RESOTECH
CONSULTANCY SERVICES PVT. LTD.
CIN - U74140MP2008PTC020576

RESOTECH CONSULTANCY SERVICES PVT. LTD.
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RCSPL/VIIMPL/TDD/D-B/21-22/439 Date: 28.02.2022

To,
M/s Virescent Infrastructure Investment Manager Private Limited
10th Floor, Parinee Crescenzo
C-30, 'G' Block, Bandra Kurla Complex
Bandra (East), Mumbai 400 051
Maharashtra, India
Tel: +91 99716 22660

Sub:-Consultancy Services for Technical Due Diligence for Kadtal (Km 278.000) Armur (Km 308.000) Road section of NH-7 in the State of Telangana.

Ref.: Work order No. HC1/Tech/2021-22/016 dated 18.01.2022.

Dear Sir,

This is with reference to work order cited above vide which we have been awarded the work mentioned in subject above. The Final Report pertaining to Technical Due Diligence is enclosed herewith for your needful.

Thanking you,

Yours truly,

For RESOTECH CONSULTANCY SERVICES PVT. LTD.

RAJNISH MISHRA
DIRECTOR

NIRMAL BOT LIMITED

Four Lane section from Km 282.617 (Kadtal) to Km 313.507 (Armur) on NH-7 (New NH-44) in the state of Telangana on BOT (Annuity) Basis

Technical Due Diligence Report

For

Virescent Infrastructure Investment Manager Private Limited
(For The Purpose of Highways Infrastructure Trust)

FEBRUARY 2022

Resotech Consultancy Services Pvt. Ltd.

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NIRMAL BOT LIMITED

TECHNICAL DUE DILIGENCE REPORT

EXECUTIVE SUMMMARY

EXECUTIVE SUMMARY

E.01 THE PROJECT ROAD

The Project Road is a Section of NH-7 which starts from Kadtal in Adilabad District (New Ch. 282+617) and ends at Armur in Nizamabad District (New Ch. 313+507). The Project Road crosses the Godavari river at the major bridge Ch. 289+834 (36x20.9m) and has a length of **30.890km**. This Project for up-gradation of the existing road to four lane carriageway with paved shoulders was awarded by the National Highways Authority of India to M/s. Nirmal BOT Limited for a Concession Period of 20 years on BOT (Annuity) basis. The Concessionaire had appointed M/s Hindustan Construction Company Ltd. as their EPC contractor for execution of work under EPC mode. The Concession Agreement was signed on 04th May 2007 and the Project commencement date was fixed as 30thOctober 2007 and commercial operation started on 22nd July 2009. On 23rd December 2015 Highway Concessions One Pvt. Ltd. had acquired 74% of controlling stake in Nirmal BOT Limited and balance 26% was acquired on 06th March 2019. Further, on 17th December 2021, Galaxy Investments II Pte. Ltd. has acquired control of 100% stakes of M/s Nirmal BOT Ltd. from Highway Concessions One Pvt. Ltd.

E.02 BROAD SCOPE OF TECHNICAL DUE DILIGENCE:

M/s Resotech Consultancy Services Pvt. Ltd. has been engaged as Technical/Engineering Due Diligence Advisor for ***Highways Infrastructure Trust*** for the purpose to carry out a Technical Due Diligence for the Project. The Broad Scope of Technical Due Diligence is as under:

i) Review of all Project Documents

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

iii) Evaluation of overall condition of the pavement, structures and other road assets by visual observations and analysis of the available investigation reports

iv) Assessment of Maintenance needs of the project road and development of a detailed O&M and Major Maintenance Cost Projection for the Concession period.

E.03 SALIENT DETAILS OF THE PROJECT ROAD

Table E.1: Salient Details of the Project Road

S. No	Parameter	Description
1	Roadway	Four laned divided Carriageway with 1.5m paved shoulders
2	ROW	60m all along the length
3	Pavement Type	Flexible
4	Bypasses	Balkonda Bypass (6.8km)
5	Service Road/Slip Road (5.5m)	Total length of 14.477 km (both side)
6	Toll Plaza	Located at Ch. 285.938 near Gamjal(6+6 Lanes)
7	Major Junctions	3 nos.

S. No	Parameter	Description
8	Minor Junctions	8 nos.
9	Bus Bays	30 nos.
10	Truck Laybyes	4 nos.
11	Grade Separator	Vehicular Under Passes – 04 nos. & Pedestrian Under Passes – 12 nos.
12	Major Bridges	2 nos. (New Ch. 285+217 & Ch. 298+845)
13	Minor Bridges	6 nos.
14	Culverts	83nos. (55 HPC, 20 Box Culvert & 8 Slab Culvert)

E.04 MAJOR FINDINGS AND CONCLUSIONS

i) The Project Road has been constructed in accordance with the requirements of the Concession Agreement with NHAI and it conforms with the requirements of the Technical Specifications. There are no pending items of works from the Scope of work as per the Concession Agreement.

ii) From review of the records of the Maintenance works it is seen that the Concessionaire has taking care of its O & M liabilities in accordance with the requirements of the CA.

iii) Various assets of the Project Road are in good condition. The Major Maintenance work on the road has been completed in 2019 and the pavement condition is good. All the structures are in good condition. The road signs, markings, furniture items and other project facilities are also seen to be maintained in good condition.

iv) On review of the asset condition, the requirements of the Concession agreement there does not appear to be any requirement of any major maintenance on the project road apart from the Routine Operations and Maintenance and Periodic Renewal of the wearing course of the carriageway required after every five years as per provisions of the Concession Agreement.

v) O & M Cost Projection is shown in Table E.2.

Table E.2 Operation& Maintenance Cost Projections

Sl. No	Year	Periodic Maintenance Costs incl. GST (in Cr.)	Routine Operations and Maintenance Cost incl. GST (in Cr.)
1	2022-23		6.20
2	2023-24	14.80	5.90
3	2024-25	14.80	5.90
4	2025-26		6.20
5	2026-27		6.20
6	2027-28 (Oct 27) *		3.62
7	Expenses towards Handing over cost	1.50	
	TOTAL	**31.10**	**34.01**

* Reduced cost for Routine maintenance has been considered in the year of Periodic Renewal

Note: Rates of Telangana 2021-22 SOR have been adopted based on 2022-23 base rates.

TECHNICAL DUE DILIGENCE REPORT

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LIST OF ABBREVIATIONS USED

Abbreviations	Meaning
ATMS	Automatic Toll Management System
AVCC	Automatic Vehicle Count Classifier
BBD	Benkelman Beam Deflection
BC	Bituminous Concrete
BOQ	Bill of Quantities
BOT	Build Operate and Transfer
B/T	Bituminous
B/s	Both Sides
CA	Concession Agreement

Abbreviations	Meaning
CB	Crash Barrier
CBR	California Bearing Ratio
CC	Cement Concrete
c/c	Centre to Centre
CD	Cross Drainage
Ch	Chainage
COD	Commercial Operation Date
COM	Communication Port
COS	Change of Scope
C/s	Cross-section
Cr.	Crores
cum	Cubic Meter
DBM	Dense Bituminous Macadam
DC	Design Chainage
Dept.	Department
Dia	diameter
DL	Dead Load
DLC	Dry Lean Concrete
DLP	Defect Liability Period
D/s	Downstream
Dwg	Drawing
ECW	Existing Carriageway
Emb	Embankment
EPC	Engineering Procurement Construction
Etc.	Etcetra
ETC	Electronic Toll Collection
Fe415, Fe500	Grade of Steel
Fig.	Figure
FME	Force Majeure Event
FWD	Falling Weight Deflectometer
gms	Grams
GSB	Granular Sub Base
HD	High Definition
HDD	Hard Disk Drive
Hm	Hectometer
HPC	Hume Pipe Culvert
HYSD	High Yield Stress Deformed
IC / IE	Independent Consultant / Engineer

Abbreviations	Meaning
IRC	Indian Road Congress
Jn.	Junction
Kg	Kilogram
Km	Kilometer
Km/h	Kilometer per hour
L	Length
LCV	Light Commercial Vehicle
LHS	Left Hand Side
LL	Live Load
LMV	Light Motor Vehicle
LOA	Letter of Award
Ltd	Limited
m	Meter
M15, M30, M35	Grades of Concrete
MAV	Multi Axle Vehicle
Max	Maximum
MBCB	Metal Beam Crash Barrier
MCW	Main Carriageway
Min	Minimum
MoRTH	Ministry of Road Transport & Highways
MP	Mega Pixel
NHAI	National Highway Authority of India
M/s	Messer's
MSA, msa	Million Standard Axles
mm	Millimeter
MjB	Major Bridge
MnB	Minor Bridge
MoEF	Ministry of Environment and Forests
NA	Not Applicable
NBC	National Building Code
NH	National Highway
NOC	No Objection Certificate
Nos, No.	Numbers
O&M	Operation & Maintenance
PCC	Plain Cement Concrete
PCOD	Provisional Commercial Operation Date
PQC	Pavement Quality Concrete
PR	Project Road

Abbreviations	Meaning
PUP, u/p	Pedestrian Underpass
PWD	Public Works Department
Pvt. Ltd.	Private Limited
Res.	Residence
RCC	Reinforced Cement Concrete
R/f	Reinforcement
RFID	Radio Frequency Identification
RHS	Right Hand Side
ROW	Right of Way
SBC	Safe Bearing Capacity
SC	Slab Culvert
Sch.	Schedule
SG	Sub-grade
SH	State Highway
SIDL	Super Imposed Dead Load
SMPS	Switch Mode Power Supply
SP	Special Publication
SPV	Special Purpose Vehicle
Sqm.	Square Meter
SR	Service Road
Str.	Structure
TCS	Typical Cross Section
TFT	Thin Film Transistor Monitor
T/m^2	Tonne per square meter
TMS	Toll Management System
UPS	Uninterrupted Power Supply
U/s	Upstream
VDF	Vehicle Damage Factor
VUP	Vehicular Underpass
W	Width
WIM	Weigh in Motion
WMM	Wet Mix Macadam
WPI	Wholesale Price Index
&	and
X	Cross Junction
T	T-Junction
Y	Y-Junction

CHAPTER 1.0: INTRODUCTION

1.1 BACKGROUND

National ***Highways Authority of India (NHAI)*** has up-graded the Nagpur-Hyderabad Section from New Ch.282.617 (Kadtal) to Ch. 313.507 (Armur) (Old Ch. 278.000 to Ch. 308.000) of NH-7 in the State of Telangana from Two lane with paved shoulders to Four lane with paved shoulders under the North-South Corridor (NHDP Phase II). This Project was awarded to M/s. Nirmal BOT Limited for a Concession Period of 20 years. The Concessionaire had appointed M/s Hindustan Construction Company Ltd. as their EPC contractor for execution of work under EPC mode. The Concession Agreement was signed on 04th May 2007 and the Project commencement date was fixed as 30th October 2007 and commercial operation started on 22nd July 2009.

1.2 PROJECT ROAD LOCATION

The National Highway 07 is a section of the North – South Corridor (length 3745 km) which starts from Varanasi and connects major cities like Jabalpur, Nagpur, Hyderabad, Kurnool, Bangalore, Salem and Madurai. The Project Road is a Section of which starts from Kadtal in Adilabad District (New Ch. 282+617) and ends at Armur in Nizamabad District (New Ch. 313+507). The Project Road crosses the Godavari river at the major bridge Ch. 289+834 (36x20.9m) and has a length of **30.890km**. The location map of the project road is shown in fig. 1.1 below:

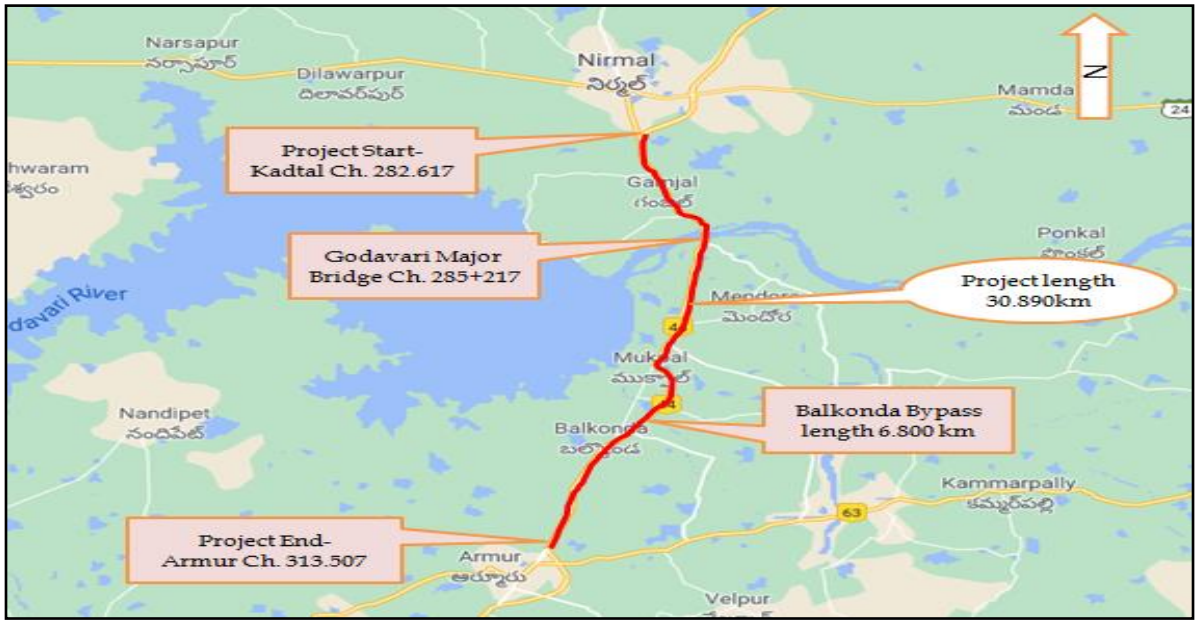

Fig 1.1: Project Road Map

1.3 SALIENT FEATURES OF PROJECT

The Salient Features of the Project are brought out in **Table 1.1** below.

Table 1.1: Salient Details of Project

S. No	Parameter	Description
A.	**Basic Details**	
1	Project Name	Design, Construction, Development, Finance, Operation and Maintanance of 4-lane dual carriageway from New Ch. 282.617 (Kadtal) to Ch. 313.507 (Armur) of NH-7 section in the State of Telangana on BOT Annuity basis.
2	State	Telangana
3	NH	NH-7
4	Section	*New Ch. 282.617 (Old Ch. 278.000) (Kadthal) to Ch. 313.507 (Old Ch. 308.000) of NH-44(Armur)
5	Length of the Project	30.890 km
B.	**Contract Details**	
1	Concessionaire	M/s Nirmal BOT Ltd.
2	Independent Consultant (during Development)	Aarvee Associates Architects Engineers & Consultants Pvt. Ltd.
3	Independent Consultant (Current)	Aarvee Associates Architects Engineers & Consultants Pvt. Ltd. in association with Shree Bhawani Consultancy Services Pvt. Ltd.
4	Date of Award (LOA)	04thMay, 2007
5	Appointed Date/ Commencement Date	30th October, 2007
6	Provisional Completion Date /(COD)	22th July, 2009
7	Final Completion Certificate issued	03rd October, 2018
8	Concession Period	20 years (from Commencement Date)
9	Concession Completion Date	29th Oct., 2027
C.	**Project Details**	
1	Roadway	4 laned divided Carriageway with 1.5m paved shoulders
2	ROW	60m all along the length
3	Pavement Type	Flexible
4	Bypasses	Balkonda Bypass (6.8km)
5	Service Road/Slip Road (5.5m)	Total length of 14.477 km (both side)
6	Toll Plaza	Located at New Ch. 285.938 near Gamjal (5+5 Lanes)
7	Major Junctions	3 nos.
8	Minor Junctions	8 nos.
9	Bus Bays	26 nos.

S. No	Parameter	Description
10	Truck Laybyes	4 nos.
11	Grade Separator	VUP – 04 nos. & PUP – 12 nos.
12	Major Bridge	2 nos. (New Ch. 285+217 & Ch. 298+845)
13	Minor Bridge	6 nos.
14	Culverts	83nos. (55 HPC, 20 Box Culvert & 8 Slab Culvert)

* Note: For the purpose of report we have used new chainages of the project road. Please note, new chainage Km. 282.617 corresponds to old Km. 278.000. Accordingly other chainages are to be referred in the report.

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 provisional completion certificates, punch list items completion certificate, clearances, monthly IE reports, important correspondence if any.

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. Review of As-Built drawings.

g. 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.

h. 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.

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

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

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

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, MCB, guard rails etc. other

safety measures, toll collection infrastructure, buildings, 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. Recommendations for any major repair/ rehabilitation and strengthening based on the condition survey and design reports.

g. 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.

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

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

1.4.4 O&M ASSESSMENT AND SUBMISSION OF REPORTS

a. To Develope 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 comprehensive report for InvIT by covering all scope of work mentioned herein above.

CHAPTER 2.0: REVIEW OF DOCUMENTS

2.1 REVIEW OF CONCESSION AGREEMENT

The ***National Highway Authority of India (NHAI)*** in accordance with the statutory powers vested on it by the Ministry of Road Transport and Highways (MoRTH), Government of India has entered into a Concession Agreement on 04th May 2007 with ***M/s Nirmal BOT Limited,*** a Special Purpose Vehicle (SPV) formed for implementing this project, a company incorporated under Indian Companies Act, 1956 for Construction, Development, Finance, Operation and Maintenance of Km 278.000 (Kadtal) to km 308.000 (armur) on NH-7 in the state of Telangana under North-South Corridor (NHDP Phase II) on BOT (Annuity) Basis.

Our observations on the major relevant provisions of the Concession Agreement are given below.

2.1.1 SPECIFIC COMMENTS ON ARTICLES OF CONCESSION AGREEMENT

Since the Project has been completed and is presently under the Operation Period, we have reviewed the provisions pertaining to Operation and Maintenance under the various clauses of the Concession Agreement and our specific comments are indicated below clause-wise.

Table 2.1: Comments on Concession Agreement

Sl No.	Article, Clause No. & Page No.	Subject	Information in Brief	Remarks
1.	Chapter I, Article II, Cl. 2.1, p 16.	Scope of Project	The scope of the Project shall include performance and execution by the Concessionaire of all design, engineering, financing, procurement, construction, completion, operation and maintenance of the Project Highway as described in Schedule B and Schedule C of this Agreement. It shall also include the performance and fulfilment of other obligations by the Concessionaire under this Agreement	Since all the phases of work has been completed and COD has been issued, the work is presently in Operation and maintenance stage.
2.	Chapter II, Article III, p 18	Grant of concession	NHAI hereby grants to the Concessionaire and the Concessionaire hereby accepts the Concession for a period of 20 (twenty) years commencing from the Commencement Date. The Concession Period shall	As per definition the Commencement date means the date 180 days from the date of signing of the Concession Agreement (Commencement date is

Sl No.	Article, Clause No. & Page No.	Subject	Information in Brief	Remarks
			commence on the Commencement Date and shall end on the Termination Date.	30.10.2007). As per definition the Termination date means the date on which this Agreement and the Concession hereunder expires pursuant to the provisions of this Agreement or is terminated by a Termination Notice.
3.	Chapter II, Article VI, p 21	Annuity	Subject to the provisions of this Agreement and in consideration of the Concessionaire accepting the Concession and undertaking to perform and discharge its obligations in accordance with the terms, conditions and covenants set forth in this Agreement, NHAI agrees and undertakes to pay to the Concessionaire, on each Annuity Payment Date, the sum of Rupees Twenty-three crores and eighty lakhs only. (Annuity).	This article and clauses from 6.1 to 6.4 describe the amount, payment mechanism and other relevant details of annuity. The Clause 6.2 also provides for Bonus/Reduction in Annuity for early/ delayed completion of the project.
4.	Chapter II, Article VII, p 25	Levy and collection of fees	The Concessionaire shall not levy, demand or collect from or in respect of any vehicle or Person, for the use of Project Facilities.The Concessionaire agrees that unless otherwise provided in this Agreement, the Project revenue shall consist of Annuity only.	This article and subsequent clauses specify that for the Concessionaire the project revenue shall consist of Annuity only and NHAI shall have the authority to levy toll on the vehicles using the Project Facilities.
5.	Chapter II, Article VIII, p 26	Capacity Augmentation	The NHAI may, following a detailed traffic study conducted by it, at any time after the COD decide to augment / increase the capacity of the Project (Capacity Augmentation) with a view to provide the desired	As per the information available, there is no such proposal for capacity augmentation from NHAI till date.

