionaire cannot complete any Construction Works on account of Force Majeure or for reasons solely attributable to the Authority, then the total cost of reduced scope shall be determined by the Authority as under: i) The IE shall determine the civil cost of reduced scope as per SOR applicable on Bid Due Date. ii) The Civil cost shall be determined by 1.06 to arrive at estimated cost of reduced scope. iii) The estimated cost shall be multiplied by the ratio of Bid Project Cost and Estimated Project Cost to arrive at the Total cost of reduced scope.	The Bid Project Price shall be reduced by the Total Cost of Reduced Scope and all references to the Bid Project Cost would mean the revised Bid Project Cost . There is no revision in the Bid Project Cost.
30	16.7	Effect of Change in Scope on the O & M Costs	If the Change in Scope leads to change in the length of the Project Highway , the O & M Payment shall be reduced or increased in proportion to the reduction or increase in the length .	There is no reduction in the length of the Project Highway.
31	18.1	Safety Requirement	The Concessionaire shall comply with the Safety Requirements specified in Schedule L . The Authority shall appoint an experienced and qualified firm or organization (the "Safety Consultant") to carry out a safety audit of the Project Highway in accordance with the Safety Requirements. It shall take all other actions necessary to secure compliance with	All costs and expenses arising out of or relating to Safety Requirements for works and services covered under the Agreement shall be borne by the Concessionaire. Cost for additional provisions will be covered by Change of Scope.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
			the Safety Requirements.	
32	21	Independent Engineer	The Authority shall appoint and Engineering Consultancy Firm to act as the Independent Consultant/ Independent Engineer. As per Clause 3.1 of Sch M, the payments to the IE on account of fees and expenses not exceeding 3 % of the Bid Project Cost shall borne equally by the Authority and the Concessionaire.	The detailed Terms of Reference for the Independent Engineer have been specified in Sch N of the Concession Agreement
33	22.1.1	Financial Close	The Concessionaire shall achieve Financial Close within 150 days from the date of signing of the Concession Agreement and in the event of a delay, it shall be entitled to a further period not exceeding 120 days, subject to payment of damages at the rate of 0.05 % of the Performance Security for each day of delay. A further period of 95 days shall be provided subject to payment of damages at the rate of 1 % of the Performance Security for each day of delay.	The damages payable under this clause shall be in addition to the Damages if any payable under Clause 4.3.
34	23.1	Bid Project Cost	The Bid Project Cost specified in this clause in inclusive of the cost of construction , interest during construction , working capital , physical contingences and all other costs and expenses and charges for and in respect of construction of the project but excludes additional costs on account of variation in Price Index, COS, Change in Law, Force Majeure or breach of this	The Bid Project Cost as on Bid Date shall be deemed to be Rs 952.11 Cr as against the Estimated Project Cost of Rs 765.50 Cr.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
			Agreement payable to the Contractor as per the Agreement.	
35	23.2.1	Adjusted Bid Project Cost	The Bid Project Cost specified in Clause 23.1 shall be revised from time to time to reflect the variation in Price Index occurring after the Reference Index immediately preceding the Bid Date.	The Effect of price variation on the payments to be made to the Concessionaire under the Agreement is covered under this clause.
36	23.3, 23.4 and 23.6	Payment of Bid Project Cost	40 % of the Bid Project Cost adjusted for the Price Index Multiple shall be due and payable to the Concessionaire in 5 equal monthly instalments of 8 % each during the construction period on achieving the following payment milestones: PM -I : 20 % physical progress PM-II: 40% physical progress PM-III : 60 % physical progress PM- IV: 75 % physical progress PM-V: 90 % physical progress The remaining Bid Project Cost adjusted for Price Index Multiple shall be due and payable in 30 biannual instalments commencing from 180th day of COD as percentages of Completion cost remaining to be paid on COD as specified in Clause 23.6.3. The Completion cost is the Bid Project Cost adjusted for variation in Price Index Multiple.	Interest shall be due and payable to the Concessionaire on the reducing balance of Completion Cost at an interest rate equal to the applicable Bank Rate plus 3 %. Interest would be calculated on simple interest basis only.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
37	23.5	Bonus on Early Completion	If COD is achieved on or more than 30 days prior to the Scheduled Completion Date the Concessionaire shall be entitled to a Bonus of 0.5 % of 60% of Bid Project Cost for the first 30 days and thereafter calculated on pro rata basis for each additional day.	Payment of Bonus for early Completion as per this Clause has been worked out to Rs 18.87 Cr for 168 days.
38	23.7	O & M Payment	O & M payments due and payable to the Concessionaire as per amount quoted in the O & M Bid shall paid in 2 equal biannual payment . The O & M Payments shall be adjusted by the Price Index Multiple.	As per the Financial Bid , the first year O & M Cost quoted is Rs 5 Cr. Any O & M expense in excess of the O& M payment shall be borne by the Concessionaire
39	23.9	Treatment of Incomplete works	In the event the COD occurs upon issuance of a Provisional Certificate, the Annuity payments and the O & M payments shall be made as if all works have been completed. The remaining works shall be completed by the Concessionaire within the period specified in the Agreement. In case the Authority determines that any incomplete works are not required to be completed for any reason it will modify the Scope of work in accordance with Article 16 and the Completion Cost , Annuity Payments and O & M Payments shall be reduced on account of the Change of Scope.	All works have been completed.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
40	25	Escrow Account	The Concessionaire shall open an Escrow Account with a Bank before the Appointed Date which will be operated in accordance with the terms of Escrow Agreement to be entered into amongst the Concessionaire, the Authority, the Escrow Bank, and the Senior Lenders through the Lender's Representative.	All funds related to the Financial Package , all payments by the Authority and all revenues from or in respect of the Project shall be deposited in the Escrow Account. All project related expenses shall be withdrawn from the Escrow Account only.
41	26.1	Insurance during Concession Period	The Concessionaire shall affect and maintain at its own cost, during the Construction Period and the Operation Period, such insurances for such maximum sums as may be required under the Financing Agreements, the Applicable Law, and as may be necessary for mitigating the risks that may devolve on the Authority as a consequence of any act or omission of the Concessionaire during the Construction Period.	The Concessionaire shall procure that the Authority shall be a co insured in each insurance policy and that the insurer shall pay the proceeds of insurance into the Escrow Account. Concessionaire to further indemnify the Authority from and against all losses and claims arising from the Concessionaire's failure to comply with conditions imposed by the insurance policies.
42	27.2	Appointment of auditors	The Concessionaire shall appoint and have during the subsistence of this Agreement as its Statutory Auditors, a firm chosen by it from the mutually agreed list of five reputable firms of chartered accountants (the "Panel of Chartered Accountants") prepared in accordance with criteria given in Schedule P.	The Concessionaire shall bear all fees and expenses of the Statutory Auditors.
43	28.1	Force Majeure	Force Majeure shall mean occurrence in India of any or all non-political event, Indirect Political Event and Political event, if it affects a party's	Upon occurrence of any Force Majeure event after the Appointed date but before the COD, the Construction period and the Project Completion Schedule

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
			performance to meet its obligations under the Concession Agreement.	shall be extended by a period equal to the duration for which such Force Majeure event subsists. If such event occurs after the COD the Concessionaire shall be entitled to receive Annuity Payments plus interest payable as per the Agreement. Upon occurrence of a non-political event the Parties shall bear their respective Force Majeure costs. Upon occurrence of an indirect political event all Force Majeure costs not exceeding the insurance cover for such event shall be borne by the Concessionaire and one half of any excess amount shall be reimbursed by the Authority to the Concessionaire. Upon occurrence of a Political event all Force Majeure costs shall be reimbursed by the Authority to the Concessionaire
44	30	Suspension of Concessionaire's Rights	In case of a Concessionaire's Default the Authority may suspend all rights of the Concessionaire under the Agreement and exercise such rights itself or authorise any other person to exercise the same on its behalf during the period of suspension.	The period of suspension shall not exceed 180 days and this period may be further increased by 90 days upon written request from the Concessionaire and the Lender's Representative. At any time during the suspension the Lender's Representative shall be entitled to substitute the Concessionaire in accordance with the Substitution Agreement. The Authority shall withhold the termination for the maximum period allowed for Suspension.
45	31	Termination	On occurrence of a default , if the Concessionaire fails to cure the default within the cure period of 60	Upon termination on account of Concessionaire's default during the Operation Period the Authority shall pay to the Concessionaire 65