Sl No.	Article, Clause No. & Page No.	Subject	Information in Brief	Remarks
			level of service to the users of Project Facility. The Concessionaire shall have option to submit its proposal for Capacity Augmentation. In case the Concessionaire after participating in the bidding process, fails to give the lowest offer, the Concessionaire shall be given the first right of refusal to match the preferred offer. If the Concessionaire matches the preferred offer, the parties shall enter into a suitable agreement supplement to this agreement to give effect to the changes in scope of the Project, Concession Period and all other necessary and consequential changes.In case the Concessionaire chooses not to submit its proposal or is not the preferred bidder and fails or declines to match the preferred offer, NHAI shall be entitled to terminate this agreement upon payment to the Concessionaire of the Termination Payment which shall be an amount equivalent to the Discounted Value of the Future Net Cashflows.	
6.	Chapter III Article IX	Obligations of the Concessionaire	Clauses 9.1 to 9.7 spell out various obligations of the Concessionaire during the Concession Period	The obligations of the Concessionaire are covered comprehensively
7.	Chapter III Article X	Obligations of NHAI	Clause 10.1 spells out various obligations of the NHAI during the Concession Period	The obligations of the NHAI are covered comprehensively.
8.	Chapter III, Article XI, Cl. 11.1 (xiii), p 36	Representations and Warrants	The equity share holding of the single entity and their Associates as the case may be in the issued and paid-up equity share capital of the Concessionaire shall not be less	This clause restricts the dilution of shareholding.

Sl No.	Article, Clause No. & Page No.	Subject	Information in Brief	Remarks
			than 26% during the balance remaining Operations Period.	
9.	Chapter IV, Article XVII, Cl. 17.5, p 47	Value Addition-Improvement to Project Assets and Project Highway	NHAI may request improvement to the Project Assets and Project Highway, subject to a limit of 20% of the Project Cost, during the Operation Period.	Work may be executed under COS through the existing Concessionaire subject to the limit of 20% of the Contract Value. The cost shall be borne by NHAI.
10.	Chapter IV, Article XVIII, Cl. 18.1, p 48	Operation and Maintenance	The Concessionaire shall operate and maintain the Project Highway by itself or through O&M contractor	This clause specifies the Concessionaire's obligations during Operations Period. The Concessionaire is bound by the Agreement to maintain the Project Highway as per specifications and standards and adhere to safety standards as mentioned in Schedule S.
11.	Chapter IV, Article XVIII, Cl. 18.2, p 48	Maintenance manual	The Concessionaire shall in consultation with the IC prepare not later than 180 days before the Scheduled Project Completion Date, the Repair and Maintenance Manual for the regular and periodic maintenance and shall ensure and procure that, at all times during the Operations Period, the Project Highway is maintained in a manner that it complies with the Specifications and Standards and minimum maintenance requirements.	An O & M Manual has been prepared by the Concessionaire and is on record.
12.	Chapter IV, Article XVIII, Cl. 18.3, p 48	Maintenance Programme	Not later than 45 days before the beginning of each Accounting Year, the Concessionaire shall in consultation with IC prepare and provide to NHAI, its proposed programme of preventive and other scheduled	The items to be included in Maintenance Programme including intervals for carrying out inspection and Preventive Maintenance Schedule are specified.

Sl No.	Article, Clause No. & Page No.	Subject	Information in Brief	Remarks
			maintenance.	
13.	Chapter IV, Article XVIII, Cl. 18.4, p 49	Operation and Maintenance	Maintenance shall include replacement of equipment/ consumables, horticultural maintenance and upkeep of all Project Assets in good order and working condition.	Concessionaire is bound by agreement to maintain these.
14.	Chapter IV, Article XIX, Cl. 19.1, p 52	Maintenance Report	The Concessionaire shall undertake periodic (at least once every calendar month but once every week during monsoons) inspection of the Project Highway to determine the condition of the Project Highway including its compliance with the Maintenance Manual, the Maintenance Programme, Specifications and Standards and the maintenance required and shall submit reports of such inspection ("Maintenance Reports") to NHAI and the Independent Consultant.	Concessionaire is bound by agreement to submit these reports in time and the same is being submitted as part of the Monthly Progress Reports.
15.	Chapter IV, Article XIX, Cl. 19.2, p 52	O&M Inspection Report	The IE shall review the Maintenance Reports and inspect the Project Highway once a month during the Operations Period and make out an Inspection Report of such inspection. The Concessionaire upon receipt of this Report shall remedy the defects and deficiencies, if found any.	The Inspection report by the Independent Consultant is submitted as part of the Monthly Progress Report submitted by the IC.
16.	Chapter IV, Article XX, Cl. 20.1 and 20.4, p 53	Independent Consultant	NHAI shall appoint a consulting engineer firm to be the Independent Consultant who will report to NHAI. One half of the remuneration, cost and expenses of the IC shall be reimbursed by the Concessionaire to NHAI. The NHAI may at any time at its own cost appoint a Technical	The Independent Consultant is expected to protect the interests of both the Authority and the Concessionaire withing the framework of the Concession Agreement.

Sl No.	Article, Clause No. & Page No.	Subject	Information in Brief	Remarks
			Auditor in the nature of a Proof Consultant to review the work carried out by the IC.	
15.	Chapter V, Article XXV, Cl. 25.3.2, p 58	Escrow Account	From the date which is 2 years prior to the expiry of the Concession Period a sum equal to 15% of the Annuity or higher for renewal works will be retained in Escrow account. Within 14 days after the issue of Vesting Certificate the sum thus retained shall be released to the Concessionaire.	The Clause provides security to the Authority to make the Concessionaire bound to carry out any renewal work which may be required before the expiry of the Concession Agreement.
16.	Chapter V, Article XXVII, Cl. 27.2, p 59	Insurance during the Operations Period	During Operations Period, the Concessionaire shall obtain and maintain such insurance as may be required under any of the Financing Documents, Applicable Law etc.	Insurance Cover to be maintained during Operations Period have been specified.
17.	Chapter VII, Article XXXIII, Cl. 33.3, p 74	Divestment of rights and interests	Not earlier than 3 (three) months before the expiry of the Concession Period but not later than 30 (thirty) days before such expiry, the IC shall verify, in the presence of a representative of the Concessionaire, compliance by the Concessionaire with the Divestment Requirements set forth in Clause 33.2 in relation to the Project Highway and, if required, cause appropriate tests to be carried out at the Concessionaire's cost for determining the compliance therewith. If any shortcomings in the Divestment Requirements are found by either Party, it shall notify the other of the same and the Concessionaire shall rectify the same at its cost.	The Vesting Certificate is to be issued after compliance of Divestment Requirements.
18.	Chapter VIII, Article XXXIV, p 76	Defects Liability	The Concessionaire and IE shall jointly inspect (Initial Inspection) the Project Highway and Project Facilities 30-36	The Concessionaire needs to ensure by having an adequate system of preventive maintenance

Sl No.	Article, Clause No. & Page No.	Subject	Information in Brief	Remarks
			months prior to expiry of Concession Period. Upon agreement on proposals for renewal works if any, the Concessionaire shall carry out the renewal works at his own cost. The Second Inspection shall be carried out 9-12 months prior to expiry of Concession Period. From the date which is 2 years prior to the expiry of the Concession Period a sum equal to 15% of the Annuity or a higher sum estimated by the Independent Consultant for Renewal Works will be retained in the Escrow Account. If following the Second Inspection, it is agreed or determined that no renewal works are required, then within 14 days of such agreement, 50% of the sums retained in accordance with Clause 34.11 shall be released from the Escrow Account to the Concessionaire. Within 14 days of issuance of Vesting Certificate full amount will be released.	that requirements of any such renewal or a rectification is kept at the minimum.
19.	Schedule C Clause 1	Project Facilities - General	The following sections of this Schedule provide the minimum functional and spatial requirements of the facilities to be provided on the Project Highway. The Concessionaire shall review the adequacy of the proposed facilities at regular interval of 5 years and accordingly provide additional facilities with necessary approval from the IC in order to meet the demand of the road	The provision is open ended and does not specify the requirement of COS order for providing additional required facilities. It is not clear as to who will bear the cost of such additional facilities. As informed by the Concessionaire no such reviews have been conducted till date.

Sl No.	Article, Clause No. & Page No.	Subject	Information in Brief	Remarks
			users till the end of the concession period.	
20.	Schedule D Cl. 3.5.6.1, p 135	Highway Patrolling	Highway Patrolling establishment should have three shifts of 8 hours each. It would consist of 1(one) Sub Inspector, 1 (one) head constable, 3 (three) constables and 1 (one) driver. The Concessionaire shall reach an agreement for hiring the aforesaid personnel with the concerned department of the State Government of Andhra Pradesh.	The clause mandates hiring of the Patrolling staff with the concerned department of the State Govt of AP. However it is noted that the patrolling staff are being arranged by the concessionaire only.
21.	Schedule X	Reporting and Record requirements	Reporting and Record requirements during Operations phase has been specified	The Concessionaire has to fulfil these requirements as per agreement.

The Schedule-L of the Concession Agreement which pertains to the Operation and Maintenance requirements has specifically been reviewed and our observations on some of the important clauses in the same have been brought out in **Table 2.2** below.

Table 2.2: Comments on Schedule-L of Concession Agreement

Sl No.	Clause No. & Page No.	Subject	Information in Brief	Remarks
1.	Cl. 1, p 190.	Introduction	The period during which the Concessionaire shall comply with the O&M requirements covers the entire Concession Period including the Construction Period.	This clause specifies that the operation and maintenance is to be carried out during entire Concession Period

Sl No.	Clause No. & Page No.	Subject	Information in Brief	Remarks
2.	Cl. 2.1.11, p 192.	Operation and Maintenance (O&M) Requirements	In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right-of-Way (RoW) of the Project Highways inclusive of all facilities such as interchanges, street lighting facilities, traffic light facilities, emergency telephone networks and other facilities constructed by the Concessionaire within the Project Highways.	This clause specifies scope for operation and maintenance. It also limits the Concessionaire's responsibility regarding another road joining or crossing the concession limit.
3.	Cl. 2.2 to 2.4, 2.6 and 2.7, p 193	Traffic management and lane closure	Traffic Management plan and programme for a planned scheduled construction and/or maintenance activity shall be prepared in advance of that activity and got approved by the Independent Consultant/NHAI as the case may be.	These clauses along with their sub clauses specify guidelines regarding traffic management during scheduled and unscheduled maintenance activities.
4.	Cl. 3.1 to 3.8 p 199	Operations and Maintenance Manual (Maintenance Manual)	The Concessionaire shall in consultation with the Independent Consultant evolve an Operations and Maintenance Manual (Maintenance Manual)	These clauses specify that Maintenance Manual is to be evolved in consultation with IC. The details to be included in Operations part of manual, types and frequency of Inspection and strategy for preventive maintenance are specified.
5.	Cl. 4.1.3, p204	Guidelines for Maintenance Manual	The following MORT&H and IRC publications shall be referred for preparation the "Operation and Maintenance Manual" • MORT&H Manual for Maintenance of Roads. • IRC-SP-35-1990, Guidelines for Inspection and Maintenance of Bridges. • The manufacturer's	Codes and Standards for preparation of Maintenance Manual have been specified. The manufacturer's Maintenance manuals of the equipment to be used in Project Highway Operations are to be included in Maintenance manual.

Sl No.	Clause No. & Page No.	Subject	Information in Brief	Remarks
			Maintenance manual(s) of the equipment to be used in the Project Highway Operations shall form part of the said O&M Manual.	
6.	Cl. 4.2.1.1, p 205	Routine Maintenance	Routine Maintenance broadly includes, Maintenance of pavement, turfed areas, landscaping, drainage system, CD structures, buildings, Right-of-Way fences, Highway Accessories, guardrails, other miscellaneous responsibilities such as standby/on-call, emergency plant & equipment, stray animal catching operations etc, traffic and safety control devices during the routine maintenance works or any accident	The Concessionaire is required to develop maintenance sheets for each component of the works. The Concessionaire has to utilise mechanised equipment, method and innovative solutions and technology to perform these obligations and include such process in the Maintenance Manuals. All maintenance activities are to be carried out in accordance with relevant IRC Codes, Guidelines and Special Publications as are applicable to National Highways, MORT&H specifications and Technical circulars with all updates.
7.	Cl 2,6.1 and 4.3 p 198 and 206	Periodic Maintenance	Regular periodic maintenance activities: i) Renewal of the wearing surface of the road pavement laid every 5 years after initial construction or where the roughness value reaches 3000mm/km; ii) Strengthening course to be provided on 'as required' basis.	The framework of activities relating to pavement maintenance and rehabilitation in respect of flexible and rigid pavement are given in the flow charts at Appendices of this Schedule. The Concessionaire shall set forth in the Operations and Maintenance Manual the detailed procedures to be followed under each of these activities.
8.	Cl. 4.3.1 p 206	Pavement	The riding quality of the pavement shall be ensured by	This clause specifies Surface roughness of

Sl No.	Clause No. & Page No.	Subject	Information in Brief	Remarks
		Riding Quality	satisfying the minimum requirements as specified herein under i) Surface roughness of the Project Highway on completion of construction shall be 2000 mm/km as measured by vehicle mounted Bump Integrator. ii) Surface roughness shall not exceed 3000 mm/km during the service life of pavement at any time. A renewal coat of bituminous concrete shall be laid every 5 years after initial construction or where the roughness value reaches 3000 mm/km whichever is earlier to bring it to the initial value of 2000 mm/km.	Project Highway on completion of construction to be 2000 mm/km. As per Cl. 2.5.5 of Schedule D "Specifications and Standards", the Unevenness index of the pavement on completion shall not be more than 1800 mm/km. Asper Cl. 1.4.2 (i) on p 16 of Concession Agreement, in case of ambiguities or discrepancies "between two Clauses of this Agreement, the provisions of the specific clause relevant to the issue under consideration shall prevail over those in other Clauses". Since the project is in O&M stage so provision of this clause will apply.
9.	Cl. 4.3.2 p 206	Structural Condition of the Pavement	The structural condition of the flexible pavement of the Project Highway shall be assessed every year by taking Benkelman Beam Deflections and working out characteristic deflections of homogeneous sections of the Project Highway as per IRC-81-1997. Whenever the characteristic deflection exceeds 1.2 mm a bituminous overlay shall be provided appropriately designed according to IRC-81-1997 or its latest versions.	Recycling of existing crust using milling as an option can be explored by the Concessionaire in consultation with the IC to maintain the FRL at the same level throughout the concession period. However, while adopting such measures, the residual strength of existing pavement shall be estimated and equivalent thickness of new material added before laying the designed overlay. The design of profile with

Sl No.	Clause No. & Page No.	Subject	Information in Brief	Remarks
				altered pavement treatments shall be finalised in consultation with IC. In the case of cement concrete pavement, joints shall be thoroughly inspected every year and the loss of sealing compounds made good.
10.	Cl 4.3.3 p 207	Preventive Maintenance	Preventive Maintenance shall include the activities related to each element and the system as a whole of the Project Highway to ensure that during the Concession Period and at its end, it is in sound, durable and functional condition	The Concessionaire needs to ensure by having an adequate system of preventive maintenance that requirements of any renewal or rectification is kept at the minimum at the time of issue of Vesting Certificate.
11.	Cl 4.3.4 p 207	Special Repairs	Damages occurring due to natural calamities like heavy floods, sand storms, hurricanes, cyclones, earthquakes to any element or system of the Project Highway, shall be rectified and the system restored to function as per programme prepared in consultation with IC. All such activities shall fall under 'Maintenance' and shall form a part of the said Maintenance Manual.	This clause spells out the obligation of the Concessionaire to carry out special repairs to restore the system in case of damages caused by natural calamities.
12.	Cl. 4.4 and 4.5 p 207 and 213	Minimum Maintenance Requirement	Steps as mentioned in O&M manual shall be followed by the Concessionaire for repairing the breaches.	Time period for attending to major breaches, minor cuts, shoulders and all other elements of Project Highway has been specified.
13.	Cl. 4.6, p 217	Incident Management	The Concessionaire shall initiate, co-ordinate and maintain an Incident Management System (IMS)	The Concessionaire shall set up a steering committee, which shall include representatives of

Sl No.	Clause No. & Page No.	Subject	Information in Brief	Remarks
			and supply regular incident statistics to client.	the various relevant agencies, to identify current & potential issues and problem areas which need addressing.
14.	Cl. 4.7, p 219	Safety Management	The Concessionaire shall maintain a comprehensive register and database of all accidents occurring on the Project Highway Section. The Concessionaire shall utilize this data to define and identify "Black Spots" and the like, make the necessary analysis of the cause of the "Black Spot".	The Concessionaire shall provide educational programs for the improvement of safety for the Users of Roads under operation. This shall occur four times per annum. This shall be carried out by the issuing of pamphlets, billboards, etc. The Road Patrols shall in addition take every opportunity at events such as accidents and the like to educate the Users.
15.	Cl. 4.8.2, p 220	Encroachments:	From the date of the commencement of O&M period, the Concessionaire shall be required to determine all encroachments and unauthorised accesses to the highway. The Concessionaire shall list the encroachments with a description, location and extent of each encroachment	The Concessionaire shall draw up a method statement and programme for the removal of the Unauthorized accesses or encroachments for approval by the client. All encroachments shall be removed, and unauthorised accesses closed within 3 months of the commencement of O&M period.
16.	Cl. 4.8.3, p 221	Inspections	The Concessionaire shall draft Inspection procedures for each part and component of the National Highway Section that requires periodic inspection. The inspection reports will be submitted to the IC and the NHAI. Based on reports, detailed investigations shall be undertaken by the	The Concessionaire shall carry out any maintenance, repair or rehabilitation works found necessary by these investigations in accordance with the Maintenance Manual and this Agreement.

Sl No.	Clause No. & Page No.	Subject	Information in Brief	Remarks
			Concessionaire itself and/or on advice of the IC and the NHAI.	
17.	Cl. 5, p 222	Transfer Certificate	The Concessionaire shall obtain a Transfer Certificate as per Schedule L1 appended to this Schedule.	This is a mandatory requirement for Divestment and subsequent issue of Vesting Certificate.

2.1.2 CONCLUSIONS ON OBSERVATIONS ON CONCESSION AGREEMENT

The Concession Agreement is comprehensive and covers all the issues concerned with the Construction and Operation of the Project.

2.2 REVIEW OF O&M MANUAL

2.2.1 PROVISIONS OF O&M MANUAL

As per Clause 18.2 of the Concession Agreement, the Concessionnaire shall in consultation with the Independent Consultant prepare the repair and Maintenance Manual (Maintenance Manual) for the regular and periodic maintenance and shall ensure that at all times during the Operations period, the Project Highway is maintained in a manner that it complies with the Specifications and Standards and the minimum maintenance requirements set forth in Schedule L of the Concession Agreement. The O&M Manual describes guidelines for implementing the O&M requirements successfully by prescribing the procedures and systems for activities involved as per the Concession Period. This Manual shall act as guideline to assist the Concessionaire and the IE, who has to independently inspect the maintenance and report to NHAI. Certain forms and procedures have been annexed therein, which facilitates proper supervision and also enable the maintenance works to progress in an orderly and efficient manner.

The Manual reflects the best practices for maintenance of highways / bridges of this type and has been generated based on standard practices. The broad structure of the O&M Maunal is as under:

SECTION 1: PROJECT DETAILS

This section gives the Project background, the requirements and scope of Operations and Maintenance and the suggested Organisation Structure of the Concessionaire Team.

SECTION 2: OPERATIONS

This section describes the procedures and protocols to be followed during the activities pertaining to Operations under the following heads.

i) Traffic Management
ii) Emergency Response Protocol

iii) Environment Management Plan for mitigating the adverse impact of Air quality, Noise, water quality and improper land use.

iv) Regular Operations of Systems like Highway Patrolling System, Rescue and Medical Aid Services, Lighting System and the Higway Traffic Management System

SECTION 3: MAINTENANCE

This section describes the methodology and procedures to be followed for undertaking the Maintenance activities under the following heads.

i) Maintenance Methodology and programme for Routine Maintenance , Periodic Maintenance and repairs for the Major breaches in the the Roadways

ii) Maintenance Intervention Levels

The maintenance Manual prescribes the intervention levels as described in Table 2.3 below. These intervention levels are in accordance with the requirement of the Concession Agreement.

Table 2.3: Maintenance Intervention Levels

Sl. No.	Service Factor	Level of Service
1	Roughness by Bump Integrator (Max. permissibility)	3000mm/km
2	Potholes/km (max) i) Less than 75mm deep ii) More than 75mm deep	Nil Nil
3	Percent Cracking	Up to 10% of length of Project Highway
4	Rut Depth not exceeding 10mm	Up to 10% of length of Project Highway
5	User Information	All road signs, km post and road marking in good condition.
6	Percentage Defective Bridge Deck area and bump at approach	Nil
7	Camber i) Mainline ii) Service Road	(+ or -) 0.15% variation from the Camber as er Design Requirements (+ or -) 0.20% variation from the Camber as per Design Requirements
8	Drainage	No visible water pool within the Project Highway
9	Characteristic Deflections as per IRC:81-1997	Upto 1.2 mm

iii) Safety Manageement Programme- to be followed during the construction and maintenance activities

iv) Inspection procedures for undertaking inspections of varying degrees like visual inspection, close inspection & thorough inspection, frequencies of such

inspections and also provides formats for such inspections. Frequencies under normal circumstances are as given in the Table 2.4 below.

Table 2.4 Frequency of Inspection

Sl. No.	Object	Item	Daily	Monthly	Quartely	Before and after rains
1	Riding Surface	Pavement	V	C		T
		Expansion Joints	V	C		T
2	Median	Kerb	V	C		T
3	Side Slopes	Shape	V		C	T
		Turfing		V		T
		Pitching & Masonary		V		T
		Retaingin Wall		C		T
4	Drainage	Shoulder Drain	R	C		
		Median Drain	R	C		
		Slip Slope Drain	R	C		
		Bridge Catch Basin	R	C		
		Gullies & Catch Pits	R	C		
5	Bridges	Super structure			C	T
		Substructure			C	T
		Head wing walls and aprons			C	T
		Painting				T
		Hand Rail		C	T	
6	Culverts	Box/Slab				T
		Hume Pipe				T
7	Guard Rail	Shoulder/Medina	V		C	T
8	Traffic Operation Facilites	Signs		C	T	
		Marking	V	C	T	
		Delineator	V	C	T	
		Lighting	V		C	
9	Other Facilities	Vegetation/Landscaping	V	C	T	
		Truck Lay Bye	V	C		
		Way side amenities	V	C		
10	Traffic Conditions		V	T	C	
11	Encroachemnts		V	T		

NOTE: V= Visual Inspection, C=Close Inspection, T= Through Inspection & R= Visual Inspection during rainy season only.

v) Requirement of Monthly MPR and other reporting requirements.

2.2.2 CONCULSIONS ON REVIEW OF O&M MANUAL

The O&M Manual is comprehensively covering all the aspects of Operations and Maintenance requirements for the Project Road as presecribed in the Concession Agreement and also the best industry practices.

2.3 REVIEW OF O&M CONTRACTS

2.3.1 CONCTRACT FOR OPERATION AND MAINTENANCE

The Concessionare has issued work order to M/s RPM Infra for the operation and maintenance of the road on 08.01.2016. The work order was issued for a period of One year from 2016. Thereafter amendments to the work orders are being issued for the extension of the duration. The latest amendment is amendment 7th as per which the contract has been extended up to 31.03.2022. The contract provides for the Bill of Quantity for the Routine maintenance which covers the following major items:

a) Cleaning of Main carriageway
b) Cleaning of Project facitlities
c) Cleaning of ROW
d) Cleaning of Structure
e) Maintenane of lined drain
f) Maintenance of Median and Avenue Plantation
g) Electrical Maintenance
h) Maintenance of Toll Plaza
i) Routine Maintenance Supervision

The contract also provides for Incidence Management patrol vehicles and Incidence Management with ambulance. Apart from the above BOQ items the contract also provides for repair work items to be operated with the work notice from M/s Nirmal BOT Ltd. Items like Metal Beam Crash Barrier, Sign Boards etc are to be supplied by the Concessionare to the Contractor. Further the contract also provides for provisional items for supply of labour and equipments as per the instruction from the Concessionare.

2.3.2 CONTRACT FOR PERIODIC MAINTANACE

The concessionare entered into a contract for carrying out major / periodic maintenance of the road sections with M/s Marko Lines Traffic Controls Pvt. Ltd. The scope of work of the contractor includes milling of existing Bitumenous layers as may be required, overlay with BC/DBM wherever required. Provision of Tack coat, kerb topping, kerb painting, construction of repair of earthen shoulders. The contract furhters provides for the variation in the BOQ quantities to any extent during actual execution depending on the site condition at the same unit rates as metioned in the BOQ. The only price variation allowed is, for increase or decrease in Bitumen price. The work under the contract was completed on 24.09.2019 and NHAI has issued Completion certificate for the major maintenance vide letter dated 28.01.2021.

2.3.3 CONCLUSIONS ON REVIEW OF O&M CONTRACTS

The work order/Contracts for operation and maintenance activity are found to be covering all the requirement stipulated in the concession aggrement comprehencsively.

2.4 REVIEW OF OTHER DOCUMETS

The documents related to Provisional Completion certificates, Completion Cetirifcates, project clearances and monthly IE reports (current), etc were reviwed and it is noted that there are no pending issues or balance work that may have potential impact on the maintenance cost or which may warrant a one time expense in future.

CHAPTER 3.0: REVIEW OF DESIGNS AND AS BUILT DRAWINGS

3.1 REVIEW OF DESIGNS AND AS-BUILT DRAWINGS

The As-built drawings for highways and structures as prepared by the Concessionaire were studied by us and our observations for the same have been presented in the subsequent paragraphs below. It is noted that there is difference in the project chainages as given in the schedule, as mentioned in the As-buit drawings and as found on the Kilometer stone at site. As per Schedule the Starting Chainage is 278+000 and End Chainage is 308+000. As per As-Built Drawings the Starting Chainage is 278+000 and End Chainage is 308+890 while as per the site the Starting Chainage is 282+617 and End Chainage is 313+507.

3.1.1 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.**1 below.

Table 3.1: Review of As-built Drawings for Highways

Sl. No.	Name of Item	As per Agreement Schedule	As per As -Built Drawing	Remarks
1	Project Length	30.890 km	30.890 km	
2	Design Speed	100 kmph	100 kmph (however some speed restrictions have been put in place at some locations)	
3	Horizontal Curves	Minimum radii – 360 m	Under Limits	
4	Vertical curves	Minimum Gradiant 3.3%	Under Limit	
5	Stopping Sight Distance	As per IRC: SP-23	Under Limits	

Sl. No.	Name of Item	As per Agreement Schedule					As per As -Built Drawing						Remarks
6	Length of Bypass	Name of Town	From	To	Length (in km)		Name of Town	From	To	Length (in km)			
		Balkonda	294+600	301+400	7.10		Balkonda	294+690	301+350	6.80			
7	Length of Service Road/Slip Road	S. No	From	To	Length	Side	S. No.	From	To	Side	Length	Remarks	
		1	278+400	279+200	0.80	BS	1	278+100	278+810	LHS	2.2	Kadtal	
								278+200	279+653	RHS			
		2	282+000	282+200	0.20	BS	2	281+686	282+286	LHS	1.4	Gamjal	
								281+575	282+390	RHS			
		3	287+400	287+600	0.20	BS	3	286+981	287+800	LHS	1.6	Doodgaon	
								286+981	287+800	RHS			
		4	287+600	289+600	2.00	BS	4	287+900	288+607	LHS	1.5	Pochampadu	
								287+800	288+607	RHS			
		5	290+000	290+200	0.20	BS	Not found in As-built Drawing					Sonpet	
		6	291+000	292+000	1.00	BS	5	290+600	292+000	LHS	2.9	Bussapur	
								290+530	292+000	RHS			
		7	292+800	293+700	0.90	BS	6	292+490	293+464	LHS	1.9	Nallur	
								292+580	293+458	RHS			
		8	306+300	306+700	0.40	BS	7	306+200	306+908		1.4	Srirampur	

Sl. No.	Name of Item	As per Agreement Schedule					As per As -Built Drawing					Remarks
										LHS		
								306+200	306+844	RHS		
		Total Length (km)			11.40		Total Length (km)				12.80	
8	Design of pavement	Flexible pavement design as per IRC-37-2001					Flexible pavement design as per IRC-37-2001					
		Rigid pavement as per IRC-58					Rigid pavement as per IRC-58					
9	Design Life	Flexible pavement 20 years					Flexible pavement 20 years					
		Rigid pavement 30 years					Rigid pavement 30 years					
10	Crust Details	**MCW**		**Service Road**			**MCW**		**Service Road**			
		BC = 50mm		SDBC = 25mm			BC = 50mm		SDBC = 25mm			
		DBM = 130mm		DBM = 50mm			DBM = 130mm		DBM = 50mm			
		WMM = 250mm		WMM = 250mm			WMM = 250mm		WMM = 250mm			
		GSB = 200mm		GSB = 200mm			GSB = 200mm		GSB = 200mm			
		SG = 500mm		SG = 500mm			SG = 500mm		SG = 500mm			
		Total = 1130mm		Total = 1025mm			Total = 1130mm		Total = 1025mm			
11	Major Junctions	2 Nos.					3 Nos.					
		287+500	4 Legged Jn for Entry to Pochampad				288+150	Entry to Pochampad				
		293+200	3 Legged Jn for Entry				294+670	Entry to Balkonda				
							301+356	Exit from Balkonda				
12	Minor Junctions	7 nos as per the Schedule B					8 Nos.					
13	Truck Laybye	**Sl. No**	**From**	**To**	**Side**		**Sl. No**	**From**	**To**	**Side**		As per standards
		1	288+400	288+600	LHS		1	288+850	289+200	LHS		
		2	293+800	294+000	RHS		2	293+605	293+900	RHS		

Sl. No.	Name of Item	As per Agreement Schedule				As per As -Built Drawing				Remarks
		3	294+300	294+400	LHS	3	294+060	294+410	LHS	
		4	306+000	306+200	RHS	4	307+070	307+350	RHS	
14	Bus Bays	**Sl. No**	**LHS**	**RHS**	**Location**	**Sl. No.**	**LHS**	**RHS**	**Location**	As per standard
						1	278+490	278+910	On SR	
		1	279+200	279+100	Kadtal	2	280+350	280+350	On MCW	
		2	282+100	282+150	Gamjal	3	281+955	282+070	On SR	
		3	283+650	283+700	Soampet	4	283+540	283+540	On MCW	
		4	284+400	284+500	Soan	5	284+470	284+500	On MCW	
		5	287+400	287+500	Doodgaon	6	287+370	287+380	On SR	
		6	288+100	2888+250	Pochampadu	7	288+160	288+075	On SR	
						8	290+700	290+700	On MCW	
						9	291+490	291+510	On SR	
						10	293+140	293+100	On SR	
		7	304+000	304+000	Chittapur	11	306+440	306+560	On SR	
		8	305+600	305+00	Srirmpur	12	307+520	307+580	On MCW	
15	Toll Plaza	**Chainage**		**Name of Location**	**No. of Lanes**	**Chainage**		**Name of Location**	**No. of Lanes**	
		280+400		Near Gamjal	6+6	281+320		Near Gamjal	6+6	

3.1.2 AS-BUILT DRAWINGS OF STRUCTURES

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

Table 3.2: Review of As-built Drawings for Structures

Sl. No.	Type of Structure	PROPOSAL AS PER AGREEMENT SCHEDULE						AS PER AS-BUILT DRAWING				
		Sl. No	Chainage	Arrang. of Structure	Span Arrang. (m)	Length of Str. (m)	Proposal	Sl. No	Chainage	Arrang. of Structure	Span Arrang.	Length of Str. (m)
1	Major Bridge	**2 Nos.**						**2 Nos.**				
		1	287+400	RCC Deck Slab with PSC Girder	36x20.90	752.4	New 4 lane bridge on Godavari	1	284+855	RCC Deck Slab with PSC Girder	26X20.745+ 10X21.945	758.82
		2	298+845	RCC Deck Slab with PSC Girder	4x17.6	70.4	New 4 lane bridge in Balkonda bypass	2	298+802	RCC Deck Slab with PSC Girder	2X20.745 + 2X21.945	85.38
2	Minor Bridge	**4 Nos.**						**6 Nos.**				
								1	279+744	RCC Deck Slab	1X7.967	7.967
								2	288+303	RCC Deck Slab with PSC Girder	3X21.48	64.44
		1	290.35	RCC Deck Slab	7X6 + 1X7.25	49.35	Widening of existing bridge	3	293+963	RCC Deck Slab withPSC Girder	2X15.750	31.44

Sl. No.	Type of Structure	PROPOSAL AS PER AGREEMENT SCHEDULE						AS PER AS-BUILT DRAWING				
		Sl. No	Chainage	Arrang. of Structure	Span Arrang. (m)	Length of Str. (m)	Proposal	Sl. No	Chainage	Arrang. of Structure	Span Arrang.	Length of Str. (m)
	Minor Bridge	2	295+980	RCC Deck Slab	2X6.6	13.2	Widening of existing bridge	4	295+482	RCC Box type (Skew)	2X5	11.5
		3	302+880	RCC Deck Slab	1X13.5	13.5	New Constructi on	5	300+911	RCC Box type	2X6.75	15.4
		4	310+270	RCC Deck Slab	1X8	8	Widening of existing bridge	6	308+287	RCC Solid Slab	1x8	8.0
3	Underpasses (VUP)	**4 Nos.**						**4 Nos.**				
		1	293+535	Box Type	1X12	12	New Construct-ion	1	291+556	Box Type	1X12	12
		2	297+672	Box Type	1X12	12	New Construct-ion	2	295+681	Box Type	1X12	12
		3	299+300	Box Type	1X12	12	New Construct-ion	3	298+008	Box Type	1X12	12
		4	302+310	Box Type	1X12	12	New Construct-ion	4	300+360	Box Type	1X12	12

Sl. No.	Type of Structure	PROPOSAL AS PER AGREEMENT SCHEDULE						AS PER AS-BUILT DRAWING				
		Sl. No	Chainage	Arrang. of Structure	Span Arrang. (m)	Length of Str. (m)	Proposal	Sl. No	Chainage	Arrang. of Structure	Span Arrang.	Length of Str. (m)
4	Under-passes (PUP)	**11 Nos.**						**11 Nos.**				
		1	284+040	Box Type	1X5	5m	New Construction	1	278+785	Box Type	1X5	5m
		2	289+42	Box Type	1X5	5m	New Construction	2	282+005	Box Type	1X5	5m
		3	293+100	Box Type	1X5	5m	New Construction	3	287+422	Box Type	1X5	5m
		4	294+650	Box Type	1X5	5m	New Construction	4	291+140	Box Type	1X5	5m
		5	297+262	Box Type	1X5	5m	New Construction	5	293+049	Box Type	1X5	5m
		6	298+281	Box Type	1X5	5m	New Construction	6	295+275	Box Type	1X5	5m
		7	299+995	Box Type	1X5	5m	New Construction	7	296+297	Box Type	1X5	5m

Sl. No.	Type of Structure	PROPOSAL AS PER AGREEMENT SCHEDULE						AS PER AS-BUILT DRAWING				
		Sl. No	Chainage	Arrang. of Structure	Span Arrang. (m)	Length of Str. (m)	Proposal	Sl. No	Chainage	Arrang. of Structure	Span Arrang.	Length of Str. (m)
		8	301+294	Box Type	1X5	5m	New Construction	8	297+322	Box Type	1X5	5m
		9	302+000	Box Type	1X5	5m	New Construction	9	299+305	Box Type	1X5	5m
		10	303+430	Box Type	1X5	5m	New Construction	10	300+005	Box Type	1X6.5	6.5m
		11	305+541	Box Type	1X5	5m	New Construction	11	301+595	Box Type	1X5	5m
4	Culverts	1	BC	6 Nos.				1	BC	20Nos.		
		2	SC	22 Nos.				2	SC	8 Nos.		
		3	HPC	48 Nos.				3	HPC	55Nos.		

3.2 REVIEW OF PAVEMENT DESIGN REQUIREMENTS

As per Clause 7 of Schedule B the pavement designs including overlay and that of the service roads shall be done in accordance with Schedule-D of the Concession Agreement. Provision of flexible pavement was specified for new two lanes and paved shoulders & service roads while provision of rigid pavement was specified for toll plaza locations, truck laybyes, and for pavement below all underpasses and for cross roads leading to underpasses within the ROW limits. The Pavement Design was to be based on the following two parameters:

a) Traffic Forecast : As per Project Report or as assessed by the Concessionaire
b) Design Life : 20 years for Flexible Pavement, 30 years for Rigid Pavement

3.2.1 FLEXIBLEPAVEMENT REQUIREMENTS – NEW CONSTRUCTION

a) Design life: 20 years
b) Minimum Subgrade CBR: 10 %
c) Minimum Crust composition

Table 3.3 Main carriageway crust details

Sl no.	Layer Composition	Thickness (mm)
1	BC	40
2	DBM	130
3	WMM	250
4	GSB	200

The pavement composition for paved shoulders shall be same as that of Main Carriageway.

3.2.2 FLEXIBLE PAVEMENT REQUIREMENTS – STRENGHTENING OF EXISTING CARRIAGEWAY

Strengthening of existing Flexible Pavement was provisioned to be done with not less than 40 mm BC and 125 mm DBM over Profile Corrective Course.

3.2.3 PAVEMENT COMPOSITION FOR SLIP ROAD / SERVICE ROAD

For the Service roads the minimum composition of pavement was to be as per Table 3.4 below.

Table 3.4 Service Road crust details

Sl no.	Layer Composition	Thickness (mm)
1	SDBC	25
2	BM	50
3	WMM	250
4	GSB	200

3.2.4 RIGID PAVEMENT REQUIREMENTS

Rigid Pavement was provisioned to be done in accordance with IRC: 58- 2002 considering 30 years Design Life with an effective K value of 180 Mpa/m.