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
			days the Concessionaire shall be deemed to be in default of the Agreement , and the Authority shall be entitled to terminate the agreement by issuing a termination notice as per Clause 31.1.2 On occurrence of a default , if the Authority fails to cure the default within the cure period of 90 days the Authority shall be deemed to be in default of the Agreement , and the Concessionaire shall be entitled to terminate the agreement by issuing a termination notice as per Clause 31.2.2	% of the sum of Annuity payments remaining to be paid including interest thereupon up to the Transfer Date. Upon termination during the Construction period the Termination Payment shall be based on the Payment Milestone achieved as specified in Clause 31.3.2. The Termination payment to be paid by the Authority on account of Authority's default have been specified in Clause 31.3.3.
46	33	Defect Liability After Termination	The Concessionaire shall be responsible for all defects and deficiencies in the Project for a period of 120 days after Termination.	Specified amount shall be retained in the Escrow Account for rectification of the Defects for a period of 120 days after Termination.
47	35	Change in Law	If, as a result of Change in Law, the Concessionaire suffers/benefits from an increase in costs or reduction/increase in net after-tax return or other financial burden/gains, an amendment to the Concession Agreement is contemplated so as to place the Concessionaire in the same financial position.	This will be applicable only if the aggregate financial effect exceeds the higher of Rs 1.53 Crore or 2 % of the total Annuity Payments in any Accounting year. The Clauses 35.1 & 35.2 shall be restricted to changes in Law directly affecting the Concessionaire's cost of performing its obligations under the Concession Agreement.

SL. No.	ARTICLE & CLAUSE NO.	SUBJECT	INFORMATION IN BRIEF	REMARKS
48	38.1	Dispute resolution	Any dispute, difference, or controversy arising under or out of or in relation to this Agreement between the Parties, and so notified in writing by either Party to the other Party (the "Dispute") shall, in the first instance, be attempted to be resolved amicably in accordance with the conciliation procedure set forth in Clause 38.2. Any Dispute which is not resolved by conciliation shall be referred to the Arbitration Tribunal in accordance with Clause 38.3	The procedure for Dispute resolution has been clearly specified.
49	41.9	Entire Agreement	This Agreement and the Schedules together constitute a complete and exclusive statement of the terms of the agreement between the Parties, and no amendment or modification hereto shall be valid and effective unless such modification or amendment is agreed to in writing by the Parties and duly executed by persons especially empowered in this behalf by the respective Parties.	This is a standard clause used in Agreements.

2.4.2 O&M REQUIREMENT

Since the Project has been completed provisionally and is presently under the Operation Period, we have separately reviewed the provisions of Article 17 (Operation & Maintenance), Article 19 (Monitoring of O&M), Article 20 (Regulation & Management) and Schedule-K of the Concession Agreement, which pertains to the Operation and Maintenance requirements, and our observations on some of the important clauses there in have been brought out in **Table 2.3** below:

Table 2.3: Comments on O & M requirement as per Concession Agreement

SL. NO	ARTICLE/CLAUSE	SUBJECT	INFORMATION IN BRIEF	REMARKS
1	17.1	O&M Obligations of the Concessionaire	During the Operation Period, the Concessionaire shall operate and maintain the Project Highway in accordance with the Concession Agreement.	The Operation and Maintenance can either be done by the Concessionaire itself or through the O&M Contractor.
2	17.2	Maintenance Requirements	The Concessionaire shall procure that at all times during the Operation Period; the Project Highway conforms to the maintenance requirements set forth in Schedule K.	It needs to be ensured by the Concessionaire.
3	17.3	Maintenance Manual	No later than 90 days prior to the Scheduled Four Laning Date, the Concessionaire shall, in consultation with the Independent Engineer, evolve a repair and maintenance manual for the regular and preventive maintenance of the Project Highway.	The Maintenance Manual shall be revised and updated once every 3 (three) years, and the provisions of this Clause 17.3 shall apply, mutatis mutandis, to such revision.
4	17.4	Maintenance Programme	On or before COD and no later than 45 days prior to the beginning of each Accounting Year during the Operation Period, the Concessionaire shall provide its proposed annual programme of preventive, urgent, and other scheduled maintenance.	The Concessionaire may modify the Maintenance Programme as may be reasonable.
5	17.8	Damages for breach of maintenance obligations	In the event that the Concessionaire fails to repair or rectify any defect or deficiency set forth in the Maintenance Requirements within the period specified therein, the Authority shall be entitled to recover Damages, to be calculated and paid for each day of delay at the higher of (a) 2% of the Performance Security and (b) 0.1% of the cost of such repair or rectification as estimated by IE.	In case of any Dispute in the amount of damages determined the Dispute Resolution Procedure shall apply.
6	17.9	Authority's right to take remedial measures	In the event, the Concessionaire does not maintain and/or repair the Project Road in conformity with the Maintenance Requirements and fails to commence remedial works within 15 days; the Authority shall be entitled to undertake such remedial measures at the risk and cost of the Concessionaire and to recover its cost	In addition to recovery of the aforesaid cost, a sum equal to 20% of such cost shall be paid by the Concessionaire to the Authority as Damages. The Authority shall have the right to recover the cost and damages directly from the Escrow Account.

SL. NO	ARTICLE/CLAUSE	SUBJECT	INFORMATION IN BRIEF	REMARKS
			from the Concessionaire.	
7	19.2	Inspection	The Independent Engineer shall inspect and make a report stating in reasonable detail the defects or deficiencies, if any, on the Project Highway with reference to Maintenance Requirements, Maintenance Manual, the Maintenance Programme, and Safety Requirements.	IE shall inspect the Project Highway at least once a month.
8	19.3	Tests	The Concessionaire shall carry out all the tests specified by the IE for determining that the Project Highway conforms to the Maintenance Requirement and furnish the results of such tests forthwith to the Independent Engineer.	One-half of the costs incurred on such tests, and to the extent certified by the Independent Engineer as reasonable, shall be reimbursed by the Authority to the Concessionaire.
9	20.7	Recurring expenditure on Police assistance	On or before the Scheduled Four-Laning Date, the Concessionaire shall provide to the State Police Department one Jeep or similar vehicle, at each toll plaza, in good working condition along with chauffeurs for round the-clock patrolling.	The operating costs of such vehicle, including the salaries and allowances of the chauffeurs, shall be met by the Concessionaire.
10	20.8	Recurring expenditure on Medical Aid Posts	For providing emergency medical aid during the Operation Period, the Concessionaire shall aid in setting up and operating a medical aid post at each of the Toll Plaza with round-the-clock ambulance services for victims of accidents on the Project Highway.	The Concessionaire shall at its own cost at each of the toll plazas shall: - (i)construct and maintain a building for medical aid posts (ii) provide one Ambulance with chauffeurs for round the clock services, including the salaries and allowances of the drivers (iii) meet operating expenses (iv)Reimburse the pay and allowances of up to 2 (two) medical personnel deployed exclusively for the Medical Aid Posts and ambulance.
11	Schedule K, clause 2 & 4	Repair /rectification of defects and deficiencies	The Concessionaire's obligations regarding Maintenance Requirements shall include repair and rectification of the defects and deficiencies specified in Annex - I of this Schedule - K within the time limit set forth therein.	The Concessionaire shall be entitled to an extension of time if the nature and extent of any defect justify more time for its repair. The IE shall determine such additional time.

SL. NO	ARTICLE/CLAUSE	SUBJECT	INFORMATION IN BRIEF	REMARKS
12	Schedule K, Clause 7	Divestment requirement	All defects and deficiencies specified in this Schedule-K shall be repaired and rectified by the Concessionaire so that the Project Highway conforms to the Maintenance Requirements on the Transfer Date.	To be ensured by the Concessionaire
13	Schedule K, Clause 8	Display of Schedule - K	The Concessionaire shall display a copy of this Schedule-K at the Toll Plazas along with the Complaint Register stipulated in Article 40.	To be ensured by the Concessionaire.
14	Schedule K -Annexure I	Maintenance Requirement Criteria	Roughness By Bump Integrator (Max. Permissibility)	Not Exceeding 2750 mm/Km
			Potholes / km(max)	NIL
			Percent Cracking	Cracked area< 5 % of the pavement in a stretch of 1 km
			Rutting	Rutting exceeding 10mm in not more than 2 % of the road surface in a stretch of 1 km (measured with 3 m straight edge)
			Ravelling/Stripping of bitumen surface	Not exceeding 10 sqm
			Damage to pavement edges	Not exceeding 10 cm
			Variation in the prescribed slope of camber /cross fail	Not exceeding 2 %
			Embankment slope	Variation not more than 15%
			Edge drop at shoulders	Not exceeding 40 mm
			All other defects or deficiencies in functionality of sign boards, ATMS etc	To be rectified within the period specified in the Annexure I

2.4.3 CONCLUSIONS ON OBSERVATIONS ON CONCESSION AGREEMENT

The Concession Agreement is based on a standard form of agreement that has been used for several other similar projects of NHAI.