3.3 REVIEW OF PAVEMENT DESIGN OF THE CONCESSIONAIRE

3.3.1 REVIEW OF PAVEMENT DESIGN REPORT

The Flexible Pavement for Main Carriageway and Service Roads has been designed as per IRC: 37-2001. In the pavement design report on the new carriageway, the Flexible pavement crust was designed for a traffic of 40 MSA and for the Rigid pavement crust was for a traffic of 50 MSA and the VDF adopted was Bus-0.7, LCV-0.336, Truck (2A/3A)-2.475 & MAV-4.747. The pavement composition on widening portion of existing carriageway is also kept same as the pavement composition of new carriageway as shown in Table 3.5. The pavement composiotion actually adopted by the Concessioanire is summarized in Table 3.6 below.

Table 3.5: Summary of Flexible Pavement Design as per Pavement Design Report

Composition of Pavement	MCW	Service Road/ Slip Road	Unit
Bituminous Concrete	40	-	mm
Semi Dense Bituminous Concrete	-	25	mm
Dense Bituminous Macadam (DBM)	100	50	mm
Wet Mix Macadam	250	250	mm
Granular Sub –base	200	200	mm
Subgrade	500	500	mm
CBR	10	10	%

Table 3.6: Summary of Flexible Pavement Design as adopted by Concessionaire

Composition of Pavement	MCW	Service Road /Slip Road	Unit
Bituminous Concrete	40	-	mm
Semi Dense Bituminous Concrete	-	25	mm
Dense Bituminous Macadam (DBM)	130	50	mm
Wet Mix Macadam	250	250	mm
Granular Sub –base	200	200	mm
Subgrade	500	500	mm
CBR	10	10	%

3.3.2. REVIEW OF OVERLAY DESIGN DURING INITIAL CONSTRUCTION

Based on Benkelman Beam Deflection studies the overlay design for the existing pavement as given in different homogeneous sections in the pavement design report is furnished in Table 3.7 below.

Table 3.7 Overlay design for existing pavement as per pavement design report

Chainage		Recommended Overlay (mm)	
From	To	DBM	BC
278+000	288+000	80	40
288+000	292+000	50	40
292+000	301+000	110	40
301+000	308+000	70	40

3.3.3 REVIEW OF RIGID PAVEMENT DESIGN

The Rigid Pavement has been designed with thickness of PQC as 300mm over DLC layer of thickness 100mm and WMM of 150mm thickness. The Rigid pavement has been designed for 30 years. The summary of pavement design has been shown below in **Table 3.8**.

Table 3.8: Summary of Rigid Pavement Design

Flexural Strength of Plain Concrete (90 days)		40	kg/cm^2
Thickness of Pavement Quality Concrete (M 40 Grade)		300	mm
Polythene Layer between PQC and DLC		125	micron
Dry Lean Concrete layer		100	mm
Wet Mix Macadam		150	mm
CBR		10	%
Length of slab or spacing between consecutive Transverse joints		3.125	m
Width of slab or spacing between consecutive Longitudinal joints		5.0	m
Dowel Bars (Mild Steel)	Dia	32	mm
	Spacing	200	mm
	Length	500	mm
Deformed (HYSD) Tie Bars	Dia	12	mm
	Spacing	400	mm
	Length	640	mm

3.3.4 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.

3.4 REVIEW OF DESIGN BASIS OF STRUCTURES

3.4.1 MAJOR AND MINOR BRIDGES

There are two Major Bridges and four Minor Bridges which have been reconstructed and two Minor bridges which have been newly constructed for the new carriageway portion as per the Concession Agreement. The codes which have been followed for the design are IRC: 78-2000, IRC: 6-2000 and IRC: 21-2000. Following Design Parameters have been considered:

I The abutments for the Major Bridges at Ch. 289+834 have been designed as Box type and for Major Bridge at Ch. 303+462 these are designed as Wall type. Piers for both Bridges have been designed as Wall type. The Foundations are open type and the superstructure is PSC Girder (Pre-tensioned) with RCC slabs. Following design parameters have been considered.

a) Material :M-30 Concrete for Piers, Abutments, Pier & Abutment Caps, Superstructure, M45 for PSC Girder, M40 for Crash Barrier, PCC M15 for Return Walls.
b) Cover R/f : Nominal cover provided is 50mm and Min. clear cover is 35mm.
c) SBC considered : Details not available.
d) Bearings : Elastomeric bearings
e) Expansion joints : Strip seal type

II The abutments and piers for the Minor Bridges (Ch. 292+920 and Ch. 298+580) have been designed as Wall Type. The Foundations are open type and the superstructure is RCC slabs with RCC Girder (Ch. 298+580) and Pre-tensioned Girder (Ch. 292+920). Following design parameters have been considered.

a) Material : PCC M15 for Piers, Abutments, M30 for Pier & Abutment Caps, Superstructure, M40 for Crash Barrier (Ch. 298+580), M40 Parapet (Ch. 292+920).
b) Cover R/f : 75mm on earthen face & foundation, 50mm on front face of stem, Minimum Nominal cover- 40mm.
c) SBC considered : For Minor Bridge at Ch. 298+580 Soil Bearing Capacity is 20 Ton/sqm. For other Minor Bridge deatails not available.
d) Bearings : Elastomeric Bearings
e) Expansion joints : Strip seal type

3.5 PROJECT FACILITIES

As per schedule C paragraph 1 it is mentioned that "The Concessionaire shall review the adequacy of the proposed facilities at regular interals of 5 years and accordingly provide additional facilities with necessary approval from the Independent Consultant in order to meet the demand of the road till the end of the concession period." As these are additional facilities, same shall be carried out under change of scope. As per discussion with the Concessionaire, additional facilities are constructed in O&M phase under Change of Scope from NHAI.

3.6 CONCLUSIONS ON REVIEW OF DESIGNS AND DRAWINGS

On the basis of the review of Designs and As-built drawings for the Project, it is confirmed that the Project has been developed in accordance with the provisions of the Schedules of Concession Agreement. As per the design report the pavement composition adopted by the Concessionaire for the slip road is same as that of the service road.

3.7 DETAILS OF COS ORDERS

a) VUP (Grade II) at Soan Ch. 284.160 (new 289+067) on account of Road Safety by Push Box Method: Approved on 03.10.2018 amounting to 11.47 Cr.

b) Provising Toilet block at the Toll Plaza under Swachh Bharat Mission: Approved on date 19.02.2018 amounting to 0.26 Cr.

c) Construction of Service road for Petrol Bumk from Ch.307+840 to Ch. 307+400 on RHS near Balkonda: Approved on 26.07.2018 amounting to 0.77 Cr.

d) Major junction improvement work by carrying out geometrical improvements at Balkonda village at Km 305+947 under Black Spot rectification (BS TG-70) amounting to 0.66 Cr.

e) Construction of Highway Mini Nest at Toll Plaza: Approved on 29.12.2017 amounting to 0.46 Cr.

f) Additional PQC for accommodating loops of ETC equipment and segregation of Traffic islands: Approved on 10.03.2016 amounting to 0.105 Cr

g) Construction of Kothapalli Service road and Bus Shelters: Approved on 30.10.2019 amounting to 4.2 Cr.

h) Short Term Improvement of Black Spot (BS-TG – 02 - 413) at Ch. 301+330 (old chainage) near Soan to Madhapur section from Ch. 288+500 to Ch. 289+000. Approved on 15.05.2020 amounting to 0.09 Cr.

CHAPTER 4.0: EXISTING INVENTORY & CONDITION SURVEY

4.1 PROJECT DETAILS

The Project Road is the Section of NH-07 Starting at Kadtal at Ch. 282+617 (Old Km. 278+000) in Adilabad District towards Nagpur side and Ends at Armur at Ch. 313+507 (Old Ch. 308+00) in Nizamabad District. The Project road crosses the Godavari River at New Ch. 289+807 of NH-7 in Nizamabad District. The Length of Project Road is **30.890 km**. The notable built-up areas through which the Project Road passes are Kadtal, Gamjal, Doodgaon, Pochampadu, Sonpet, Bussapur, Nallur and Srirampur and it bypasses the Balkonda town.

The road traverses through mainly 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

<table>
<tr><th>SL. No</th><th>Parameter</th><th colspan="6">Description</th></tr>
<tr><td>1.</td><td>Main Carriageway Details</td><td colspan="6">4 laned divided Carriageway with 1.5 m paved shoulders and 1.0 m earthen shoulder in rural and median width of 4.5 m</td></tr>
<tr><td>2.</td><td>ROW</td><td colspan="6">60 m all along the length</td></tr>
<tr><td rowspan="12">3.</td><td rowspan="12">Service Road/Slip Road is 5.5 m wide Total Length (both side) = 14.477 km</td><td colspan="2">LHS - S.R.</td><td colspan="2">RHS – S.R.</td><td colspan="2">Name of Village</td></tr>
<tr><td colspan="2">282+817 to 283+417</td><td colspan="2">282+917 to 284+167</td><td colspan="2">Kadtal</td></tr>
<tr><td colspan="2">286+297 to 286+917</td><td colspan="2">286+277 to 286+917</td><td colspan="2">Gamjal</td></tr>
<tr><td colspan="2">290+617 to 290+817</td><td colspan="2">291+677 to 292+217</td><td colspan="2" rowspan="2">Doodgaon</td></tr>
<tr><td colspan="2">291+677 to 292+217</td><td colspan="2">292+217 to 292+317</td></tr>
<tr><td colspan="2">292+567 to 282+700</td><td colspan="2" rowspan="2">292+217 to 293+117</td><td colspan="2" rowspan="2">Pochampad</td></tr>
<tr><td colspan="2">292+740 to 293+117</td></tr>
<tr><td colspan="2" rowspan="2">295+317 to 296+617</td><td colspan="2">295+247 to 295+617</td><td colspan="2" rowspan="2">Bussapur</td></tr>
<tr><td colspan="2">295+617 to 296+617</td></tr>
<tr><td colspan="2">297+397 to 297+977</td><td colspan="2">297+297 to 297+977</td><td colspan="2">Nallur</td></tr>
<tr><td colspan="2">306+017 to 306+577</td><td colspan="2">306+017 to 306+577</td><td colspan="2">Balkonda</td></tr>
<tr><td colspan="2">310+837 to 311+417</td><td colspan="2">310+837 to 311+437</td><td colspan="2">Srirampur</td></tr>
<tr><td rowspan="3">4.</td><td rowspan="3">Pavement Type (Flexible for MCW and SR, Rigid at Toll Plaza)</td><td>MCW</td><td>40 mm BC
130 mm DBM
250 mm WMM
200 mm GSB
500 mm SG (10% CBR)</td><td>Service Road</td><td colspan="3">25mm SDBC
50mm BM
250mm WMM
200mm GSB
500mm SG (10% CBR)</td></tr>
<tr><td colspan="4">300 mm PQC, 150 mm DLC,
150 mm WMM, 500 mm Subgrade</td><td rowspan="2">For Toll Plazas</td></tr>
<tr><td colspan="4">Dowel Bars (MS) – 32 mm dia, 250mm c/c, 500 mm
Tie Bars (Plain) – 12 mm dia, 350 mm c/c, 580 mm</td></tr>
<tr><td>5.</td><td>Junctions</td><td colspan="4">3 nos. (Major junctions) & 8 nos. (Minor junctions)</td><td></td></tr>
</table>

SL. No	Parameter	Description	
6.	Major Bridges	2 nos.	
7.	Minor Bridges	6 nos.	
8.	Underpasses	VUPs - 5 nos. (1 no. VUP under COS) and PUPs -12 nos.	
9.	Culverts	55 nos. (HPCs), 8 nos. (Slab Culverts) & 20 nos. (Box Culverts)	
10.	Toll Plaza	1 nos. (6+6 Lanes including Oversized vehicle lane)	
11.	Bus Bays/ Bus Shelters	30 nos.	
12.	Truck Lay Byes	4 nos.	

4.2 OVERVIEW OF ROAD ASSETS AND APPURTENANCES

Detailed inspection of the site was carried out by our team of Engineers in February 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, horticulture and landscaping 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. Barring some locations which require minor repair works, all work items have been seen to be in good condition. 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.

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, land use, etc. were noted. This information has been presented in **Table 4.2** along with the representative photographs of each 5 km stretch of the project road is shown in **Figures** below.

Fig 4.1: Section between Ch. 282-287 (LHS)

Fig 4.2: Section between Ch. 287-292 (LHS)

Fig 4.3: Section between Ch. 292-297(LHS)

Fig 4.4: Section between Ch. 297-302 (LHS)

Fig 4.5: Section between Ch. 302-307 (LHS)

Fig 4.6: Section between Ch. 307-313.507 (LHS)

Fig 4.7: Section between Ch. 282-287(RHS)

Fig 4.8: Section between Ch. 287-292 (RHS)

Fig 4.9: Section between Ch. 292-297 (RHS)

Fig 4.10: Section between Ch. 297-302(RHS)

Fig 4.11: Section between Ch. 302-307(RHS)

Fig 4.12: Section between Ch. 307-313.5 (RHS)

Table 4.2: Details of Main Carriageway Inventory

Sl. no.	Chainage (Km)		LHS				Median	RHS			
	From	To	Land use	Embankment Height (m)	LHS Earthen Shoulder (m)	Width MCW (m)	Width (m)	Width-MCW (m)	RHS Earthen Shoulder (m)	Embankment Height (m)	Land use
1	282+617	283+000	Agri	1-4.2	0.7-2.7	8.7-11.9	4.3-4.4	8.7-12	1-3.7	1-4.5	Agri
2	283+000	283+200	Built up	2.3-2.4	2.2-2.4	8.8	4.4	8.7-8.9	1.4	2.8-3	Built up
3	283+200	284+100	Agri	0 - 3	0-1.6	8.6-11.1	3-4.4	8.8-11	0-1.2	0-3	Built up
5	284+100	285+000	Agri	1.5-5	0-8.7	8.6-11.9	0-4.4	8.8-12.4	0-5	0-3	Agri
6	285+000	285+100	Built up	1.0	3.6	8.7	0.9	10.5	1.6	1.0	Agri
7	285+100	285+200	Built up	1.0	3.5	8.8	4.4	8.7	1.6	1.0	Agri
8	285+200	285+700	Agri	1.8-3.5	1.8-2.5	8.3-8.6	4.4	10.8	1.2-1.6	2.0-3.0	Agri
9	285+700	286+100	Toll Plaza								
10	286+100	286+500	Agri	0-6	1-1.8	8.6-14.1	0.9-4.4	1.5-17	1.2	1.0-3.0	Agri
11	286+500	286+800	Built up	1.0-3.0	0.0	8.6-11.6	4.4	8.8	1-1.2	1.0-3.0	Agri
13	286+800	289+500	Agri	1.2-10	0-3.5	8.6-14.5	4.4 -13.9	8.7-12.9	1-3.8	1.0-10	Agri
14	289+500	289+600	River	-	-	-	Bridge	-	-	-	River
15	289+600	290+200	River	-	-	-	Bridge	-	-	-	River
16	290+200	290+800	Agri	0-10	1.1-2	8.75-17	1-13.7	8.7-8.8	2-2.5	2.0-8	Agri
17	290+800	290+900	Built up	0.0	1.0	19.3	0.9	12.3	1.5	4.0	Agri
18	290+900	292+000	Agri	1.5-3.5	1.2-2.7	8.7-9	4.4	8.8-8.9	0-2	1.0-4.0	Agri
19	292+000	292+100	Built up	2.0	1.3	9.8	4.4	11.0	0.0	2.0	Agri
20	292+100	292+200	Built up	2.0	1.2	8.8	4.4	8.7	2.5	2.0	Built up
21	292+200	292+500	Agri	1.2-3	1.2-2.8	8.7-8.9	4.4	8.7	1.5-4.3	0-2	Built up
23	292+500	293+300	Built up	0-2	0-4.6	8.6-12.2	0.9-6.8	8.6-15	0-4.5	0-2	Built up
24	293+300	295+800	Agri	0-3.5	0-2	8.2-12.3	0.9-4.4	8.7-13.8	1.0-3.0	0-3.5	Agri
25	295+800	295+900	Built up	3	1.0	8.8	4.4	8.8	1.0	3.5	Agri

Sl. no.	Chainage (Km)		LHS				Median	RHS			
	From	To	Land use	Embankment Height (m)	LHS Earthen Shoulder (m)	Width MCW (m)	Width (m)	Width-MCW (m)	RHS Earthen Shoulder (m)	Embankment Height (m)	Land use
26	295+900	296+000	Built up	3.5	0.0	8.8	4.4	8.8	1.0	3.5	Agri
27	296+000	296+100	Built up	3.5	0.0	8.8	4.4	8.8		3.5	Agri
28	296+100	296+500	Built up	5.5	0.0	8.8-8.9	4.4	8.7-11	0.5-1	5.5	Built up
29	296+500	296+600	Agri	3.0	0.0	8.8	3.8	8.7	-	6.0	Built up
30	296+600	296+700	Agri	3.0	0.0	8.8	0.9	8.7	1.0	3.0	Built up
31	296+700	297+400	Agri	2-2.5	1-1.2	8.7-9.1	0.9-4.4	8.8-12	1.2-1.5	1-4.5	Agri
32	297+400	297+500	Built up	3.0	1.0	8.8	4.4	8.8	1.2	4.5	Agri
33	297+500	298+800	Agri	0-4.5	0-1.5	7.5-14	4.4	8.7-11.2	1-2.2	0-6	Agri
34	298+800	298+900	Agri	0.0	0.0	8.5	4.4	14.0	1	0.0	Built up
35	298+900	299+000	Agri	2.5	1.5	8.5	4.4	14.0	1	0.0	Built up
36	299+000	299+200	Agri	1.2-2.5	1.2-1.5	8.5-12.3	2.5-4.4	8.7-11.6	2-2.2	0-3	Agri
37	299+200	299+300	Agri	1.2	1.2	10.0	0.9	8.7	2.3	4.0	Built up
38	299+300	305+300	Agri	1-2	1-2.5	8.5-12.2	0.9-4.4	8.7-12.2	1-2.6	1.0-2.0	Agri
39	305+300	306+100	Agri	0-1.5	0-1.5	8.8-13.9	1.5-4.4	8.7-18.6	0-1.8	2.0-3.0	Built up
41	306+100	306+300	Built up	3.0	1.0	8.8	4.4	8.6-8.7	0-1	3.0	Built up
42	306+300	306+400	Built up	3.0	1.0	8.8	4.4	8.6	1.5	3.2	Agri
43	306+400	313+400	Agri	1.0-3.0	1-2.5	8.6-12.2	0.8-4.4	8.6-14	0-2.5	0-4	Agri
44	313+400	313+507	Agri	1.5	1.0	8.8	0-4.4	8.8	1.0	1.0	Private property

4.2.2 PAVEMENT CONDITION

The pavement is found to be in Good condition generally. Some repair works carried out on the pavement surface are seen in the form of patch works. The details in this regards are provided in Table 4.3 below. Representative photographs showing the Pavement Condition are peresented in Figures below.

Fig 4.13: Pavement Condition at Ch. 285+200 (LHS)

Fig 4.14: Pavement Condition at Ch. 285+200 (RHS)

Fig 4.15 Pavement Condition at Ch. 285+200 (RHS)

Fig 4.16 Pavement Condition at Ch. 312+905

Fig 4.17 Pavement Condition at Ch. 282+400

Fig 4.18 Pavement Condition at Ch. 297+400

Table 4.3: Details of Pavement Condition

Sl.no.	Chainage (km)		LHS Patchwork		RHS Patchwork		Condition
	From	To	Area (Sqm)	Percentage	Area (Sqm)	Percentage	
1	282.617	283.000	0.0	0.0	0.00	0.00	Good
2	283.000	284.000	771.4	8.6	0.00	0.00	Good
3	284.000	285.000	0.0	0.0	2230.00	23.54	Good
4	285.000	286.000	571.8	6.7	2590.00	30.37	Fair Narrow Cracks area 1.29%.
5	286.000	287.000	45.6	0.4	3120.00	29.49	Good
6	287.000	288.000	0.0	0.0	0.00	0.00	Good
7	288.000	289.000	0.0	0.0	0.00	0.00	Good
8	289.000	290.000	3.9	0.0	12.18	0.13	Good
9	290.000	291.000	0.0	0.0	0.00	0.00	Good
10	291.000	292.000	39.9	0.5	69.11	0.78	Good
11	292.000	293.000	0.0	0.0	0.00	0.00	Good
12	293.000	294.000	134.1	1.5	0.00	0.00	Good
13	294.000	295.000	830.5	9.0	0.00	0.00	Good
14	295.000	296.000	875.0	9.7	0.00	0.00	Good
15	296.000	297.000	140.0	1.6	0.00	0.00	Good
16	297.000	298.000	770.0	8.7	0.00	0.00	Good
17	298.000	299.000	364.7	3.8	0.00	0.00	Good
18	299.000	300.000	460.0	5.0	0.00	0.00	Good
19	300.000	301.000	1963.7	21.1	0.00	0.00	Good
20	301.000	302.000	2415.0	26.4	0.00	0.00	Good
21	302.000	303.000	4410.0	50.2	0.00	0.00	Good

Sl.no.	Chainage (km)		LHS Patchwork		RHS Patchwork		Condition
	From	To	Area (Sqm)	Percentage	Area (Sqm)	Percentage	
22	303.000	304.000	1057.0	11.6	0.00	0.00	Good
23	304.000	305.000	4600.0	51.2	0.00	0.00	Good
24	305.000	306.000	2685.0	28.9	0.00	0.00	Good
25	306.000	307.000	525.0	5.9	0.00	0.00	Good
26	307.000	308.000	0.0	0.0	0.00	0.00	Good
27	308.000	309.000	0.0	0.0	0.00	0.00	Good
28	309.000	310.000	890.0	9.9	0.00	0.00	Good
29	310.000	311.000	0.0	0.0	0.00	0.00	Good
30	311.000	312.000	1200.0	13.1	0.00	0.00	Good
31	312.000	313.000	350.0	4.0	0.00	0.00	Good
32	313.000	313.507	0.0	0.0	0.00	0.00	Good

4.2.3 SERVICE ROADS/ SLIP ROADS

Total length of Service road/ Slip road is 14.477 Km. Representative photographs of some of the Service roads/Slip Roads sections are presented in **Figures** below. The details of the service road are bought out in **Table 4.4** below.

Fig 4.19 Service Road at Ch. 282+700 RHS

Fig 4.20 Service Road at Ch. 283+100 RHS

Fig 4.21 Service Road at Ch. 286+500 LHS

Fig 4.22 Service Road at Ch. 297+400 LHS

Fig 4.23 Service Road at Ch. 302+900 RHS

Fig 4.24 Service Road at Ch. 306+200 LHS

Table 4.4: Details of Service Road/ Slip Road

Sl.no.	Village name	Chainage (Km)		Side	Length (m)	Width (m)	Condition
		From	To	LHS/RHS			
1	Kadtal	282.700	284.100	RHS	1300	4.6	Good
		282.900	283.300	LHS	400	5.4	Good
2	Gamjal	286.375	286.825	RHS	450	4.7	Good
		286.400	286.800	RHS	400	4.7	Good
3	Soan	288.300	289.300	RHS	1000	5.5	Good
4	Chakiryala	290.650	290.750	LHS	100	6.0	Good
5	Doodgaon	291.700	292.300	LHS	600	5.7	Good
6	Pocharam X road	291.775	293.025	RHS	1250	5.6	Good
		292.600	293.000	LHS	400	5.3	Good
7	Bussapur	295.275	296.525	RHS	1250	5.3	Good
		295.375	296.525	LHS	1150	5.4	Good
8	Nallur	297.375	297.925	LHS	550	4.4	Good
		297.375	297.925	RHS	550	5.2	Good
9	Kothapalli	300.200	300.500	LHS	300	5.4	Good

Sl.no.	Village name	Chainage (Km)		Side	Length (m)	Width (m)	Condition
		From	To	LHS/RHS			
		300.175	300.525	RHS	350	5.5	Good
10	Balkonda	306.100	306.600	LHS	500	5.5	Good
		306.250	306.450	RHS	200	5.5	Good
		307.375	307.725	RHS	350	5.5	Good
11	Sirampur	310.875	311.325	RHS	450	5.6	Good
		310.975	311.425	LHS	450	5.5	Good

4.2.4 MAJOR JUNCTION

There are 3 Nos. of Major junctions on the Main Carriageway which are in a Good condition. Auxiliary lanes for turning are not providesd as per the standards. Highmast lighting and solar blinkers are provided at these locations. The details of the Major junction are furnished in Table 4.5 below. Representative photographs of some of the Major Junctions are presented in **Figures** below.

Fig 4.25: Major Junction at Ch. 292+750 RHS

Fig 4.26 : Major Junction at Ch. 299+200 RHS

Fig 4.27: Major Junction at Ch. 306+000 RHS

Table 4.5: Details of Major Junctions

Sl.no	Chainage	Type (T/X/Y)	Side Road RHS		No. of Islands	Lighting	Signage	Marking	Remarks
			W (m)	Condition		High Mast			
1	292+750	T	5.0	Good	2	1	Good	Good	To Sri Ram Sagar
2	299+200	Y	4.3	Good	3	1	Good	Good	To Balkonda Village
3	306+000	T	4.5	Good	3	1	Good	Good	To Balkonda village

4.2.5 MINOR JUNCTIONS

There are total 10 no. of Minor Junctions out of which Cross (X) junction is 1 No., Y- junctions are 2 Nos. and T-junctions are 7 Nos. The details of the Minor junctions are furnished in **Table 4.6** below. Representative photographs of some of the Minor Junctions are presented in **Figures** below.

Fig 4.28 : Minor junction at Ch. 285+000 LHS

Fig 4.29 : Minor junction at Ch. 288+900 LHS

Fig 4.30 : Minor junction at Ch. 290+600 LHS

Fig 4.31 : Minor junction at Ch. 288+222 RHS

Fig 4.32 : Minor junction at Ch. 290+700 RHS

Fig 4.33 : Minor junction at Ch. 306+543 RHS

Table 4.6: Details of Minor Junctions

Sl. No	Chainage	Type (T / X / Y)	Side Road LHS		Side Road RHS		No. of Islands		Signage	Remarks
			W (m)	Condition	W (m)	Condition	LHS	RHS		
1	285+000	X	4.8	Fair	2.50	Good	-	-	Good	Sangampet village (LHS), Jaffrapur village (RHS)
2	288+900	Y	3.8	Good	-	-	-	-	Good	Soan Village
3	290+600	Y	3.3	Fair	-	-	-	-	Good	Doodgaon Village
4	309+600	T	3.9	Good	-	-	1	-	Good	Chittapur Village
5	312+200	T	2.0	Good	-	-	-	-	Good	Chepur Village
6	288+222	T	-	-	3.95	Good	3	-	Good	Auxiliary lane (L=100m & W=4.8m) Madhapur Village
7	295+300	T	-	-	3.85	Good	-	-	Good	
8	306+800	T	-	-	4.00	Good	0	1	Good	Balkonda Village
9	309+619	T	-	-	4.00	Good	0	0	Good	Komanpally Village/Fattepur

***Note** – Good- all necessary sing boards are provided and are in good condition, Fair- Some sign boards are missing

4.2.6 MEDIAN OPENINGS

The details of Median Openings are furnished in **Table 4.7** below. Representative photographs of some of the Median Opening are presented in **Figures** below. At most of the Median opening locations Solar Blinkers have been provided.

Fig 4.34 : Median Opening at Ch. 294+300

Fig 4.35 : Median Opening at Ch. 288+900

Fig 4.36: Median Opening at Ch. 307+400

Fig 4.37 : Median Opening at Ch. 286+400

Fig 4.38 : Median Opening at Ch.284+200*

Fig 4.39 : Median Opening at Ch. 311+400

Table 4.7: Details of Median Opening

Sl.no.	Chainage	Median opening		Storage lane				Condition	Sign Board	Solar Blinker
		Length	Width	LHS		RHS				
				Length	Width	Length	Width			
1	284+150	30	5	120	3.5	124	3.5	Good	Yes	Yes
2	284+950	27	5	129	3.5	116	3.5	Good	Yes	Yes
3	286+250	29	4.4	-	-	138	3.5	Good	Yes	Yes
4	288+250*	25.6	5.2	100	3.5	52	3.5	Good	No	Yes
5	290+850	30	5	117	3.5	137.5	3.5	Good	Yes	Yes
6	292+750	26	1.9	77.5	3.5	42	3.5	Good	Yes	Yes
7	294+350	30	5	130	3.5	125	3.5	Good	Yes	Yes
8	295+350	14.8	4.4	-	-	-	-	Good	Yes	Yes
9	296+750	20	4.9	110	3.5	130	3.5	Good	Yes	Yes
10	299+250	20.2	5.3	80	3.5	-	-	Good	Yes	No
11	301+250	25	5.2	128	3.5	150	3.5	Good	Yes	Yes
12	303+250	25	5.2	100	3.5	110	3.5	Good	Yes	Yes
13	305+950	21.9	5	-	-	98	3.5	Good	No	Yes
14	307+450	10	5.2	113	3.5	110	3.5	Good	Yes	Yes
15	309+550	26	5.2	129	3.5	-	-	Good	Yes	Yes
16	309+650	25	5.2	-	-	124	3.5	Good	Yes	Yes
17	311+450	25	5	100	3.5	102	3.5	Good	Yes	Yes
18	312+150	25	2.4	-	-	110	3.5	Good	No	Yes

*Median opening is closed using Temparary Barricading from safety considerations

4.2.7 BUS BAYS

There are 10 nos. of Bus bay with Bus Bay Shleter and 20 nos. are only Bus Shelters. Condition of Bus Bays Shelter/Bus Shelters is presented in **Table 4.8** below. Representative photographs of some of the BusBays/Bus Shelters are presented in **Figures** below.

Fig 4.40: Bus Shelter at Ch. 283+100 LHS

Fig 4.41 : Bus Shelter at Ch.286+500 LHS

Fig 4.42 Bus Shelter at Ch. 290+600 LHS

Fig 4.43 Bus Shelter at Ch. 295+200 RHS

Fig 4.44 Bus Shelter at Ch. 306+625 RHS

Fig 4.45 Bus Shelter at Ch. 312+200 LHS

Table 4.8: Details of Bus Bays

Sl.no	Chainage	Side	Bus Bay Lane		Pavement		Entry / Exit (Taper Y/N)	Marking	Lighting	Remark
			Length (m)	Paved Width (m)	Type	Condition				
1	283+100	LHS	45	9.3	BT	Good	Y	Good	Panchayat street light	Physical separator provided
2	283+430	RHS	Only shelter		BT	Good	N	Fair	Panchayat street light	
3	285+000	LHS	Only shelter		BT	Good	N	Fair	N	
4	285+33	RHS	Only shelter		BT	Good	N	Fair	Panchayat street light	
5	286+600	LHS	Only shelter		BT	Good	N	Good	Panchayat street light	
6	286+683	RHS	Only shelter		BT	Good	N	Good	Panchayat street light	
7	288+100	LHS	110	5.3	BT	Good	Y	Good	N	
8	288+153	RHS	70	4.8	BT	Good	Y	Good	N	
9	289+090	LHS	99	4.22	BT	Good	Y	Good	Y	
10	289+118	RHS	94	5	BT	Good	Y	Good	N	
11	290+729	RHS	100	5	BT	Good	Y	Good	N	
12	290+900	LHS	96	4.97	BT	Good	Y	Good	N	

Sl.no	Chainage	Side	Bus Bay Lane		Pavement		Entry / Exit (Taper Y/N)	Marking	Lighting	Remark
			Length (m)	Paved Width (m)	Type	Condition				
13	292+000	RHS	Only shelter		BT	Good	N	Fair	N	
14	292+700	RHS	Only shelter		BT	Good	N	Good	N	
15	292+850	LHS	Only shelter		BT	Good	N	Good	Panchayat street light	
16	295+200	LHS	Only shelter		BT	Good	N	Good	N	
17	295+300	RHS	Only shelter		BT	Good	N	Fair	N	
18	296+100	LHS	Only shelter		BT	Good	N	Good	Panchayat street light	
19	296+100	LHS	Only shelter		BT	Good	N	Good		
20	297+100	RHS	Only shelter		BT	Good	N	Fair	N	
21	297+700	RHS	Only shelter		BT	Good	N	Good	Panchayat street light	
22	297+850	LHS	Only shelter		BT	Good	N	Good		
23	306+650	LHS	Only shelter		BT	Good	N	Good	Panchayat street light	
24	306+650	RHS	Only shelter		BT	Good	N	Good		
25	306+800	RHS	115	4.5	BT	Good	Y	Good	N	
26	309+500	RHS	61	4.5	BT	Good	Y	Good	N	

Sl.no	Chainage	Side	Bus Bay Lane		Pavement		Entry / Exit (Taper Y/N)	Marking	Lighting	Remark
			Length (m)	Paved Width (m)	Type	Condition				
27	309+517	LHS	152	4.5	BT	Good	Y	Good	N	
28	311+057	LHS	Only shelter		BT	Good	N	Good	Panchayat street light	
29	312+100	LHS	Only shelter		BT	Good	N	Good	N	
30	312+230	RHS	Only shelter		BT	Good	N	Good	N	

***Note –** Good- All necessary facilities at Bus shelter were clean, Sign boards & Road markings are provided and are in good condition.
Fair- Some Cleaning needs to be carried out and road markings has faded

4.2.8 TRUCK LAY-BYES

There are Total 4 nos. of Truck lay byes (2 nos. of truck lay bye are provided on each side of the Main carriageway). Details are furnished in Table 4.9 below. Representative photographs of some of the Truck lay-bye are presented in figures below.

Fig 4.46 : Truck Lay Bye at Ch. 293+600 LHS


Fig 4.47: Truck Lay Bye at Ch. 298+867 LHS


Fig 4.48 : Truck Lay Bye at Ch. 298+860 LHS

Table 4.9: Details of Truck Lay bye

Sl. No	Chainage	Side	Truck Parking		Physical Island			Pavement		Cond. of Pucca Drain	Facilities provided		
			L (m)	Paved Width (m)	L (m)	W (m)	Cond.	Type	Cond.		Toilet	Road Marking/ Sinage	Lighting
1	293+660	LHS	100	11.00	100	2.4	Good	CC	Good	Good	Y	Fair	6
2	298+400	RHS	95	11.00	140	3.0	Good	CC	Good	Good	Y	Good	6
3	298+867	LHS	142	11.00	142	3.0	Good	CC	Good	Good	Y	Fair	6
4	311+800	RHS	95	11.50	140	3.0	Good	CC	Good	Good	Y	Good	6

4.2.9 DRAIN

Pucca Drains are provided mostly provided along the slip/service road. Covered drains are provided in the built–up stretchs towards the outer side of the service road. Uncovered Toe Drains are provided towards the inner side of the service road. Besides these earthen (unlined) drain are provided in the remaining stretches. The details of the drains are presented in **Table 4.10** below. Representative photographs of some of the Drains are presented in **Figures** below.

Fig 4.49 Drain at Ch. 283+000 LHS

Fig 4.50 Drain at Ch. 283+100 RHS

Fig 4.51 Drain at Ch. 292+600 LHS

Fig 4.52 Drain at Ch. 306+200 LHS

Fig 4.53 Drain at Ch. 306+543 LHS

Fig 4.54 Drain at Ch. 297+200 RHS

Table 4.10: Details of Pucca Drain

S.no	LHS RCC Drain			Transverse Median Drain			RHS RCC Drain		
	From	To	Condition	From	To	Condition	From	To	Condition
1	282+816	282+900	Good	283+400	284+000	Good	282+816	282+900	Good
2	282+900	283+000	Good	284+500	284+800	Good	282+900	284+000	Good
3	283+000	283+100	Good	285+450	25+800	Good	284+000	283+100	Good
4	283+100	283+200	Good	286+150	286+400	Good	283+100	283+200	Good
5	283+200	283+300	Good	287+500	287+900	Good	283+200	283+300	Good
6	283+300	283+400	Good	288+750	289+000	Good	283+300	283+400	Good
7	286+300	286+400	Good	289+000	289+350	Good	283+400	283+500	Good
8	286+400	286+500	Good	289+350	289+600	Good	283+500	283+600	Good
9	286+500	286+600	Good	290+600	290+700	Good	283+600	283+700	Good
10	286+600	286+700	Good	290+700	290+800	Good	283+700	283+800	Good
11	286+700	286+800	Good	291+180	291+400	Good	283+800	283+900	Good
12	286+800	286+900	Good	291+900	292+000	Good	283+900	284+000	Good
13	292+300	292+339	Good	292+000	292+100	Good	284+000	284+100	Good
14	292+500	292+600	Good	292+100	292+200	Good	284+100	284+200	Good

S.no	LHS RCC Drain			Transverse Median Drain			RHS RCC Drain		
	From	To	Condition	From	To	Condition	From	To	Condition
15	292+600	292+700	Good	292+200	292+300	Good	286+300	286+400	Good
16	293+510	293+810	Good	292+300	292+600	Good	286+400	286+500	Good
17	297+300	297+400	Good	296+400	296+500	Good	286+500	286+600	Good
18	297+400	297+500	Good	296+500	296+600	Good	286+600	286+700	Good
19	297+500	297+600	Good	297+300	297+400	Good	286+700	286+800	Good
20	297+600	297+700	Good	297+400	297+500	Good	286+800	286+900	Good
21	297+700	297+800	Good	297+500	297+600	Good	291+700	291+800	Good
22	297+800	297+900	Good	299+000	300+100	Good	291+901	293+000	Good
23	297+900	298+000	Good	300+150	300+200	Good	293+000	292+101	Good
24	298+696	299+038	Good	300+200	300+300	Good	292+100	292+200	Good
25	306+100	306+200	Good	300+300	300+400	Good	292+200	292+300	Good
26	306+200	306+300	Good	300+400	300+500	Good	292+300	292+400	Good
27	306+300	306+400	Good	300+500	300+600	Good	292+400	292+500	Good
28	306+400	306+500	Good	300+600	300+800	Good	292+500	292+600	Good
29	306+500	306+600	Good	301+850	302+000	Good	292+600	292+700	Good
30				302+000	302+600	Good	292+700	292+800	Good
31				305+700	305+900	Good	292+800	292+900	Good
32				306+100	306+200	Good	292+901	294+000	Good
33				306+200	306+300	Good	294+000	293+101	Good
34				306+300	306+400	Good	297+300	297+400	Good
35				306+400	306+500	Good	297+400	297+500	Good
36				306+500	306+600	Good	297+500	297+600	Good
37				306+600	306+800	Good	297+600	297+700	Good
38				309+800	310+000	Good	297+700	297+800	Good
39				311+100	311+300	Good	297+800	297+900	Good
41				311+300	311+400	Good	297+900	298+000	Good

S.no	LHS RCC Drain			Transverse Median Drain			RHS RCC Drain		
	From	To	Condition	From	To	Condition	From	To	Condition
42							298+253	298+548	Good
43							300+150	300+200	Good
44							300+200	300+300	Good
45							300+300	300+400	Good
46							300+400	300+500	Good
47							300+500	300+600	Good
48							307+300	307+400	Good
49							307+400	307+500	Good
50							307+500	307+600	Good
51							307+600	307+700	Good
52							311+653	311+948	Good

4.2.10 SIGN BOARDS

The details in respect of the sign boards installed on the Project Road are presented in **Table 4.11** below. Representative photographs of some of the Sign Boards are presented in **Figures** below.