The Concession Agreement is comprehensive and covers almost all the issues concerned with the Construction and Operation of the Project. Areas of concern observed during the review of the Concession Agreement have been pointed out.

2.5 REVIEW OF EPC AGREEMENT

EPC Agreement was signed on 17/01/2020 between Concessionaire and HG_Infra Engineering Pvt Ltd. The comments on the major relevant provisions have been brought out in Table 2.4 below.

Table 2.4: Comments on EPC Agreement

SR. NO.	ARTICLE NO.	SUBJECT	INFORMATION IN BRIEF
1	Recital-C	Terms and conditions	EPC Contractor was appointed to execute the Works on EPC basis for completion of the works in accordance with the terms and conditions of the EPC contract and the Concession Agreement.
2	Recital-D		the EPC Contractor agreed to carry out and complete the work and remedy the defects there in on the terms and conditions of the Contract.
3	Recital-E		The EPC contract shall be read in conjunction with the concession agreement. The EPC contractor is to undertake the work such that the client is not in breach of any of its obligation under the concession agreement timing to the contractor performance of its obligations under the EPC contract
4	Clause (II) of Agreement	Contract Price	the work shall be executed on lump sum basis for an amount Rs. 801 Cr. Inclusive of 12% GST
5	Clause(III) of Agreement	Validity of Contract	The contract shall remain in force and effect either till the parties perform all their respective obligation or is terminated by any of the parties as per contract.
6	Clause(9.1) of GCC	Liquidated damages	EPC contractor shall be liable for liquidated damages equivalent to loss incurred by the concessionaire/authority for delay in completion of the project, If the damages are due to default of EPC contractor.
7	Supplementary Agreement-1 (Dated-04/10/2021)	Modification in provision	Provision relating to inconsistent Provisions and jurisdiction of the court were added/modified.
8	Supplementary Agreement-2 (Dated-04/05/2022)	Modification in provision	Provision relating to sharing of bonus amount received from Authority was modified.

2.6 CHANGE OF SCOPE ORDER

The details of various COS approved till date are mentioned in table 2.5 below:

Table 2.5: Details of COS

COS PROPOSAL	CONCESSIONAIRE COS PROPOSAL AMOUNT. RS	IE FORWARDED AMOUNT TO NHAI	APPROVAL STATUS
COS-1	Final proposal of Rs. 78,42,69,942/- vide latter No. 506 dated 19.02.2021 for obtaining COS order.	Rs. 78,13, 73,142/- Vide letter No 1544 dated 01.03.2021	1. NHAI Accorded Final Approval of Rs.74,73,83,410 Vide Letter PIU/EC/PKG-II/IE/2020-21/1075 dated 23.03.2021 2. The same has been confirmed by IE Vide DCS(JV)-GEAS /Narnaul-Ateli/PKG -02/IE/2020-21/452 dated 23.03.2021
COS-02	The (2nd) second proposal for COS-02 was submitted by the Concessionaire on 22.02.2022 for Final Approval	Rs. 21,84,00,974/- Positive COS and Rs. 10,12,94,640 negative Variation against the approved COS-I, vide letter No. 2374. dated 28.02.2022	1. NHAI Accorded Final Approval of Rs.21,84,00,974 Positive COS-2 and Rs. 10,12,94,640 negative Variation against the approved COS-I, Vide Letter PIU/EC/PKG-II/IE/2021-22/1680 dated 17.03.2022 2. The same has been confirmed by IE Vide DCS(JV)-GEAS /Narnaul-Ateli/PKG -02/IE/2021-22/963 dated 21.03.2022

CHAPTER 3.0: REVIEW OF DESIGNS AND AS BUILT DRAWINGS

3.1 REVIEW OF DESIGNS AND AS-BUILT DRAWINGS

The As-built drawings for the Project Highway have been reviewed by us in order to ascertain whether the provision of the Technical Schedules and the Specifications have been followed during the construction of the Project Road. The details of the as built drawings are summarized in Table 3.1 and observations on the same are brought out in the subparas below:

Table 3.1: Details of As Built Drawings Reviewed

S. NO.	DESCRIPTION
1	As Built Plan and Profile Drawings (for Main carriageway and Service Road)
2	Approved Typical Cross Sections
3	Drawings of Structures
4	Junction drawing
5	Toll Plaza Drawings
6	Project Faculties like Bus Bay, Truck Lay Bye, Rest Area etc.
7	Miscellaneous like Drain section. Pedestrian Guard Rails, RCC Crash Barrier, New Jersey Crash Barrier, Noise Barrier etc.

3.2 AS-BUILT DRAWINGS OF HIGHWAYS

Our observations on the development provisions mentioned in the Technical Schedules of Concession Agreement viz a viz the As- Built Drawings have been presented in **Table 3.2** below.

Table 3.2: Review of As-built Drawings for Highways

S. NO.	NAME OF ITEM	AS PER SCHEDULE	AS PER AS -BUILT DRAWING	REMARKS
1	Project Length	40.810 km (Narnaul Bypass section= 23.46 km from design Ch. 28+000 to Ch.51+460; NH-11 Feeder Route= 14.050 km from design Ch.30+450 to Ch. 44+500; ILMH Feeder Route=3.300 km from design Ch. 0+000 to 3+300)	40.810 km (Narnaul Bypass section Six lane from design Ch. 28+000 to Ch.42+000 & Four lane from design Ch. 42+000 to Ch.51+460; NH-11 Feeder Route Four lane from design Ch.30+450 to Ch. 44+500; ILMH Feeder Route Four lane from design Ch. 0+000 to 3+300)	
2	Design Speed	100 Kmph	100 Kmph (for Main Carriageway) & 40 Kmph (for Interchange Ramps/Loops)	
3	Horizontal Curve	As per IRC: SP 84 - 2018	Design is within the limits	
4	Vertical Curve			

5 — Length of Service Road/Slip Road

S. No.	From	To	Width(m)	Length (m)	Side	From	To	Side	Width(m)	Length (m)
Narnaul bypass (Economic Corridor)						Narnaul bypass (Economic Corridor)				
1	28+000	42+000	7	14000	BS	28+000	38+130	BS	7	10130
2	45+100	46+300	7	1200	BS	38+270	41+500	BS	7	3230
3	50+900	51+460	7	560	BS					
Ateli-Narnaul (Feeder Road NH-11)						Ateli-Narnaul (Feeder Road NH-11)				
4	30+450	32+20	7	1750	BS	30+450	44+500	BS	7.5	14050
5	33+000	34+200	7	1200	BS					
6	36+800	43+230	7	6430	BS					
	Sub- total (in m)			25140	BS	ILMH Feeder Route				
	Total length (in m)			50280		0+240	0+880	LHS	3.5	640
						0+240	1+780	RHS	3.5	1540
						Total length (in m)			57000	

6 — Design of pavement

Sl. no	Pavement Layer	Thickness LHS MCW	Thickness RHS MCW	Thickness SR		Pavement Layer Thickness: LHS MCW	RHS MCW	SR
Narnaul bypass (90 MSA for MCW & 10 MSA SR)					Narnaul bypass (150 MSA/90 MSA for LHS MCW 90 MSA for RHS MCW & 10 MSA SR)			