Fig 4.55 : Sign Boards at Ch. 284+360 LHS

Fig 4.56 : Sign Boards at Ch. 285+100 LHS

Fig 4.57: Sign Boards at Ch. 285+600 LHS

Fig 4.58 : Sign Boards at Ch.289+200 RHS

Fig 4.59 : Sign Boards at Ch. 289+900 LHS

Fig 4.60 : Sign Boards at Ch.305+900 RHS

Fig 4.61 : Sign Boards at Ch. 309+400 LHS

Fig 4.62 : Sign Boards at Ch. 285+6050 LHS*

Fig 4.63 : Sign Boards at Ch. 284+900 RHS

Fig 4.64 : Sign Boards at Ch.309+700 RHS

Fig 4.65 : Sign Boards at Ch. 285+938

Fig 4.66: Gaurd Stones at Ch. 309+700 (RHS)

Table 4.11: Details of Sign Boards

Sl. No	Chainage (km)	282-283	283-284	284-285	285-286	286-287	287-288	288-289	289-290	290-291	291-292	292-293	293-294	294-295
1	Junction ahead/ Direction inform.	2	2	4	4	10	-	7	7	4	1	7	3	-
2	Chevron	-	5	-	-	-	-	-	-	27	32	47	-	-
3	Route marker	2	-	1	-	-	2	5	1	1	-	1	-	-
4	T/Y/+/Straggered	1	-	-	-	-	-	4	-	4	-	3	-	-
5	U-Turn	1	-	-	-	-	-	1	-	-	-	-	-	-
6	Accident prone area	2	-	-	-	-	-	1	1	-	-	-	-	-
7	Object Hazard Marker	1	2	5	2	3	2	8	1	4	5	9	3	2
8	Delineators	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Gap in median	-	-	4	1	4	-	2	-	6	-	2	-	3
10	Solar Blinker	-	-	5	-	1	1	5	4	2	-	2	-	2
11	Left/ Right Hand Curve	-	2	2	-	-	2	2	1	2	2	2	-	-
12	Helpline No. /Emergency	1	2	-	-	1	2	-	-	1	-	2	-	-
13	Overhed gantry	1	-	-		-		-	-	-	-	-	-	-
14	Overhed gantry (VMS)				1		1							
15	Cantiliver gantry	-	-	1	1	2	-	-	-	-	-	-	-	-
16	Petrol Pump	-	-	-	-	-	-	-	-	-	-	1	-	-
17	Toll Plaza sign board	-	-	1	-	2	-	-	-	-	-	-	-	-

Sl. No	Chainage (km)	282-283	283-284	284-285	285-286	286-287	287-288	288-289	289-290	290-291	291-292	292-293	293-294	294-295
18	Speed Breaker/ Rumble strip	1	-	-	-	-	-	2	2	-	-	1	-	-
19	Toll rates/ Exempted vehicle	-	-	-	4	-	-	-	-	-	-	-	-	-
20	Pedestrian crossing	1	-	-	1	-	-	3	1	3	-	5	-	-
21	Guard Stones	140	201	192	136	77	154	39	21	42	273	18	63	31
22	Speed limit	4	-	-	-	2	-	2	2	2	1	1	-	-
23	No Entry	-	-	1	-	1	-	-	-	-	-	-	-	-
24	Truck Lay bye	-	-	-	-	-	-	-	-	-	-	-	1	-
25	Bus Stop	-	1	-	-	-	-	2	2	2	1	-	-	-
26	No Overtaking	1	-	-	-	-	-	1	1	-	-	-	-	-
27	No Stoping	2	-	-	-	-	-	2	1	-	1	-	-	-
29	Lane Merging	-	1	-	-	-	-	-	-	-	-	1	-	-
30	Electric line	-	-	-	-	-	-	-	-	-	-	-	1	1
Sl. No	**Chainage (km)**	**295-296**	**296-297**	**297-298**	**298-299**	**299-300**	**300-301**	**301-302**	**302-303**	**303-304**	**304-305**	**305-306**	**306-307**	**307-308**
1	Junction ahead/ Direction inform.	4	3	9	4	4	1	-	-	-	1	2	4	1
2	Chevron	-	-	-	19	38	-	-	-	-	-	19	5	-
3	Route marker	-	-	-	1	1	-	-	-	-	-	1	1	-
4	T/Y/+/Straggered	3	-	1	2	2	-	-	-	-	-	1	3	-
5	STOP	-	-	-	-	-	1	-	-	-	-	-	-	-
6	Accident prone area	-	-	-	1	-	-	-	-	-	-	1	-	1
7	Object Hazard Marker	6	5	6	9	6	7	4	5	4	7	5	4	6

Sl. No	Chainage (km)	295-296	296-297	297-298	298-299	299-300	300-301	301-302	302-303	303-304	304-305	305-306	306-307	307-308
8	Delineators	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Gap in median	-	3	-	2	4	2	2	2	2	-	1	-	3
10	Solar Blinker	3	2	-	1	1	-	1	-	1	1	1	-	2
11	Left/ Right Hand Curve	-	-	-	2	2	-	-	-	-	-	2	2	1
13	Helpline No. /Emergency	-	-	2	-	1	-	-	-	2	1	1	-	2
14	Stray animal	1	-	-	-	-	-	-	-	-	-	-	-	-
15	Overhed gantry	-	-	-	-	1	-	-	-	-	-	1	-	-
16	Petrol Pump	-	-	-	1	-	-	-	-	-	-	-	-	-
17	Speed Breaker/ Rumble strip	-	-	-	-	-	2	-	-	-	-	1	-	1
18	Pedestrian crossing	-	1	-	2	1	-	-	-	-	-	1	2	-
19	Guard Posts	53	27	120	-	106	-	-	-	15	-	-	60	50
20	Speed limit	-	-	-	-	-	2	-	-	-	-	-	3	-
21	No Entry	-	-	-	-	-	1	-	-	-	-	-	-	-
22	Truck Lay bye	-	-	-	1	-	-	-	-	-	-	-	-	-
23	Bus Stop	-	-	-	-	-	-	-	-	-	-	-	2	-
24	U turn prohibited	2	-	-	-	-	-	-	-	-	-	-	-	-
25	One way	-	-	-	-	-	-	-	-	-	-	-	1	1
26	No Right/Left turn	-	-	-	-	-	2	-	-	-	-	-	-	-
27	No Overtaking	-	-	-	-	-	-	-	-	-	-	1	1	-
28	No Stoping	-	-	-	-	-	-	-	-	-	-	1	1	-
29	Lane Merging	-	-	-	-	-	2	-	-	-	-	-	2	1

Sl. No	Chainage (km)	308-309	309-310	310-311	311-312	312-313	313-314							
1	Junction ahead/ Direction inform.	-	7	1	2	5	1							
2	Route marker	1	3	-	-	2	-							
3	T/Y/+/Straggered	-	3	-	-	3	-							
4	Object Hazard Marker	3	5	-	5	4	2							
5	Delineators	-	-	-	-	-	-							
6	Gap in median	-	4	-	4	-	-							
7	Solar Blinker	-	2	-	2	2	-							
8	Left/ Right Hand Curve	-	2	-	-	-	-							
9	Helpline No. /Emergency	-	1	-	-	1	-							
10	Overhed gantry	-	-	-	-	-	1							
11	Petrol Pump	1	-	-	-	-	-							
12	Pedestrian crossing	-	3	-	-	3	-							
13	Speed limit	-	-	1	-	-	-							
14	Bus Stop	-	1	-	-	2	-							

4.2.11 METAL BEAM CRASH BARRIERS

The details of the Metal Beam Crash Barriers are furnished in **Table 4.12** below. At some of the locations the MBCB were damaged and repair works were also seen to be under progress. Representative photographs of some of theMBCB are presented in **Figures** below.

Fig 4.67 MBCB at Ch.285+480 LHS

Fig 4.68 MBCB at Ch.290+400 LHS

Fig 4.69 MBCB at Ch.310+500 LHS

Fig 4.70 MBCB at Ch.306+300 LHS

Fig 4.71 MBCB at Ch. 306+000 LHS

Fig 4.72 MBCB at Ch. 305+600 LHS

Table 4.12: Details of Metal Beam Crash Barriers.

Sl. No	Chainage		Length LHS (m)	Length Median (m)	Length RHS (m)	Condition (length of damage)
	From	To				
1	283.000	284.000	317		135	Good
2	284.000	285.000	352	393	120	Good
3	285.000	286.000	109	117	165	Damged – 10m (LHS)
4	286.000	287.000	100	142		Good
5	287.000	288.000			117	Good
6	288.000	289.000	742	297	700	Good
7	289.000	290.000	395	90	500	Good
8	290.000	291.000	383	292.13	302	Damaged – 20m (LHS)
9	291.000	292.000	230		528	Good
10	292.000	293.000	196	1195	66	Good
11	293.000	294.000		28		Good
12	294.000	295.000		389		Good
13	295.000	296.000	290			Good
14	296.000	297.000	400	230	500	Good
15	297.000	298.000	100		460	Good
16	299.000	300.000	500	220	660	Good
17	300.000	301.000	800		1000	Good
18	301.000	302.000	600	280	700	Good
19	302.000	303.000	80		880	Good
20	303.000	304.000	300	310	200	Good
21	304.000	305.000	1000		1000	Good
22	305.000	306.000	700	133	620	Good
23	306.000	307.000	80		400	Good
24	307.000	308.000		233		Good
25	309.000	310.000	80	254	80	Good
26	310.000	311.000	500		200	Good
27	311.000	312.000	300	235	100	Good
28	312.000	313.000		234		Good

4.2.12 PEDESTRIAN GUARD RAIL

Details of the Pedestrian Guard Rails are furnished in **Table 4.13**below.

Table 4.13: Condition of Pedestrian Guard Rails

Sl. No	Chainage From	Chainage To	Side	Length (m)	Remark
1	292.592	292.708	LHS	116	Pochampad Village
2	292.788	292.912	LHS	124	
3	292.608	292.738	RHS	130	
4	292.788	292.912	RHS	124	
5	292.987	293.070	RHS	83	

4.2.13 LIGHTING

Details of Lighting provided on the Project Road are furnished in **Table 4.14** below.Representative photos of same are shown in **Figures** below.

Fig 4.73 Lighting at Ch. 288+900

Fig 4.74 Lighting at Ch. 292+800

Fig 4.75 Lighting on service Roadat Ch. 298+600

Table 4.14: Details of Lighting

S.no	Chainages	Side	Type of lighting	Numbers	Remarks
1	285+939	B/S	High mast	4	2 on each side
1	292+750	RHS	High mast	1	
2	299+200	RHS	High mast	1	
3	306+000	RHS	High mast	1	
4	293+660	LHS	Single arm	6	
5	298+400	RHS	Single arm	6	
6	298+867	LHS	Single arm	6	
7	311+800	RHS	Single arm	6	
8	283+402	BS	Lamp	6	Not functional
9	286+622	BS	Lamp	6	Not functional
10	292+039	BS	Lamp	6	Not functional
11	295+757	BS	Lamp	6	
12	297+666	BS	Lamp	6	
13	300+914	BS	Lamp	6	
14	301+939	BS	Lamp	6	
15	306+202	BS	Lamp	6	
16	311+120	BS	Lamp	6	
17	296+173	BS	Lamp	6	
18	300+301	BS	Lamp	6	Not functional
19	288+800 to 288+900	Median	Double arm solar	1	
20	288+900 to 289+000	Median	Double arm solar	3	
21	289+000 to 289+100	Median	Double arm solar	3	
22	289+100 to 289+200	Median	Double arm solar	1	

4.2.14 KM STONES

Kilometer stones are generally seen to be available on the project road and are seen to be in Good condtion. Some hectometre stones were found to be missing.

4.3 OVERVIEW OF STRUCTURES

Detailed inventory of structures has been carried out. It is found that most of the structures are in Good condition with requirement pertaining mainly to routine maintenance and cleaning. The summarized details of the Inventory & Condition Survey for various structures are brought out in subsequent paras.

4.3.1 MAJOR BRIDGES

4.3.1.1 MAJOR BRIDGE STRUCTURE DETAILS

There are two Major Bridges on the Project Road. The details of these are furnished in Table 4.15 below. The condition survey of these bridges on both LHS/RHS carriageways was conducted by visual inspection.

Table 4.15: Details of Major Bridges

S. No	Location	Chainage	Str. No.	Type of Str.	Span Arrangement (L / R)	Side	Overall Length (m)	Carriageway width (m)	Overall width(m)	Type of Super Structure	Type of Sub Structure	Railing / Crash Barrier
1	Near Soan village on Godavari river	289+834	290/1	MjB	36X21.95m	L	790.2 m	9.0 m	12.0 m	RCC Deck Slab with PSC Girder	RCC Wall Type Abutments & RCC Wall type piers	RCC Crash Barrier
					36X21.95m	R	790.2 m	9.0 m	12.0 m	RCC Deck Slab with PSC Girder	RCC Wall Type Abutments & RCC Wall type piers	RCC Crash Barrier

S. No	Location	Chainage	Str. No.	Type of Str.	Span Arrangement (L / R)	Side	Overall Length (m)	Carriageway width (m)	Overall width(m)	Type of Super Structure	Type of Sub Structure	Railing / Crash Barrier
2	Near Kisan nagar Village	303+462	304/3	MjB	(2X20.745m) + (2X21.945 m)	L	85.38 m	9.0 m	12.0 m	RCC Deck Slab with PSC Girder	RCC Wall Type Abutments & RCC Wall type piers	RCC Crash Barrier
					(2X20.745m) + (2X21.945 m)	R	85.38 m	9.0 m	12.0 m	RCC Deck Slab with PSC Girder	RCC Wall Type Abutments & RCC Wall type piers	RCC Crash Barrier

4.3.1.2 OBSERVATION ON THE CONDITION OF THE MAJOR BRIDGES

Repesentative photographs of the Major bridges are shown in Figures below. Requirement of some minor repairs has been identified after general visual observation, as per the detail below.

Major Bridge (RHS) at Ch.289+834 (36X21.95m): Rubber seals of expansion joints are seen to be damaged.

Fig. 4.76: Major Bridge at Ch. 289+834

Fig. 4. 77: Major Bridge at Ch. 289+834

Fig. 4. 78: Major Bridge at Ch. 289+834

Fig. 4.79 : Major Bridge at Ch. 303+462

Fig. 4. 80: Major Bridge at Ch. 303+462

Fig. 4.81 : Major Bridge at Ch. 303+462

4.3.2 MINOR BRIDGES

4.3.2.1 MINOR BRIDGE STRUCTURE DETAILS

There are 6 numbers of Minor Bridges on the Project Road. Details for the Minor Bridges are furnished in Table 4.16 below.

Table 4.16: Details of Minor Bridges

S. No.	Chainage	Side	Span Arrangement	Overall Length (m)	Carriageway Width(m)	Overall width (m)	Type of Super Structure	Type of Substructure	Safety Barrier
1	284+360	LHS	1X8m	8	11	12	RCC Deck Slab	PCC Gravity Wall Type Abutments	RCC Crash Barriers
		RHS	1X8m	8	11	12	RCC Deck Slab	PCC Gravity Wall Type Abutments	RCC Crash Barriers

S. No.	Chainage	Side	Span Arrangement	Overall Length (m)	Carriageway Width(m)	Overall width (m)	Type of Super Structure	Type of Substructure	Safety Barrier
2	292+920	LHS	3X21.48m	64.44	11	22	RCC Deck Slab withPSC Girder	RCC Wall Type Abutments & RCC Wall type piers	RCC Crash Barriers
		RHS	3X21.48m	64.44	11	22	RCC Deck Slab withPSC Girder	RCC Wall Type Abutments & RCC Wall type piers	RCC Crash Barriers
3	298+580	LHS	2X16m	32	11	12	RCC Deck Slab with PSC Girder	RCC Wall Type Abutments & RCC Wall type piers	RCC Crash Barriers
		RHS	2X16m	32	9	12	RCC Deck Slab withPSC Girder	RCC Wall Type Abutments & RCC Wall type piers	RCC Crash Barriers
4	300+099	LHS	2X6.5(skew) X3.5	42.5 (clear)	9	33m (straight)	RCC Box type	RCC Box type	MBCB
		RHS	2X6.5 (skew) X3.5	42.5 (clear)	9	33 (straight)	RCC Box type	RCC Box type	MBCB
5	305+528	LHS	2X7X3	16	9	27	RCC Box type	RCC Box type	MBCB
		RHS	2X7X3	16	11	27	RCC Box type	RCC Box type	MBCB
6	312+904	LHS	1x9	9	11	12	RCC Solid Slab	RCC Wall Type Abutments	RCC Crash Barriers
		RHS	1X9	9	11	12	RCC Solid Slab	RCC Wall Type Abutments	RCC Crash Barriers

4.3.2.2 OBSERVATION ON THE CONDITION OF THE MINOR BRIDGES

Repesentative photographs of the Minor bridges are shown in Figures below. The condition of the Minor Bridges are found to be in Good condition. Some of the Critical site observations made in respect of some of structures are summarised below.

a) Minor Bridge (RHS) at Ch.284+360 (1x8m)

Some Sagging in observed on the top slab but no cracks are observed which indicates that this defect is due to the poor workmanship during construction but is not leading to any structural damage.

b) Minor Bridge (RHS) at Ch.292+920 (3X21.48m)

The Old masonry structure needs to dismantled to avoid obstruction in the waterway.

c) Minor Bridge (RHS) at Ch.298+580 (2x16m)

The Old masonry structure needs to dismantled to avoid obstruction in the waterway.

Fig. 4.82 : Minor Bridge at Ch.284+360

Fig. 4. 83: Minor Bridge at Ch.284+360

Fig. 4.84: Minor Bridge at Ch.284+360

Fig. 4.85 : Minor Bridge at Ch. 298+580

Fig. 4.86 : Minor Bridge at Ch.305+528

Fig. 4.87 : Minor Bridge at Ch.305+528

4.3.3 VEHICULAR UNDERPASSES (VUP)

There are 5 nos. VUP on the project road and are in Good condition. The details of the structures are mentioned in Table 4.17 below.

Table 4.17: Details of Vehicular Underpasses

S. No.	Chainage	Span Arrangement	Overall width of Structure	Type of Super Str.	Safety Barrier
1	286+500	1X12X5.5	29.5m	Box Type	RCC Crash Barriers
2	296+173	1X12X5.5	27.5 m	Box Type	RCC Crash Barriers
3	300+301	1X12X5.5	34.5 m	Box Type	RCC Crash Barriers
4	302+625	1X12X5.5	29.9 m	Box Type	RCC Crash Barriers
5	304+977	1X12X5.5	29.9 m	Box Type	RCC Crash Barriers

Fig. 4.88 : VUP at Ch. 286+500

Fig. 4. 89: VUP at Ch. 296+190

Fig. 4.90 : VUP at Ch. 300+200

Fig. 4.91 : VUP at Ch. 300+301

Fig. 4.92 : VUP at Ch. 300+301

Fig. 4.93 : VUP at Ch. 304+977

4.3.4 PEDESTRIAN UNDERPASSES (PUP)

There are 12 nos. of PUPs on the project road and are in Good condition. The details of the structures are mentioned in Table 4.18 below.

Table 4.18: Details of Pedestrain Underpasses

Sl. No.	Chainage	Span Arrang.	Width of Structure	Type of Super Structure	Safety Barrier
1	283+402	1X5X3	27 m	Box Type	RCC Crash Barriers
2	286+622	1X5X3	27 m	Box Type	RCC Crash Barriers
3	292+039	1X5X3	27.5 m	Box Type	RCC Crash Barriers
4	295+757	1X5X3	27.5 m	Box Type	RCC Crash Barriers
5	297+666	1X5X3	27.5 m	Box Type	RCC Crash Barriers
6	299+892	1X5X3	27.5 m	Box Type	RCC Crash Barriers
7	300+914	1X5X3	27.5 m	Box Type	RCC Crash Barriers
8	301+939	1X5X3	27.5 m	Box Type	RCC Crash Barriers
9	303+922	1X5X3	27.5 m	Box Type	RCC Crash Barriers
10	304+622	1X6.5X4.5	27.5 m	Box Type	RCC Crash Barriers
11	306+202	1X5X3	27.5 m	Box Type	RCC Crash Barriers
12	311+120	1X5X3	27.5 m	Box Type	RCC Crash Barriers

Fig. 4.94 : PUP at Ch. 283+402

Fig. 4.95 : PUP at Ch. 299+892

Fig. 4.96 : PUP at Ch. 286+622

Fig. 4.97 : PUP at Ch.311+120

Fig. 4.98: PUP at Ch. 306+202

Fig. 4.99 : PUP at Ch. 300+914

4.3.5 CULVERTS

The total 83 number of culverts are there on the Project Road and they are summarized in Table 4.19 below.

4.3.5.1 CULVERT STRUCTURE DETAILS

The total number of culverts on the Project Road are summarized in Table 4.19 below.

Table 4.19: Details of Culverts on the Project Road

Sl. No.	Type of Stucture	Number
1	Slab Culvert	8
2	Box Culvert	22
3	Hume Pipe Culvert	55

4.3.5.2 OBSERVATIONS IN RESPECT OF BOX/ SLAB CULVERT

Most of the culverts are in good condition some repair/maintenance work are required to be carried out on some culverts. The details of such culverts are summaried in Table 4.20. In most of the culvert it is observed that general cleaning of vegetation and garbage from the water way is requireds. In some structures it is found that Object Hazard Markers are missing.

Fig. 4.100 : Box Culvert at Ch. 286+917

Fig. 4.101: Slab Culvert at Ch. 291+545

Fig. 4.102: Box Culvert at Ch. 297+728

Fig. 4.103 : Box Culvert at Ch. 299+577

Fig.4.104: Slab Culvert at 301+387

Fig. 4.105 : Box Culvert at Ch. 308+214

Table 4.20: Observations highlighting repair and maintenance needs for Box/Slab Culverts

Sl. No.	Chainage	Type of Structure	Span Arrangement	Observations on LHS side	Observations on RHS side
1	286+917	BC	1X2m	Stone boulder pitching covered with vegetation.	Stone boulder pitching covered with vegetation.
2	299+577	BC	1X2m	Honeycombing observed in crash barrier. General cleaning required over pitching.	Honey combing observed in crash barrier.
3	304+006	BC	1X3m	General cleaning required over pitching.	Honey combing observed over box opening.
4	308+214	SC	1x4m	Vegetation to be cleared from the waterway. Stone Pitching is covered with vegetation.	Top Edge of Slab is damaged and the reinforcement is exposed in about 4m length. Minor repair works are required. Stone Pitching is covered by vegetation.

4.3.5.3 OBSERVATIONS IN RESPECT OF HUME PIPE CULVERTS

It is observed that the condition of the Hume Pipe Culverts is generally good, however on some Pipe culverts the water way is seen to be blocked and there is a requirement of removal of vegetation/garbage to clear the water way. The details in this regard are summaried in Table 4.21. Representative photos of the Pipe Culverts are shown in Figures below.

Fig. 4.106 : HPC at Ch. 283+632(LHS)

Fig. 4.107: HPC at Ch. 295+165 (LHS).

Fig. 4.108 : HPC at Ch. 290+600

Fig. 4.109 : HPC at Ch. 286+030

Fig. 4.110 : HPC at Ch. 291+000

Fig. 4.111 : HPC at Ch. 305+900

Table 4.21: Observations highlighting repair and maintenance needs for Hume Pipe Culverts

Sl. No.	Chainage	Span Arrangement	Observations on LHS side	Observations on RHS side
1	283+632	1x1.2m	Pipe not functional and is buried completely and need to be cleared.	Waterway obstructed by debris.
2	285+875	1x1.2m	Water way obstructed with bushes.	Waterway is obstructed with bushes, garbage, and debris.
3	287+167	2x1.2m	Water way obstructed with bushes.	Waterway obstructed with bushes.
4	288+448	3x1.2m	Good condition	Water way obstructed with bushes and garbage. Backfilling eroded.
5	292+062	1x1.2m	Dumped garbage obstructing the Waterway needs to be cleared.	Bushes and debris blocking the waterway and need to be cleared.
6	296+888	2x1.2m	Waterway obstructed with garbage and debris.	Waterway obstructed by garbage and bushes.
7	297+313	1x1.2m	Good condition	Pipe Opening obstructed by filled up soil
8	298+881	1x1.2m	Pipe Opening obstructed by filled up soil	Pipe Opening obstructed by filled up soil
9	304+347	1x1.2m	Waterway obstructed by dumped pipe	Good condition
10	311+439	2x1.2m	Good condition	Waterway obstructed by bushes and garbage.
11	312+737	1x1.2m	Good condition	Water way obstructed by bushes.
12	313+413	1x1.2m	Pipe Opening obstructed by filled up soil	Waterway obstructed by garbage.

Note: As the cleaning of structures is being carried out twice in a year i.e before and after monsoon.

CHAPTER 5.0: OPERATION & MAINTENANCE

5.1 OPERATION & MAINTENANCE - REQUIREMENTS OF CONCESSION AGREEMENT

The Scope of Works for O&M stage has been mentioned in the Schedule-L of the Concession Agreement and also the O&M Manual as described earlier. The O&M Manual is a guideline to assist the Concessionaire. Certain forms and procedures are annexed as part of the Manual for facilitating proper supervision and implementation of various O&M activities. The Concessionaire is expected to cover the following two aspects during the entire Operations Period.

a) OPERATIONS PART

This includes ensuring smooth and uninterrupted flow of traffic during normal operating conditions, functioning of patrolling system, functioning of rescue and medical aid services, functioning of the Project Facilities, public toilets and other sanitary facilities and solid waste disposal system.

b) MAINTENANCE PART

This includes maintaining the Project Road in traffic worthy conditions and the Project's Ancillary Facilities in usable condition satisfying the performance criteria as provided in the Concession Agreement throughout the Concession Period through regular maintenance and preventive maintenance of the various items and elements of the Project Highway.

5.2 PERIODIC MAINTENANCE STRATEGY

Periodic Maintenance for the carriageway shall be carried out as required and renewal layer shall be laid every 5 years after the initial construction (from COD). This periodic maintenance shall also include profile corrective course of overlays with the periodic renewal of the wearing course of the road pavement. Paved shoulders shall also be treated in similar manner as applicable to the main carriageway lanes. The periodic renewal shall result in improvement of the riding quality and road roughness value shall be restored to meet the relevant standards. As per the above provisions of the Concession Agreement since the COD has been achieved in the year 2009 and the Concession Period ends in October 2027, the periodic maintenance activity needs to be carried out in the years 2014, 2019 & 2024. The Periodic maintenance required in the years 2014 and 2019 have been completed by the Concessionaire. The First periodic maintenance (2014) was delayed and completed in December 2015 instead of 2014 and the Second periodic maintenance was completed in Sepetember2019.

As per Article XXIV of Concession Agreement "the Concessionaire and IE shall jointly inspect (Initial Inspection) the Project Highway and Project Facilities 30-36 months prior to expiry of Concession Period. Upon agreement on proposals for renewal works if any, the Concessionaire shall carry out the renewal works at his own cost. The Second Inspection shall be carried out 9-12 months prior to expiry of Concession Period. From the date which is 2 years prior to the expiry of the Concession Period a sum equal to 15% of the Annuity or a

higher sum estimated by the Independent Consultant for Renewal Works will be retained in the Escrow Account. If following the Second Inspection, it is agreed or determined that no renewal works are required, then within 14 days of such agreement, 50% of the sums retained in accordance with Clause 34.11 shall be released from the Escrow Account to the Concessionaire. Within 14 days of issuance of Vesting Certificate full amount will be released. Road marking as specified and other roadside features shall also be restored to meet the relevant standards". Thus the over all strategy of the concessionaire should be to carryout the Routine and Periodic Maintenance as per the required frequence so that no major requirements come up at the time of issuance of Vesting Certificate.

5.3 ROUTINE PAVEMENT MAINTENANCE

The pavement shall be treated for various distresses occurring as per cl. 4.4.7. of Sch. L of the Concession Agreement as mentioned in Table 5.1 below:

Table 5.1: Pavement Maintenance criteria

Sl. no.	Type of Distress	Limiting value of Distress	Treatment of Distress
1 a)	Cracking of Bituminous pavement i.e hairline, alligator, longitudinal, transverse, shrinkage, reflective and edge cracking, linear & slippage etc.	For any 50 m section of the pavement the cracked area shall not exceed 0.5 sq.m. at a place.	Treament needs to be done within 7 days after their detection.
1 b)		Width of crack not less than 3 mm and is resulting in settlement of pavement upto 10 mm in depth and exceeding 0. 5 sq.m.	Crack shall be repaired by slurry seal as per MORTH specification 516.
1c)		Width of crack not less than 3 mm and is resulting in settlement of pavement exceeding 10 mm in depth and exceeding 0. 5 sq.m	Area shall be repaired by patching as per MORTH specification 3004.
1 d)	Alligator crack		Patching upto full depth.
1e)	Slippage cracks		Repair by removing the affected bituminous layer and replacing it with surface patch.
1 f)	Edge cracking		Reconstruction of the shoulder with good quality material.
2	Rutting	For any 50 m section of the pavement, ruts shall not be	Treatment shall be done within 15 days after their

Sl. no.	Type of Distress	Limiting value of Distress	Treatment of Distress
		deeper than 10 mm and length shall not be more than 5 m	detection as per IRC:82-1982 specifications.
3	Corrugations and Shoving	Damage exceeds 1 sq.m at any place and depth /height of corrugation /shoving exceeds 10 mm.	Shall be rectified /corrected within 2 days after its detection as per IRC:82-1982 specifications.
4	Settlement & Great depression	Damage exceeds 1 sq.m at any place and depth is within 10 mm.	Shall be rectified /corrected within 3 days after its detection as per IRC:82-1982 specifications.
5	Upheaval or Swell	For any 50 m section of the pavemnet, upheaval or swell shall not exceed 0.5 sq.m, if height is nore than 10 mm.	Shall be treated within 7 days after detection as per IRC:82-1982.
6	Ravelling	For any 50 m section of pavement, if raveling of bitumenous surface is not more than 3% the pavemnet surface of that section and ravelled area does not exceed 1 sq.m. at a place.	Shall be rectified within 7 days after their detection by slurry seal treatment in accordance with MORT&H specification.
7	Potholes	No potholes shall be on the pavement surface irrespective of the size and depth.	Potholes shall be repiared within 2 days after their detection.

5.3.1 DETAILS OF LATEST BBD TESTS

The Concessionaire has been conducting the BBD studies in the Operation period last one has been conducted in Dec. 2021. Based on the information provided by the Concessionaire, bituminous overlay on the entire Project Road has been carried out twice (2015 & 2019) since COD and next overlay is being planned by the Concessionaire in FY 2024 and FY 2025.

The Benkelman Beam Deflection studies have been carried out by the Concessionaire in 13th Jan to 16th Dec. 2021, the report of which has been submitted by the Concessionaire. Summary of the same has been presented in Table 5.2 below.

Table 5.2: Summary of Latest BBD Test

Sr. No.	Chainage		Side	Characteristic Deflection	Side	Characteristic Deflection
	From	To				
1	282.600	283.600	LHS	0.574	RHS	0.527
2	283.600	284.600	LHS	0.488	RHS	0.550
3	284.600	285.600	LHS	0.469	RHS	0.485
4	285.600	286.600	LHS	0.416	RHS	0.496
5	286.600	287.600	LHS	0.422	RHS	0.570
6	287.600	288.600	LHS	0.428	RHS	0.480
7	288.600	289.600	LHS	0.485	RHS	0.504
8	289.600	290.600	LHS	0.432	RHS	0.482
9	290.600	291.600	LHS	0.438	RHS	0.454
10	291.600	292.600	LHS	0.422	RHS	0.514
11	292.600	293.600	LHS	0.591	RHS	0.459
12	293.600	294.600	LHS	0.479	RHS	0.478
13	294.600	295.600	LHS	0.456	RHS	0.491
14	295.600	296.600	LHS	0.482	RHS	0.464
15	296.600	297.600	LHS	0.445	RHS	0.496
16	297.600	298.600	LHS	0.457	RHS	0.519
17	298.600	299.600	LHS	0.558	RHS	0.516
18	299.600	300.600	LHS	0.424	RHS	0.519
19	300.600	301.600	LHS	0.470	RHS	0.451
20	301.600	302.600	LHS	0.445	RHS	0.543
21	302.600	303.600	LHS	0.474	RHS	0.453
22	303.600	304.600	LHS	0.463	RHS	0.450
23	304.600	305.600	LHS	0.420	RHS	0.428
24	305.600	306.600	LHS	0.478	RHS	0.513
25	306.600	307.600	LHS	0.501	RHS	0.511
26	307.600	308.600	LHS	0.498	RHS	0.454
27	308.600	309.600	LHS	0.479	RHS	0.483
28	309.600	310.600	LHS	0.480	RHS	0.488
29	310.600	311.600	LHS	0.422	RHS	0.500
30	311.600	312.600	LHS	0.443	RHS	0.503
31	312.600	313.500	LHS	0.521	RHS	0.512
			Average	**0.469**		**0.493**

As per the Sch. L of the Concession Agreement, wherever the characterstic deflection exceeds 1.2 mm a bituminous overlay shall be provided appropriately designed according to IRC 81-1997. From the above Table 5.2, it can be seen that the deflection values are within the acceptable limits. Thus, there is no requirement of any overlay as per the BBD test results.

5.3.2 LATEST ROUGHNESS MEASUREMENT STUDIES

Roughness Measurement by using Fifth Wheel Bump Integrator is being done by the Concessionaire on regular intervals as mentioned in the O&M Manual. The O&M Manual specifies that Concessionaire has to ensure that at no point during the Operations Period, the roughness in the road surface shall exceed the prescribed acceptable Roughness Values given in para 4.3.1 of the Concession Agreement, i.e. surface roughness shall not exceed 3000mm/km during the service life of pavement at any time. A renewelable coat of bituminous concrete shall be laid every 5 year after initial construction or where the roughness value reaches 3000 mm /km which ever is earlier to bring it to the initial value of 2000 mm/km.

The latest Roughness Measurement Report, made available to us is for studies done on 16th Dec. 2021. The Calibrated Roughness values mm/km for both the carriageways have been represented in **Table 5.3** below.

Table 5.3: Latest Roughness Measurement Values using Fifth Wheel Bump Integrator

S.No.	Chainage from	Chainage to	LHS	RHS
1	282.600	283.000	1586	1796
2	283.000	284.000	1831	1770
3	284.000	285.000	1863	1863
4	285.000	286.000	1988	1866
5	286.000	287.000	1828	1916
6	287.000	288.000	1789	1845
7	288.000	289.000	1961	1882
8	289.000	290.000	1910	2167
9	290.000	291.000	1821	1999
10	291.000	292.000	1793	1896
11	292.000	293.000	1966	1994
12	293.000	294.000	1812	1807
13	294.000	295.000	1798	1798
14	295.000	296.000	1826	1812
15	296.000	297.000	1756	1789
16	297.000	298.000	1793	1803
17	298.000	299.000	1849	1877
18	299.000	300.000	1868	1896
19	300.000	301.000	1947	1789
20	301.000	302.000	1784	1835
21	302.000	303.000	1961	1863
22	303.000	304.000	1831	1868
23	304.000	305.000	1938	1849
24	305.000	306.000	1873	1868
25	306.000	307.000	1775	1891

S.No.	Chainage from	Chainage to	LHS	RHS
26	307.000	308.000	1779	1826
27	308.000	309.000	1756	1817
28	309.000	310.000	1789	1891
29	310.000	311.000	1765	1835
30	311.000	312.000	1849	1896
31	312.000	313.000	1793	1891
32	313.000	313.500	1835	1667
	Maximum Values		**1988**	**2167**
	Average Values		**1834**	**1861**

As seen from above, the maximum Roughness Values on LHS and RHS carriageway are seen to be 1988 mm/km and 2167 mm/km respectively which are within the Acceptable Range. The pavement surface on an average is seen to have a Roughness Value of 1834 mm/km and 1861 mm/km on LHS and RHS respectively which also are within the Acceptable Range.

5.4 REVIEW OF DESIGN MSA CALCULATION AND RESIDUAL LIFE OF PAVEMENT

5.4.1 Design MSA calculations as per initial Pavement Design Report.

The growth rates for MSA calculation adopted are as per Table 5.4 below.

Table 5.4: Growth rate of vehicles as per Pavement Design Report

Growth Rate of Vehicle Class in percentage				
Year (2005)	**Bus**	**LCV**	**Truck**	
			2-Axle	**4-6 Axle**
2005 to 2013	3.0	8.0	8.0	8.0
2014-2023	3.0	7.0	7.0	7.0
2023-2029	2.5	6.5	6.5	6.5

VDF and Commercial Vehicles per day adopted as per Traffic Survey carried out in 2005-2006 (Pavement Design Report) are brought out in Table 5.5 below.

Table 5.5: CVPD & VDF as per Pavement Design Report

Vehicle category	Standard Bus	LCV	2 Axle Truck	4-6 Axle
Number of vehicles	441	330	1849	77
VDF	**0.70**	**0.34**	**2.48**	**4.75**

The calculation of design MSA on the basis of the above parameters as considered in the Pavement Design Report is brought out in Table 5.6 below:

Table 5.6: MSA calculation as per Pavement Design Report

Design Period	Concession Period	Year	Standard Bus	LCV	2 Axle Truck	4-6 Axle	CVPD	E.S.A.L	Cumulative M.S.A.
	Base Year	2005	441	330	1849	77	2697	733838	
Construction Period		2006	454	356	1997	83	2891	790432	**0.79**
	1	2007	468	385	2157	90	3099	851491	**1.64**
	2	2008	482	416	2329	97	3324	917369	**2.56**
1	3	2009	496	449	2516	105	3566	988450	**3.55**
2	4	2010	511	485	2717	113	3826	1065148	**4.61**
3	5	2011	527	524	2934	122	4107	1147911	**5.76**
4	6	2012	542	566	3169	132	4409	1237221	**7.00**
5	7	2013	559	611	3422	143	4734	1333600	**8.33**
6	8	2014	575	654	3662	152	5043	1424811	**9.76**
7	9	2015	593	699	3918	163	5373	1522343	**11.28**
8	10	2016	610	748	4193	175	5726	1626636	**12.91**
9	11	2017	629	801	4486	187	6102	1738160	**14.64**
10	12	2018	648	857	4800	200	6504	1857422	**16.50**
11	13	2019	667	917	5136	214	6934	1984960	**18.49**
12	14	2020	687	981	5496	229	7392	2121350	**20.61**
13	15	2021	708	1049	5880	245	7882	2267212	**22.87**
14	16	2022	729	1123	6292	262	8406	2423204	**25.30**
15	17	2023	751	1202	6732	280	8965	2590035	**27.89**
16	18	2024	770	1280	7170	299	9518	2755510	**30.64**
17	19	2025	789	1363	7636	318	10106	2931669	**33.57**
18	20	2026	809	1451	8132	339	10731	3119204	**36.69**
19	21	2027	829	1546	8661	361	11396	3318854	**40.01**

5.4.2 Alternative Design MSA calculations considering uniform growth rate of 5%:

In this altenative design calcultation, the details of the commercial vehicles and VDF have been taken as per the pavement design report however uniform growth rate of 5% has been considered through out the concession period. The MSA projection on this basis is furnished in the Table 5.7 below.