S. NO.	NAME OF ITEM	AS PER SCHEDULE					AS PER AS -BUILT DRAWING						REMARKS
							Layer	150 MSA	60 MSA	90 MSA	60 MSA	10 MSA	
		1	BC	50 mm	50 mm	40mm	BC	50mm	50mm	50mm	50mm	40mm	
		2	DBM	120mm	120mm	60mm	DBM	120mm	100mm	120mm	100mm	60mm	
		3	WMM	250mm	250mm	250mm	WMM	250mm	250mm	250mm	250mm	250mm	
		4	GSB	200mm	200mm	200mm	GSB		200mm	200mm	200mm	200mm	
		5	CTSB				CTSB	200mm					
		6	SG	500mm	500mm	500mm	SG	500mm	500mm	500mm	500mm	500mm	
		Ateli-Narnaul					Ateli-Narnaul						
		1	BC	50 mm	40mm	40mm	Layer	150 MSA		60 MSA			
		2	DBM	100mm	60mm	60mm	BC	50mm		50mm		40mm	
		3	WMM	250mm	250mm	250mm	DBM	120mm		100mm		60mm	
		4	GSB	200mm	200mm	200mm	WMM	250mm		250mm		250mm	
		5	CTSB				GSB			200mm		200mm	
		6	SG	500mm	500mm	500mm	CTSB	200mm					
							SG	500mm		500mm		500mm	
		ILMH					ILMH						
		1	BC	50 mm	50 mm	40mm	BC	50mm		50mm		40mm	
		2	DBM	120mm	120mm	60mm	DBM	100mm		100mm		60mm	
		3	WMM	250mm	250mm	250mm	WMM	250mm		250mm		250mm	
		4	GSB	200mm	200mm	200mm	GSB	200mm		200mm		200mm	
		5	SG	500mm	500mm	500mm	SG	500mm		500mm		500mm	
7	Major junction	02 nos.					02 nos.						Nos. are based on the as built drawings made available. However, at site 03 nos. & 31 nos major and minor junctions were found.
8	Minor Junctions	Nil					10 Nos.						
9	Railway Over bridge	01 no.					01 no.						

S. NO.	NAME OF ITEM	AS PER SCHEDULE	AS PER AS -BUILT DRAWING	REMARKS
10	Flyover	03 nos.	03 nos.	
11	Overpass	01 nos.	01 nos.	
12.a	Vehicular Underpass	14 nos.	14 nos.	
12. b	Light Vehicular Underpass	01 no.	3 nos. (2 nos. under COS)	
13	Pedestrian Underpass	16 nos.	20 nos. (including 2 nos. subways)	
14	Major Bridge	01 no.	01 no.	
15	Minor Bridge	05 no.	05 nos.	
16	Culvert	Box Culvert 61 nos. (i.e. MCW-45 nos. & cross road-16 nos.)	51 nos *	Nos. are based on the as built drawings made available. However, at site 61 nos. culvert were found.
17	Bus Bay/Bus Shelter	13 nos.	13 nos.	
18	Rest Area cum Truck Lay Bye	02 Nos. (at Ch. 32+000)	02 nos.	

3.3 PAVEMENT DESIGN REVIEW

3.3.1 REVIEW OF PAVEMENT DESIGN REQUIREMENTS AS PER SCHEDULE

The Project Road consist of Six and Four lane Flexible pavement in various sections of the project road as mentioned in Table 3.3 below which are to be designed for the minimum MSA as mentioned below:

1. Flexible Pavement for the Main carriageway (Economic Corridor) – 90 MSA
2. Flexible Pavement for the Main carriageway (Feeder Route) – 60 MSA
3. Flexible pavement on the Service Road and Cross road – 10 MSA

Table 3.3.: Project Road sections as per the CA

Sr. No	Section	Existin Chainage		Design Chainage		Length (Km)	Proposal	
		From	To	From	To			
1	Proposed Narnaul Bypass	-	-	28.000	42.000	14.000	6-Lane	Economic Corridor
		-	-	42.000	51.460	9.460	4-Lane	Feeder Route
2	Connectivity of ILMH to proposed Narnaul Bypass	-	-	0.000	3.300	3.300	4-Lane	
3	NH-11: Start of Ateli mandi Bypass - Narnaul Bypass Crossing	43+445	50+400	30.450	38.000	7.55*	4-Lane	
		50+400	51+000	38.000	38.750	0.750	4-Lane	
		51+000	53+900	38.750	41.400	2.65**	4-Lane	
		53+900	56+900	41.400	44.500	3.100	4-Lane	

Minimum Pavement Composition specified in the Schedule B are brought out in Table 3.4 below

Table 3.4.: Pavement Composition for main carriageway and service road as per the CA

COMPOSITION OF PAVEMENT	MAIN CARRAIGEWAY		SERVICE ROAD	UNIT
	Economic Corridor	Feeder Road		
Bituminous Concrete (BC) – VG 40	50	50	40	mm
Dense Bituminous Macadam (DBM)	120	100	60	mm
Wet Mix Macadam (WMM)	250	250	250	mm
Granular Sub Base (GSB)	200	200	200	mm
Subgrade (SG)	500	500	500	mm

3.3.2 REVIEW OF FLEXIBLE PAVEMENT REQUIREMENTS AS PER AS BUILT DRAWING

The details of the pavement composition adopted as seen in the as built drawing are as under. The design life of the pavement is 20 years and CBR adopted is 13% for Main Carraigeway& 10% for Service Road. The MSA and VDF considered in the base year (2019) and traffic are brought out in Tables 3.5 to 3.8:

Table 3.5: Pavement crust details (adopted) as per as built drawing

DIRECTION	ADOPTED MSA FOR MCW	FLEXIBLE PAVEMENT THICKNESS (MM)				
		BC	DBM	WMM	GSB	CTSB
Ateli - Narnaul						
30+450 to 44+500 LHS	60 MSA	50	120	150		
30+450 to 44+500 RHS	150 MSA	50	100	250	200	200
	150 MSA	50	140	250	200	
Narnaul Bypass						
	MSA	BC	DBM	WMM	GSB	
28+000 to 42+000 LHS	150 MSA	50	140	250	200	
	150 MSA	50	120	250		200
28+000 to 42+000 RHS	90 MSA	50	120	250	200	
42+000 to 51+460	60 MSA	50	100	250	200	
Connectivity of ILMH to proposed Narnaul Bypass						
0+000 to 3+300	60 MSA	50	100	250	200	
Service Roads	10 MSA	40	60	250	200	

Table 3.6: Traffic number (ADT-2019) as per Traffic report

Categories	A	B	C	D	E	F	G	H
2- Wheeler	1912	1929	1912	1929	1912	1929	1912	1929
3- Wheeler	45	41	45	41	45	41	45	41
Passenger Car	861	884	861	884	861	884	861	884
Mini Bus	11	11	11	11	11	11	11	11
Standard Bus	78	74	78	74	78	74	78	74
	373	363	373	363	373	363	373	363
2- axle Trucks	84	88	84	88	84	88	84	88
3- axle Trucks	245	263	245	263	245	263	245	263
MAV	366	389	366	389	366	389	366	389
Oversized Vehicles	0	0	0	0	0	0	0	0
HCm/EME	0	0	0	0	0	0	0	0
Tractors	66	76	66	76	66	76	66	76
Total Non-motorized vehicals	18	19	18	19	18	19	18	19
Total traffic	4060	4138	4060	4138	4060	4138	4060	4138

Table 3.7 : Details of VDF for the base year 2019 as per the Traffic report

SL. NO.	LOCATIONS	DIRECTION	VEHICLE CODE				
			BUS	LCV	2 AXLE	3 AXLE	MULTI - AXLE
1	Km 28+000	A.Nangal Chaudharay to Narnaul	0.86	1.27	4.06	6.69	15.53
		B. Narnaul to Nangal Chaudharay	1.11	0.64	6.03	7.24	15.09
2	Km 33+000	C. Nangal Chaudharay to Mandana	1.23	0.24	1.58	3.62	10.07
		D. Mandana to Nangal Chaudharay	0.93	0.37	3.14	1.24	6.35
3	Km 45+700	E. Mahendragarh to Narnaul	1.17	1.01	1.68	1.95	7.26
		F. Narnaul to Mahendragarh	1.37	0.86	4.88	12.22	17.59
4	Km 51+000	G. Narnaul to Sighana	1.23	0.75	3.86	5.41	14.55
		H. Sighana to Narnaul	1.26	0.55	1.84	10.66	14.99

Table 3.8 : Details of MSA for the base year 2019 as per the Traffic reportfor the Concession Period