Table 5.7: MSA Calculation for Fixed 5% growth rate

Design Period	Concession Period	Year	Standard Bus	LCV	2 Axle Truck	4-6 Axle	CVPD	E.S.A.L	Cumulative M.S.A.
	Base Year	2005	441	330	1849	77	2697	733838	
Construction Period		2006	463	347	1941	81	2832	770530	**0.77**
	1	2007	486	364	2039	85	2973	809056	**1.58**
	2	2008	511	382	2140	89	3122	849509	**2.43**
1	3	2009	536	401	2247	94	3278	891985	**3.32**
2	4	2010	563	421	2360	98	3442	936584	**4.26**

Design Period	Concession Period	Year	Standard Bus	LCV	2 Axle Truck	4-6 Axle	CVPD	E.S.A.L	Cumulative M.S.A.
3	5	2011	591	442	2478	103	3614	983413	**5.24**
4	6	2012	621	464	2602	108	3795	1032584	**6.27**
5	7	2013	652	488	2732	114	3985	1084213	**7.36**
6	8	2014	684	512	2868	119	4184	1138424	**8.50**
7	9	2015	718	538	3012	125	4393	1195345	**9.69**
8	10	2016	754	564	3162	132	4613	1255112	**10.95**
9	11	2017	792	593	3321	138	4843	1317868	**12.26**
10	12	2018	832	622	3487	145	5086	1383761	**13.65**
11	13	2019	873	653	3661	152	5340	1452949	**15.10**
12	14	2020	917	686	3844	160	5607	1525597	**16.63**
13	15	2021	963	720	4036	168	5887	1601876	**18.23**
14	16	2022	1011	756	4238	176	6182	1681970	**19.91**
15	17	2023	1061	794	4450	185	6491	1766069	**21.68**
16	18	2024	1114	834	4672	195	6815	1854372	**23.53**
17	19	2025	1170	876	4906	204	7156	1947091	**25.48**
18	20	2026	1229	919	5151	215	7514	2044445	**27.52**
19	21	2027	1290	965	5409	225	7889	2146668	**29.67**

5.4.3 Altenative Design MSA calculations based on the assessed Traffic growth rate on the basis of Present Toll Data.

As per Dec. MPR the details of daily traffic are furnished in Table 5.8 under:

Table 5.8 Toll Data from MPR Dec 21

Vehicle category	Car	LCV	Bus / Truck	3 Axle Truck	MAV	OSV
Dec-21 (Monthly)	125531	17131	64469	49220	71743	84
Dec-21 (Avg. daily)	4049	552	2080	1588	2314	3

The tentative assessment of growth rates which could have led to increase in traffic level from 2005 to 2021 has been made and is furnished in Table 5.9 below:

Table 5.9: Assessed Traffic growth rate

Vehicle category	Bus	LCV	2-Axle /3- Axle	4-6 Axle
2005-06 (Avg. daily)	441	330	1849	77
2020-21 (Avg. daily) *	504	371	2091	1594
Growth Rates	0.91	0.80	0.81	22.40

* SCF of 0.9 has been considered for the month of January

The MSA projection based on these assessed growth rates are brought out in Table 5.10 below:

Table 5.10: MSA calculations based on Present Toll data

Design Period	Concession Period	Year	Standard Bus	LCV	2 Axle Truck	4-6 Axle	CVPD	E.S.A.L	Cumulative M.S.A.
	Base Year	2005	441	330	1849	77	2697	733838	
Construction Period		2006	445	333	1864	94	2736	750558	**0.75**
	1	2007	449	335	1879	115	2778	769832	**1.52**
	2	2008	453	338	1894	141	2826	792224	**2.31**
1	3	2009	457	341	1909	173	2879	818422	**3.13**
2	4	2010	461	343	1924	212	2940	849269	**3.98**
3	5	2011	465	346	1940	259	3010	885796	**4.87**
4	6	2012	470	349	1955	317	3090	929266	**5.80**
5	7	2013	474	352	1971	388	3184	981224	**6.78**
6	8	2014	478	355	1986	475	3294	1043562	**7.82**
7	9	2015	482	357	2002	581	3423	1118594	**8.94**
8	10	2016	487	360	2018	711	3577	1209154	**10.15**
9	11	2017	491	363	2035	871	3759	1318709	**11.47**
10	12	2018	495	366	2051	1066	3978	1451504	**12.92**
11	13	2019	500	369	2067	1304	4241	1612734	**14.53**
12	14	2020	504	372	2084	1597	4557	1808758	**16.34**
13	15	2021	509	375	2100	1954	4939	2047360	**18.39**
14	16	2022	514	378	2117	2392	5401	2338065	**20.73**
15	17	2023	518	381	2134	2928	5961	2692535	**23.42**
16	18	2024	523	384	2151	3584	6642	3125041	**26.54**
17	19	2025	528	387	2168	4387	7470	3653053	**30.20**
18	20	2026	532	390	2186	5369	8477	4297953	**34.49**
19	21	2027	537	393	2203	6572	9705	5085912	**39.58**

5.5.4 Comparision of MSA projection in Different Scenarios.

A comparative asseseesment of the MSA is brought out in Table 5.11 below.

Table 5.11: Summary of MSA scenarios

Scenario	Adopted Growth Rate	Cum. MSA consumed from COD till present day (2021-22)(in Cr.)	Cum. MSA consumed at the End of C.P. (in Cr.)
Scenario 1	As per Projected growth rates in Pavement Design Report	**22.87**	**40.01**
Scenario 2	Uniform growth rate of 5%	**18.23**	**29.67**
Scenario 3	Assessed growth rate on the basis of present toll data	**19.25**	**39.58**

From the aformentioned table the following inferences can be drawn.

The pavement design for the project road has been carried out for design traffic of 40 MSA. Although the traffic growth projected for different categories of vehicles in the pavement design report does not seem to be matching with the actual traffic growth rate seen from the present traffic growth rate data, the cumulative MSA calculated at the end of the concession period even on the basis of the growth rates assessed in para 5.6.3 is less than the design traffic of 40 MSA.

From the above it can said that the pavement design adopted for the project road is adequate for the remaining concession period and there should not be any need for carriying out any structural overlay.

5.5 STATUS OF O&M

a. The COD for the project road was on 22nd July 2009 and first overlay was carried out from 2014 to 2015. It is pertinent to note here that damages for delay in carrying out the renewal work was imposed by NHAI on the Concessionare stating that the first renewal should have been completed prior to the completion of five years from 5 years of COD and there was a delay of 490 days. However, the Arbitral Tribunal on 21.08.2019 observed that imposition of damages by NHAI is not tanable under the provisions of Concession Agreement. As per details provided by Concessionaire, the matter is settled with NHAI and NHAI has already refunded the damages recovered from Annuity payment.

b. Second overlay was carried out from 15.03.2019 to 24.09.2019 by the Concessionaire and the Comletion Certificate was issued by NHAI without imposition of any damages for delay.

c. From the detailed site inventory carried out, it is noted that the O&M requirements for the project are being catered to adequately. The condition of the pavement is generally good. The markings and signages are provided adequately, barring missing sign borads at some locations. Condition of the structures is found to be satisfactory. Some MBCB are damaged and the repair works are seen under progress.

CHAPTER 6.0: OPERATION AND MAINTENANCE COSTS

6.1 OPERATIONS & MAINTENANCE COSTS AND FUTURE STRATEGY

6.1.1 BROAD STRATEGY

Looking to the condition of the Project Highway, it was found that the Project Road is in a Good condition. The renewal of the wearing course has been carried out as per the renewal cycle specified in the Concession Agreement. The Concession Agreement specifies at least one renewal layer laid every 5 years after the initial construction. As per this the next renewal cycle have considered 50% works in the year's 2023-2024 & 2024-2025.

For the structures and other road assests, regular upkeep and repairs needs to carried out during the routine maintenance as specified in the O & M manual. From the condition surevy it is seen that, there is little likelyhood of any major maintenance for the structures in the remaining concession period.

6.1.2 ASSESSMENT OF COSTS AS PER PRESENT CONDITION SURVEY

The assessment of the O&M costs has been done by considering works pertaining to functional overlay and repair to the minor damages to the road furniture. Rates of Telangana 2021-22 SOR have been adopted. A summary of O&M Cost for the year 2022-23 is furnished in **Table 6.1** below. The break-up of these costs are presented in the subsequent paras.

Table 6.1: Base O&M and Periodic Maintenance Costs in year 2022-23 level is used for future year

Sl.No	Details	Amount (Rs in Cr.)
1	Periodic Maintenance Costs	29.60
2	Routine Maintenance & Operations Costs	
i)	Operational Expense	3.80
ii)	Routine Maintenance Expense	2.40

2022-2023 is adopted as the Base year and the year on year costs so worked out are brought out in the **Table 6.2** below.

Table 6.2: Operation& Maintenance Cost Projections at 2022-23 base rate

Sl. No	Year	Periodic Maintenance Costs incl. GST (in Cr.)	Routine Operations and Maintenance Cost incl. GST (in Cr.)
1	2022-23		6.20
2	2023-24	14.80	5.90
3	2024-25	14.80	5.90
4	2025-26		6.20
5	2026-27		6.20
6	2027-28 (Oct 27) *		3.62
7	Expenses towards Handing over cost	1.50	
	TOTAL	**31.10**	**34.01**

6.2 PERIODIC MAINTENANCE COSTS

The O&M Manual specifies that Concessionaire has to ensure that at no point during the Operations Period, the roughness in the road surface shall exceed the prescribed acceptable Roughness Values given in para 4.3.1 of the Concession Agreement i.e. surface roughness shall not exceed 3000 mm/km during the service life of pavement at any time. A renewelable coat of bituminous concrete shall be laid every 5 year after initial construction or where the roughness value reaches 3000 mm /km which ever is earlier to bring it to the initial value of 2000 mm/km. Based on the Test results and site inspection it is seems that no structural requirement is foreseen and hence for the functional overlay 30mm BC is considred for the entire Main carriageway. Cost for Periodical Renewal has been worked out as per Rates of Telangana 2021-22 SOR and summarized in the **Table 6.3A** and **Table 6.3B** below.

Table 6.3 A: Cost of Periodic Renewal

Main Carriageway Paved area – Rigid	8901	Sqm
Main Carriageway Paved area – Flexible	575396	Sqm
Service/ Slip Road – Flexible	69665	Sqm
Structure Deck Carriageway Area	12415	Sqm
Major/ Minor Junctions Area – Flexible	8445	Sqm

Table 6.3 B: Cost of Periodic Renewal at 2022-23 base rate

Sl. No.	Items	Unit	Qty for complete length renewal	Rates as per Telanagana SOR 21-22	Amount
1	Functional overlay with 30 **mm** BC for MCW +bus bay	Cum	17262	11560	9,95,47,333
2	Functional overlay with 25 mm SDBC for Service road + Junctions	Cum	1953	9883	1,92,99,028
3	Tack Coat on BT Layer	Sqm	653506	9	5,881,554
4	Cats Eye (Studs)	Nos	4126	361	1,489,486
5	Replacement of Wearing coat on structures 25mm	Sqm	12415	849	10,540,335
6	Lane Marking	Sqm	21869	516	11,284,163
7	Crash Barrier Concrete	Rm	62	4578	284,294
8	Median & Other Crash Barrier (RE Wall) Painting	sqm	23790	58	1,379,834
9	PGR Painting	sqm	270	96	25,939
10	Kerb Painting	Rm	22300	76	1,694,788
11	Expansion joint (50mm vide strip seal joints)	Rm	302	10431	3,150,162
12	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015) 100%	Sqm	8901	27	240,327
13	Replacement of PQC Slab (1%) every 5th year	cum	28	7,406	210,947
14	Joint sealant replacement every 5th Year (5%)	Lm	324.957	100	32,496
	Total including GST @ 12% (in Cr.)				**29.60**

6.2.2 ROUTINE OPERATION & MAINTENANCE COSTS

These costs comprises of two categories – The Routine & Preventive Maintenance and Operational Expenses. Our assessments regarding both of these are presented in the paras below.

6.2.2.1 ROUTINE & PREVENTIVE MAINTENANCE

The Routine Maintenance and cleaning have been considered to include broadly three categories.

A) Routine and Preventive Maintenance
B) Cleaning of road and other assets, removal of vegetation, cleaning of drains, etc.
C) Electrical Maintenance

For the purpose of assessing of Routine and Preventive Maintenance, we have assigned weightages on all such works of highways that might need continued attention for repair. Our assessments of these costs are presented in the **Table 6.4A** and **Table 6.4B** below.

Table 6.4A: Details of Routine Preventive Maintenance

Sl. no.	Activities		Unit	Project Qty. For 12 months	Weight-age Assigned	Rates	Total Amount
1	Replacement of sign boards		Sqm	36	9000	5%	3,20,400
2	Replacement of cat eyes		Nos	124	361	3%	44,685
3	Repair of MBCB		m	899	2852	4%	25,63,948
4	Replacement/ repairs of Guard Post		Nos	91	140	5%	12,726
5	Repair of guard rail		Rm	12	1500	3%	18,000
6.A	Pot hole filling (flexipvmt)-MCW		Sqm	173	1500	0.03%	2,58,928
6.B	Pot hole filling (flexipav.)- Service Road		Sqm	21	1500	0.03%	31,349
6.C	Rigid pavement repair		Km	1.050	30000		31,500
6.D	Flexiable pavement repair		Km	30.890	18000		5,56,020
6 E	Repairs of Drain		Km	15.607	10000		1,56,070
7 A	Sign boards	Sign boards	Nos				-
7 B	Painting on Fixtures	5 th km	Nos	1	238	5%	143
		Km		2	80	5%	192
		Hect m stone	Nos	10	21	5%	212
		Conc. crash barrier	Sqm	62	76	5%	4,720
		Railing	Rm	20	86	5%	1,720
		Guard Post	Nos	91	41	5%	3,727

Sl. no.	Activities		Unit	Project Qty. For 12 months	Weight-age Assigned	Rates	Total Amount
		Kerb stone	Sqm	446	86	2%	38,356
7 C		Road Marking	Rm	21869	663	20%	28,99,768
8	High Mast repair	Truck lay bye ,junction &Toll plaza	Nos	7	25000		1,75,000
	Highway lamps under the underpasses-		Nos	7	3000		19,800
	Highway light- Single arm pole		Nos	2	11000		26,400
	Highway light- Double arm pole		Nos	1	13000		10,400
9A	Replacement of km stone		Nos	0.5	4800	1%	2,304
9B	Replacement of hectometer stone		Nos	4	685	2%	2,767
10 A	Replacement of dead plant	Median	Nos	1,884	570	15%	10,73,795
10 B		Avenue	Nos	1,745	570	15%	9,94,365
11	Repair to the Major structure		LS/no/ month	24	3000		8,64,000
12	Repair to Minor structure		LS/no/ month	83	500		4,98,000
13	Repair of Earthen shoulders		Cum	697	414	10%	2,88,684
		TOTAL (in Cr.)					**1.09**

Table 6.4B: Yearly Routine maintenance and Cleaning Costs

Sl. No	Description	Unit	Quantity	Rates	Amount	Remarks
1	Routine and Preventive maintenance	Km	30.89	365606	11293574	as calculated in Table 6.4A
i	Repairs of distresses on flexible pavement on appoachesand slip road, service road flushing by fine aggregates during monsoon, resurfacing hungry areas by MSS					
ii	Repair of joint seals, concrete spall and edge breaking, Sealing of minor cracks withepoxy in concrete pavement					
iii	Removal and readjustment of footpath tiles to remove rut and ravel, replacement ofdamaged tiles					
iv	Repair of median, kerbs, footpath, Sign Boards, Road Markings etc					
v	Epoxy grouting in cracks in concrete in structure and epoxy coating/ painting on damaged concrete portions, cementplaster and /or repair with cement mortar					
vi	Replacement of seals of expansion joints					
vii	Replacement of damaged /stolen sign boards, fixtures such as cats eyes, delineators					
viii	Replacement of damaged electric poles / consumables/high mast lamps/street light					
ix	Landscaping: Grass cutting &prunning of shrubs &trees, Watering, Applying manure, pesticide					
2	Cleaning of road and other assets, removal of vegetation, cleaning of drains, etc.	Km	30.89	218500	6749465	as per current contract
i	Cleaning of Main Carriageway:					
ii	Cleaning of Project facilities:					
iii	Cleaning of service road, Junctions, Median Openings etc					
iv	Cleaning of Structures					
v	Cleaning of ROW					
vi	Lined Drain Maintenance					
vii	RCC Drain Maintenance					
viii	Transverse Drain Maintenance					
ix	Maintenance of the Tollplaza					

Sl. No	Description	Unit	Quantity	Rates	Amount	Remarks
x	Median planation maintenance					
3	Potable Drinking Water Maintenance	LS			779700	as per current contract
4	Electrical Maintenance	Km	30.89		669300	
	Total				19492039	
	Add 10 % for unforeseen and contingencies charges				1949204	
	Total including GST @12 % at the rate of 2022-23 (in Cr.)				**2.40**	

6.2.2.2 OPERATIONAL EXPENSES

These generally include the staff salaries, consumables, security expenses, electricity, Incidence Management charges, etc. These costs have been assessed by us in accordance with other projects of similar nature and standard industry practice. These costs are brought out in **Table 6.5** below.

Table 6.5: Costs for Operational Expenses

Sl. no	Description	Amount (in Lakh)	
		Monthly	Annually
1	Staff salaries and Other expenses	7.55	90.60
2	Consumables (Like diesel for DG operations, HSD for vehicles, stationary, printers, cartridge, etc)	2.00	24.00
3	Electricity charges	1.00	12.00
4	Incidence management expenses (Ambulance, Crane and patroling vehicle)	6.00	72.00
5	Professional consultancy charges for IE		35.00
6	Professional consultancy charges for carrying out BBD, Roughness Index test, etc.		42.00
7	House keeping and other misc. charges	2.00	24.00
8	Administration charge		5.00
9	Additional insurance charges for the project road		75.00
	Total (in Cr.)		**3.80**

NOTE: As Nirmal BOT is an Anunity based project hence the operational expenses for the Toll Plaza are not part of the liability of the Concessionaire.

6.3 CONCLUSIONS ON O&M REQUIREMENTS

The O&M Cost Projections have been worked out on the basis of the condition assessment of the Project Road taking into account the Routine/Preventive maintenance Strategy and the assessement that there does not appear to be any major maintenance requirements for the structures during the concession period.

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