YEAR	STANDARD BUS	LCV	2- AXLE	3- AXLE	MAV	MSA	DIRECTION
2019	51	218	53	158	234		Km 28+000 Nangal Chaudharay to Narnaul
	53	224	51	147	220		Km 28+000 Narnaul to Nangal Chaudharay
	12	97	2	3	6		Km 33+000 Nangal Chaudharay to Mandana
	11	93	1	3	7		Km 33+000 Mandana to Nangal Chaudharay
	118	467	65	507	588	118	Km 45+700 Mahendragarh to Narnaul
	121	461	69	412	451	121	Km 45+700 Narnaul to Mahendragarh
	72	281	16	32	68		Km 51+000 Narnaul to Sighana
	71	267	13	44	70		Km 51+000 Sighana to Narnaul
2021	57	247	60	177	262	2.14	Km 28+000 Nangal Chaudharay to Narnaul
	59	254	57	164	246	2.00	Km 28+000 Narnaul to Nangal Chaudharay
	13	110	2	3	7	0.05	Km 33+000 Nangal Chaudharay to Mandana
	12	105	1	3	8	0.04	Km 33+000 Mandana to Nangal Chaudharay
	132	529	73	567	658	2.44	Km 45+700 Mahendragarh to Narnaul
	135	523	78	460	505	5.66	Km 45+700 Narnaul to Mahendragarh
	80	319	18	36	76	0.62	Km 51+000 Narnaul to Sighana
	79	303	15	49	78	0.62	Km 51+000 Sighana to Narnaul
2036	130	639	145	400	590	54.48	Km 28+000 Nangal Chaudharay to Narnaul
	136	656	139	372	555	50.94	Km 28+000 Narnaul to Nangal Chaudharay
	31	284	5	8	15	1.19	Km 33+000 Nangal Chaudharay to Mandana
	28	272	3	8	18	1.03	Km 33+000 Mandana to Nangal Chaudharay
	302	1368	177	1284	1484	62.4	Km 45+700 Mahendragarh to Narnaul
	309	1351	188	1043	1138	144.03	Km 45+700 Narnaul to Mahendragarh
	184	823	44	81	172	16.03	Km 51+000 Narnaul to Sighana
	182	782	35	111	177	16.03	Km 51+000 Sighana to Narnaul

3.3.3 CONCLUSIONS ON PAVEMENT DESIGN

The Pavement Design of the Flexible and Rigid Pavements has been done in accordance with the relevant codes and also satisfying the provisions laid down in the Concession Agreement. The pavement design has been carried out for a Design MSA much higher than minimum MSA specified in the CA.

3.4 STRUCTURES

3.4.1 FLYOVER

The as built drawings of 3 nos. Flyover on the project road have been reviewed, the details of which are mentioned in Table 3.9 below.

Table 3.9: Details of Flyover

S.No.	Location	Chainage	Span Arrangement	Vertical Clearance	Overall Length	Overall Width	Carriageway Width	Type of Sub Structure	Type of Super Structure	Type of Bearing	Type of Expansion Joint
1	NH-148 B	39+910	3 X 35	9	112	25	2 X 9.5	RCC Circular Pier Ø1.5(ABT-1.2)	PSC I GIRDER	Elastomer Bearing	STRIP SEAL
2	NH-148 B	51+460	2 X 30	5.5	60	25	2 X 10	RCC Circular Pier Ø1.5(ABT-1.2)	PSC I GIRDER	Elastomer Bearing	STRIP SEAL
3	ILMH	03+300	2 X 30(SK-30.07)	5.5	60	25	2 X 10	RCC Circular Pier Ø1.8	PSC I-Girder	Elastomer Bearing	STRIP SEAL

3.4.2 OVERPASS

The as built drawings of 1 no. Overpass on the project road have been reviewed, the details of which are mentioned in Table 3.10 below.

Table 3.10: Details of Overpass

S. NO.	LOCATION	CHAINAGE	SPAN ARRANGE MENT	VERTICAL CLEARANCE	OVERALL LENGTH	OVERALL WIDTH	CARRIAGE WAY WIDTH	TYPE OF SUB STRUCTURE	TYPE OF SUPER STRUCTURE	TYPE OF BEARING	TYPE OF EXPANSION JOINT
1	NH-148 B	41+000	2 X 30	5.5	61	32	2 X 13.5	RCC Circular Pier Ø1.5(2 X 1.2)	PSC I GIRDER	Elastomer Bearing	STRIP SEAL

3.4.3 MAJOR BRIDGE

The as built drawings of 1 no. Major Bridge on the project road have been reviewed, the details of which are mentioned in Table 3.11 below.

Table 3.11: Details of Major Bridge

S.NO.	LOCATION	CHAINAGE	SPAN ARRANGE MENT	VERTICAL CLEARANCE	OVERALL LENGTH	OVERALL WIDTH	CARRIAGE WAY WIDTH	TYPE OF SUB STRUCTURE	TYPE OF SUPER STRUCTURE	TYPE OF BEARING	TYPE OF EXPANSION JOINT
1	ILMH	2+130	3 X 35	9	112	25	2 X 9.5	RCC Circular Pier Ø2.00	PSC I GIRDER	Elastomer Bearing	STRIP SEAL

3.4.4 RAILWAY OVER BRIDGE

The as built drawings of 1 nos. ROB on the project road have been reviewed, the details of which are mentioned in Table 3.12 below.

Table 3.12: Details of ROB

S. NO.	LOCATION	CHAINAGE	SPAN ARRANGE MENT	VERTICAL CLEARANCE	OVERALL LENGTH	OVERALL WIDTH	CARRIAGE WAY WIDTH	TYPE OF SUB STRUCTURE	TYPE OF SUPER STRUCTURE	TYPE OF BEARING	TYPE OF EXPANSION JOINT
1	NH-148B	38+200	1 X 19.5+1 X 18+1 X 36+1 X 24+1 X 19.5	8.43	117	33.6	2 X 12.5	RCC Circular Pier Ø1.80	PSC I GIRDER	Elastomer Bearing-Pot-PTFE	Strip Seal / Modular Type

3.4.5 VEHICULAR UNDERPASSES

The as built drawings of 14 nos. Vehicular Underpasses on the project road have been reviewed and details are mentioned in Table 3.13 below.

Table 3.13: Details of VUPs

S.NO.	CHAINAGE	SIDE	TYPE OF STRUCTURE	SPAN ARRANGEMENT	VERTICAL CLEARANCE	OVERALL LENGTH	OVERALL WIDTH	CARRIAGEWAY WIDTH	FOUNDATION TYPE	TYPE OF SUB STRUCTURE	TYPE OF SUPER STRUCTURE	TYPE OF BEARING
NARNAUL BYPAS												
1	29+030	LHS	VUP	2 X 20	5.5	41.8	14.5	13.5	Open	Rcc box type	BOX TYPE	NO
		RHS			5.5	41.8	14.5	13.5	Open	Rcc box type	BOX TYPE	NO
2	33+130	LHS	VUP	2 X 30	5.5	61	14.5	13.5	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
		RHS			5.5	61	14.5	13.5	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
3	36+170	LHS	VUP	1x30	5.5	30.05	14.5	13.5	Open	RCC Circular Pier Ø1.2	PSC I-Girder	Elastomer Bearing
		RHS			5.5	30.05	14.5	13.5	Open	RCC Circular Pier Ø1.2	PSC I-Girder	Elastomer Bearing
4	40+470	LHS	VUP	1x30	5.5	30.05	11	1 X 10	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
		RHS		1x30	5.5	30.05	11	1 X 10	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
5	43+570	LHS	VUP	1 X 30(30.20)	5.5	1 X 30.05	11	10	Open	RCC Circular	PSC I-Girder	Elastomer Bearing

S.NO.	CHAINAGE	SIDE	TYPE OF STRUCTURE	SPAN ARRANGEMENT	VERTICAL CLEARANCE	OVERALL LENGTH	OVERALL WIDTH	CARRIAGEWAY WIDTH	FOUNDATION TYPE	TYPE OF SUB STRUCTURE	TYPE OF SUPER STRUCTURE	TYPE OF BEARING
										Pier Ø1.5		
		RHS			5.5	1 X 30.05	11	10	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
6	45+695	LHS	VUP	2 X 30	5.5	61	11	10	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
		RHS			5.5	61	11	10	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
7	47+780	LHS	VUP	1 X 30(30.20)	5.5	1 X 30.05	11	10	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
		RHS			5.5	1 X 30.05	11	10	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
ATELI-NARNAUL												
8	31+135	BHS	VUP	1 X 30	5.5	30.05	2x 11	2 X 10	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
9	33+590	BHS	VUP	1x30	5.5	30.05	2x 11	2 X 10	Open	RCC Circular Pier Ø1.8	PSC I-Girder	Elastomer Bearing
10	36+220	BHS	VUP	1x30	5.5	30.05	2x 11	2 X 10	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
11	37+520	BHS	VUP	1x30	5.5	30.05	2x 11	2 X 10	Open	RCC Circular Pier Ø1.5	PSC I-Girder	Elastomer Bearing
12	40+110	BHS	VUP	1 X 20	5.5	20.05	2x 11	2 X 10.5	Open	Rcc box type	BOX TYPE	NO

S.NO.	CHAINAGE	SIDE	TYPE OF STRUCTURE	SPAN ARRANGEMENT	VERTICAL CLEARANCE	OVERALL LENGTH	OVERALL WIDTH	CARRIAGEWAY WIDTH	FOUNDATION TYPE	TYPE OF SUB STRUCTURE	TYPE OF SUPER STRUCTURE	TYPE OF BEARING
13	42+345	BHS	VUP	1 X 20	5.5	20.05	2x 11	2 X 10.5	Open	Rcc box type	BOX TYPE	NO
ILMH												
14	1+760	BHS	VUP	2 X 20	5.5	41.8	25	2 X 10	5.5	RCC Abut.	Integral	1+760

3.4.6 LIGHT VEHICULAR UNDERPASSES

Theas built drawings of 3 nos. Light Vehicular Underpasses on the project road have been reviewed and all the structures are Box type, the details of which are mentioned in Table 3.14 below.

Table 3.14: Details of LVUPs

S.NO.	CHAINAGE	SIDE	TYPE OF STRUCTURE	SPAN ARRANGEMENT	VERTICAL CLEARANCE	OVERALL LENGTH	OVERALL WIDTH	CARRIAGEWAY WIDTH	SUB STRUCTURE
NARNAUL BYPASS/ATELI-NARNAUL									
1	30+230	LHS	LVUP	1x12.0x4	4	13.4	14.5	13.5	Box Type
2	34+460	LHS	LVUP	1x12	4	13.4	14.5	13.5	Box Type
3	50+324	BHS	LVUP	1 X 12(SK-12.167)	4	13.4	2 X 11	2 X 10	Box Type

3.4.7 PEDESTRIAN UNDERPASSES

The as built drawings of 20 nos. Pedestrian Underpasses (including 02 nos. Subways) which are all Box type strucutres on the project road have been reviewed, the details of which are mentioned in Table 3.15 below.

Table 3.15: Details of PUP

S.NO.	DESIGN CHAINAGE	SIDE	TYPE OF STRUCTURE	SPAN ARRANGEMENT	VERTICAL CLEARANCE	OVERALL LENGTH	OVERALL WIDTH	CARRIAGEWAY WIDTH	SUB STRUCTURE
NARNAUL BYPASS									
1	28+770	BHS	PUP	1X 7	3	7.9	32	2 X 13.5	Box Type
2	29+310	BHS	PUP	1X 7	3	7.9	32	2 X 13.5	Box Type
3	32+780	BHS	PUP	1X 7	3	7.9	32	2 X 13.5	Box Type
4	33+420	BHS	PUP	1X 7	3	7.9	32	2 X 13.5	Box Type
5	43+240	BHS	PUP	1X 7	4.5	7.9	25	2 X 10	Box Type
6	43+890	BHS	PUP	1X 7	4.5	7.9	25	2 X 10	Box Type
7	45+495	BHS	PUP	1X 7	3	7.9	25	2 X 10	Box Type
8	46+590	BHS	Subway	1 X 4.8 X 2.75	5.5	5.5	26	2 X 9.5	Box Type
9	47+390	BHS	PUP	1X 7	4.5	7.9	25	2 X 10	Box Type
10	47+990	BHS	PUP	1X 7	4.5	7.9	25	2 X 10	Box Type
11	48+600	BHS	PUP	1 X 7	4	7.9	25	2 X 10	Box Type
ATELI-NARNAUL									
1	32+330	BHS	PUP	1 X 7	3	7.9	25	2 X 10	Box Type
2	33+230	BHS	PUP	1 X 7	3	7.9	25	2 X 10	Box Type
3	33+860	BHS	PUP	1 X 7	3	7.9	25	2 X 10	Box Type
4	35+900	BHS	PUP	1 X 7	3	7.9	25	2 X 10	Box Type
5	36+540	BHS	PUP	1 X 7	3	7.9	25	2 X 10	Box Type
6	42+020	BHS	PUP	1 X 7	3	7.9	25	2 X 10	Box Type
7	42+570	BHS	PUP	1 X 7	3	7.9	25	2 X 10	Box Type
8	39+255	BHS	Subway	1 X 4.8 X 3.0	3	5.7	55	2 X 9.5	Box Type
ILMH									
1	00+880	BHS	PUP	1 X 7	4	7.9	24	2 X 10	Box Type

3.4.8 MINOR BRIDGES

The as built drawings of 5 nos. Minor bridges on the project road have been reviewed, the details of which are mentioned in Table 3.16 below.

Table 3.14: Details of Minor Bridge

S.No.	Location	Chainage	Span Arrangement	Vertical Clearance	Overall Length	Carriageway Width	Foundation Type	Type of Super Structure
1	NH-148B	42+150	2 X 30	5.28	60	9.5	Open foundation	RCC Girder +Deck Slab
2	NH-148B	41+650	2 X 3.94	3.4	10.7	2 X 11		
3	NH-148B	45+455	2 X 6.5	-	14.5	2 X 11	Box type	Box type
4	NH-148B	51+363	1 X 7.5	11.72(8.5)	16	2 X 9.5	Box type	Box type
5	NH-148B	51+647	2 X 8	18.1(24.632)	22	2 X 13	Box type	Box type

3.4.9 CULVERTS

There total 51 nos. of culverts on the project road as per the as built drawing, the details of which are mentioned in in Table 3.17 below:

Table 3.167: Details of Culvert

S.NO.	CHAINAGE	SIDE	TYPE OF STRUCTURE	SPAN ARRANGEMENT	OVERALL LENGTH	OVERALL WIDTH
NARNAUL BYPASS						
1	30+000 & 30+045	BHS	Box Culvert	1 X 1.5 X 1.5	1.9	54
2	31+200 & 31+500	BHS	Box Culvert	1 X 1.5 X 1.5	1.9	70
3	32+810 & 32+600	BHS	Box Culvert	1 X 1.5 X 1.5	1.9	55
4	35+810 & 35+770	BHS	Box Culvert	1 X 1.5 X 1.5	1.9	56
5	37+685 & 37+686	BHS	Box Culvert	1 X 1.5 X 1.5	2	61

S.NO.	CHAINAGE	SIDE	TYPE OF STRUCTURE	SPAN ARRANGEMENT	OVERALL LENGTH	OVERALL WIDTH
6	28+870 & 39+102	BHS	Box Culvert	1 X 1.5 X 1.5	2	65
7	40+760 & 40+532	BHS	Box Culvert	1 X 1.5 X 1.5	1.9	54
8	46+835 & 46+844	BHS	Box Culvert	1 X 1.5 X 1.5	2	26
9	47+633 & 47+640	BHS	Box Culvert	1 X 1.5 X 1.5	2	26
11	31+450	BHS	Box Culvert	1 X 3 X 3	3.6	69.37
12	32+280	BHS	Box Culvert	1 X 3 X 2	3.6	SK(94.1)60
13	35+100 & 35+070	BHS	Box Culvert	1 X 3 X 2	3.6	61.5

S.NO.	CHAIN AGE	SIDE	TYPE OF STRUCTURE	SPAN ARRANGE MENT	OVERALL LENGTH	OVERALL WIDTH
14	36+552 & 36+528	BHS	Box Culvert	1 X 3 X 2	3.6	55.9
15	37+405	BHS	Box Culvert	1 X 5 X 1.5	5.7	54
16	41+200 & 41+232	BHS	Box Culvert	1 X 3 X 2	3.6	54
17	45+515 & 45+518	BHS	Box Culvert	1 X 5 X 2	5.7	54
19	50+496	BHS	Minor Bridge (Skew 510)	1 X 5.035(8)	9.58	30
20	40+230	BHS	Box Culvert	1 X 4	4.7	32
21	43+210 & 43+310	BHS	Box Culvert	1 X 1.5 X 1.5	1.9	26
22	43+910 & 43+956	BHS	Box Culvert	1 X 1.5 X 1.5	1.9	26
23	46+255 & 44+906	BHS	Box Culvert	1 X 1.5 X 1.5	1.9	29
24	41+240 & 47+700	BHS	Box Culvert	1 X 3 X 2	3.6	50.5

S.NO.	CHAIN AGE	SIDE	TYPE OF STRUCTURE	SPAN ARRANGE MENT	OVERALL LENGTH	OVERALL WIDTH
25	48+210 & 47+426	BHS	Box Culvert	1 X 1.5 X 1.5	1.9	26
26	49+222 & 49+230	BHS	Box Culvert	1 X 5 X 2	5.7	26
ILMH						
1	0+900	BHS	Box Culvert	1x2.0x3.0	3.6	65.366
2	1+700 & 1+645	BHS	HPC	1 x 1.2	-	62.5
3	1+700 & 1+670	BHS	Box Culvert (Cushion)			
4	1+820	BHS	Box Culvert (Cushion)	1 x 3.0 x 2.0	3.9	59.8
5	2+425	BHS	Box Culvert (Cushion)	1 X 3.0 X 3.0	3.6	36.99
6	2+930	BHS	Box Culvert	1 x 3.0 x 2.0	3.7	55.5

3.5 CONCLUSIONS ON REVIEW OF DESIGNS AND DRAWINGS

On the basis of the review of Designs and As-built drawings for the Project it is observed that the drawings and designs are as per the requirements of the CA.

CHAPTER 4.0:EXISTING INVENTORY & CONDITION SURVEY

4.1 PROJECT DETAILS

The Project Road includes Ateli Mandi to Narnaul section of NH-11 which starts from Ch. 43+445 and ends at Ch. 56+900 (Design Length 14 km) & Narnaul Bypass (Design Length 28.000 km) in the state of Haryana. The 3.3 km long stretch for connectivity to ILMH is also included in the scope of work.

The road traverses through plain terrain and is designed for 100 kmph speed. The major details of the Project are presented in **Table 4.1** below.

Table 4.1: Major Details of Project Road

SL. NO	PARAMETER	DESCRIPTION
1.	Main Carriageway Details	**40.810 km** (Narnaul Bypass section Six lane from design Ch. 28+000 to Ch.42+000 & Four lane from design Ch. 42+000 to Ch.51+460; NH-11 Feeder Route Four lane from design Ch.30+450 to Ch. 44+500; ILMH Feeder Route Four lane from design Ch. 0+000 to 3+300)
2.	Service Road/Slip Road (7.0m/3.5m)	62.070 km (excluding taper length)
3.	ROB	01 no.
4.	Flyover	03 nos.
5.	Overpass	01 no.
6.	VUP	VUPs - 13 nos.
7.	Underpasses	LVUPs - 03 nos, Subway-1 no. and PUPs -19 nos.
8.	Major Bridges	01 nos.
9.	Minor Bridges	05 nos.
10.	Culverts	61 nos. (Box Culverts) & Additional 02 nos. HPCs (including 1 no. HPC buried)
11.	Bus Bays	13 nos.
12.	Truck Lay Byes	02 nos. (both sides)
13.	Major Junctions	03 nos.
14.	Minor Junctions	31 nos.

4.2 OVERVIEW OF ROAD ASSETS AND APPURTENANCES

Detailed inspection of the site was carried out by our team of Engineers in January 2022 for assessment of status and condition of various Road Assets and Appurtenances. Inventories of various road assets and structures were prepared.

Status of various road furniture items, painting, road markings, safety fixtures, way-side amenities and toll plazas with respect to the provisions of Concession Agreement and their condition were checked. Assessment of condition of various assets was made on the basis of visual inspections. Overall the Project Road conforms to the specifications laid down in Concession Agreement. The PQC on the Main Carriageway is showing signs of early distresses. Some road furniture items and signages etc are found to be damaged or missing. The summarised details in respect of inventory/condition survey of road assets for the Project are presented in subsequent para. below. It was observed that the repair works on the Main carriageway were under progress and renewal of the Road Marking, Road Studs and Painting of the Kerb and Crash Barrier was under progress.

4.2.1 HIGHWAY INVENTORY

The basic dimensional parameters for the Project Road were observed and noted for every 100m interval. Details pertaining to the Carriageway widths, shoulders, Embankment heights, Median type, Slope protection, land use, etc. were noted. This information has been presented in **Table 4.2** along with the representative photographs of each 10 km stretch of the project road is shown in **Figures** below.

Narnaul Bypass

Fig 4.1: Section at Ch 28+000 RHS

Fig 4.2: Section at Ch 28+000 LHS

Fig 4.3: Section at Ch 28+500 LHS

Fig 4.4: Section at Ch 30+100 LHS

Fig 4.5: Section at Ch 30+500 RHS

Fig 4.6: Section at Ch 30+700 LHS

Fig 4.7: Section at Ch 32+100 RHS

Fig 4.8: Section at Ch 33+100 LHS

Fig 4.9: Section at Ch 33+400 RHS

Fig 4.10: Section at Ch 34+000 LHS

Fig 4.11: Section at Ch 34+300 RHS

Fig 4.12: Section at Ch 35+500 LHS

Fig 4.13: Section at Ch 35+950 RHS

Fig 4.14: Section at Ch 36+500 LHS

Fig 4.15: Section at Ch 36+100 RHS

Fig 4.382: Box Culvert at Ch 0+900 RHS

Fig 4.383: Box Culvert at Ch 1+700 LHS

Fig 4.384: Box Culvert at Ch 1+700 LHS

Fig 4.385: Box Culvert at Ch 1+800 LHS

Fig 4.386: Box Culvert at Ch 2+930 LHS

Fig 4.387: Box Culvert at Ch 2+930 RHS

Table 4.51: Observations and Recommedation for Box Culverts in Ateli Narnaul

S. NO	CHAINAGE	SIDE	OBSERVATION	RECOMMENDATION
1	31.717	LHS	i) Structure condition is fair.	
		RHS	i) Structure condition is fair.	
2	31.927	LHS	i) Structure condition is fair.	
		RHS	i) Structure condition is fair.	
3	32.547	LHS	i) Solid waste and soil is deposited obstruct the flow of water.	i) Cleaning is required for the adequate flow of water.
		RHS	i) Soil is deposited around the opening.	i) Soil should be removed.
4	33.157	LHS	i) Structure condition is fair.	
		RHS	i) Honeycombing is visible in crash barrier and in wing wall.	i) Grouting is recommended to fill the crack using GP-2 grouting compound.
5	34.077	LHS	i) Solid waste is dumped. Ii) Honey combing is visible in crash barrier.	i) Removal of solid waste is required.
		RHS	i) Soil is deposited in the opening which obstruct the flow of waterway.	i) Cleaning is required for the adequate flow of water.
6	35.747	LHS	i) Structure condition is fair.	
		RHS	i) Structure condition is fair.	
7	36.837	LHS	i) Structure condition is fair.	
		RHS	i) Structure condition is fair.	
8	37.727	LHS	i) Soil is deposited around opening . ii) Honey combing is visibe in crash barrier.	
		RHS	i) Opening is blocked by sand bags.	i) Sand bags should be remove to clear the flow of water.
9	39.007	LHS	i) Structure condition is fair.	
		RHS	i) Solid waste is dumped. Ii) Honey combing is visible in crash barrier and is return wall.	i) Soil should be remove.
10	39.227	LHS	i) Soil is deposited around the opening. ii) Reinforcement bar of slab is exposed in median side.	i) Cleaning is require for the adequate flow of water. ii) Exposed reinforce bar should be cut.
		RHS	i) Structure condition is fair.	
11	39.567	LHS	i) Structure condition is fair.	
		RHS	i) Dense vegetation. ii) Solid waste is dumped	i) Vegetation growing around should be clean. ii) Solid waste should be remove.
12	40.437	LHS	i) Construction material is dumped.	i) Grouting is recommended to fill the crack using GP-

S. NO	CHAINAGE	SIDE	OBSERVATION	RECOMMENDATION
			ii) Gap is visible between side wall and return wall.	2 grouting compound.
		RHS	i) Honeycombing is visible in crash barrier.	i) Grouting is recommended to fill the crack using GP-2 grouting compound.
13	41.107	LHS	i) Structure condition is fair.	
		RHS	i) Structure condition is fair.	
14	41.477	LHS	i) Structure condition is fair.	
		RHS	i)Dense vegetation. ii) OHM sign board is damaged. iii) Honeycombing is visible in crash barrier.	i) Vegetation growing around should be clean.
15	42.557	LHS	i) Dense vegetation.	i) Vegetation growing around should be clean.
		RHS	i) The opening is blocked by bricks	i) Bricks should be removed.

Table 4.52: Observations and Recommedation for Box Culverts in Narnaul Bypass

S.NO	CHAINAGE	SIDE	OBSERVATION	RECOMMENDATION
1	29+450	LHS	i) Structure condition is satisfactory.	
		RHS	i) Construction joint is visible between wing wall and side wall of culvert.	i) Grouting is recommended to fill the crack.
2	30+090	LHS	i) Soil is deposited near opening of the culvert.	i) Soil deposited should be remove to clear the path of flow.
		RHS	i) Structure condition is satisfactory.	
3	31+460	LHS	i) Structure condition is satisfactory.	
		RHS	i) Structure condition is satisfactory.	
4	31+500	LHS	i) Object hazard sign board pole is provided but sign is missing	i) Sign board should be provided as per provision.
		RHS	i) Structure condition is satisfactory.	
5	32+320	LHS	i)Honey combing is visible in top slab.	i) Grouting is recommended.
		RHS	i)Honey combing is visible in crash barrier. Ii) CC pitching seems damage.	i) Grouting is recommended.
6	32+600	LHS	i) Structure condition is satisfactory.	
		RHS	i) Structure condition is satisfactory.	
7	35+070	LHS	i) Honey combing is visible in top slab and in crash barrier.	i) Grouting is recommended.
		RHS	i) Opening is 90% blocked by soil.	i) Soil should be removed from the opening.
8	35+770	LHS	i)Honeycombing is visible in wing wall. ii) Dense Vegetation.	i)Grouting is recommended. ii) Cleaning of vegetation is require.
		RHS	i) Structure condition is satisfactory.	

S.NO	CHAINAGE	SIDE	OBSERVATION	RECOMMENDATION
9	36+520	LHS	i) Honeycombing is visible in toe wall.	i) Grouting is required.
		RHS	i) Honeycombing is visible in toe wall.	i) Grouting is required.
10	37+400	LHS	i) Structure condition is satisfactory.	
		RHS	i) Structure condition is satisfactory.	
11	37+700	LHS	i) Structure condition is satisfactory.	
		RHS	i) Structure condition is satisfactory.	
12	39+100	LHS	i) Structure condition is satisfactory.	
		RHS	i) Structure condition is satisfactory.	
13	40+230 (Subway)	LHS	i) Structure condition is satisfactory.	
		RHS	i) Structure condition is satisfactory.	
14	40+530	LHS	i) Structure condition is satisfactory.	
		RHS	i) Structure condition is satisfactory.	
15	41+230	LHS	i) Construction joint is visible between wing wall and side wall of culvert. ii) Honeycombing is visible in toe wall.	i) Grouting is recommended to fill the crack using GP-2 grouting compound.
		RHS	i) Construction joint is visible between wing wall and side wall of culvert.	i) Grouting is recommended to fill the crack using GP-2 grouting compound.
16	43+956	LHS	i) Water Logging.	
		RHS	i) Honey combing is visible in wing wall.	
17	44+906	LHS	i) Structure condition is satisfactory.	
		RHS	i) Structure condition is satisfactory.	
18	45+530	LHS	i) The bottom of the crash barrier is uplifted due to which reinforcement is exposed. ii) Painting and sign board is not done yet. iii) Mud is filled which is blocking the 50% of the opening.	i)Painting and sign board should be done as per provision. ii) Mud should be removed from the culvert for ease in flow of canal water. iii) Filler should be use in crash barrier so that the reinforcement is not exposed to atmosphere.
		RHS	i) Mud is filled which is blocking the 50% of the opening.	i) Mud should be removed from the culvert for ease in flow of canal water.
19	46+830	LHS	i) Opening is blocked by soil and concrete waste. ii) Honey comb is visible in toe wall.	i) Cleaning of opening is require. ii) Grouting is recommended.
		RHS	i) Honeycombing is visible in side walls.	i) Grouting is recommended.
20	47+430	LHS	i) Soil is deposited near opening of the culvert.	i) Cleaning of deposited soil is required.
		RHS	i) Soil is deposited near opening of the culvert.	i) Cleaning of deposited soil is required.
21	47+700	LHS	i) Structure condition is satisfactory.	

S.NO	CHAINAGE	SIDE	OBSERVATION	RECOMMENDATION
		RHS	i) Structure condition is satisfactory.	
22	50+520	LHS	i) Structure condition is satisfactory.	
		RHS	i) Structure condition is satisfactory.	

Table 4.53: Observations and Recommedation for Box Culverts in ILMH

SNO.	CHAINAGE	SIDES	OBSERVATION	RECOMMENDATION
1	0+900	LHS	i) Soil is dumped which is blocking the opening of the culvert.	i) Removal of soil is recommended.
		RHS	i) Structure condition is satisfactory.	
2	1+700	LHS	i) Structure buried in soil.	
		RHS	i) Structure buried in soil.	
3	1+820	LHS	i) Honey combing is visible in wing wall.	i) Grouting is required.
		RHS	i) Honey combing is visible in wing wall.	i) Grouting is required.
4	2+425	LHS	i) Structure condition is satisfactory.	
		RHS	i) Structure condition is satisfactory.	
5	2+930	LHS	i) Honey combing is visible in wing wall.	i) Grouting is required.
		RHS	i) Honey combing is visible in wing wall.	i) Grouting is required.

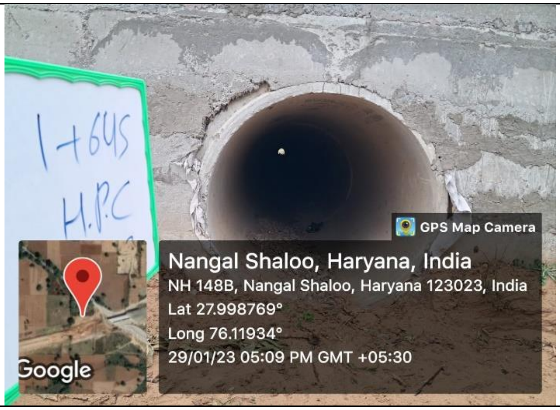

Fig 4.388: HPC at Ch 1+645

Fig 4.389: HPC at Ch 1+645

Fig 4.390: HPC at Ch 1+645

COM. TY.	DESCRIPTION	LCV	2-AXLE	3-AXLE	4-6 AXLE	TOTAL	%
8	Petroleum	1	3	0	3	**7**	2.7%
9	Gas	3	3	7	5	**18**	7.0%
10	Chemical/fertilizer/medicine	1	2	0	0	**3**	1.2%
11	Machinery part/Electric item	0	0	0	2	**2**	0.8%
12	Automobile	0	3	2	3	**8**	3.1%
13	Clothes & Textiles	3	12	15	26	**56**	21.8%
14	Others	0	0	0	0	**0**	0.0%
TOTAL		**24**	**33**	**46**	**154**	**257**	**100.0%**

Fig 5.1: Axle Load Survey at Ch- 27+800

Fig 5.2: FWD Survey

Fig 5.3: NSV Survey

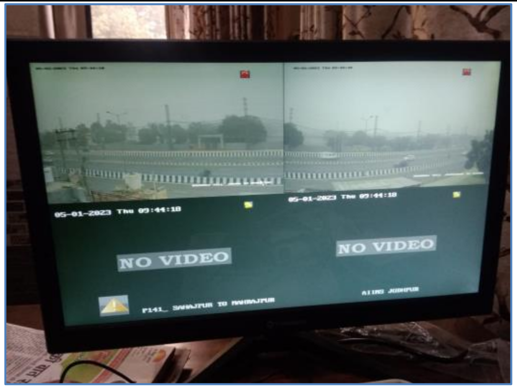

Fig 5.4: CTVC survey at Ch- 28+000