RESOTECH
CONSULTANCY SERVICES PVT. LTD.
CIN - U74140MP2008PTC020576

RESOTECH CONSULTANCY SERVICES PVT. LTD.
58, Shri Mangal Nagar, Near Elite Anmol Multi, Bicholi Hapsi Road,
Indore 452 018 (M.P.) Telefax : 0731-4006024. e-mail : contact@resotechindia.com
Website: www.resotechindia.com GSTIN:23AADCR9601G1ZL

RCSPL/VIIMPL/TDD/D-B/21-22/438 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 Dewas – Bhopal Road section of SH-18 in the State of Madhya Pradesh.

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

DEWAS BHOPAL CORRIDOR PVT. LTD.

4-LANE BHOPAL TO DEWAS ROAD SECTION OF SH-18 IN THE STATE OF MADHYA PRADESH

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.
58, Shri Mangal Nagar, Near Elite Anmol Society, Bicholi Hapsi Road,
Indore (M.P.) -452018,Phone: 0731-4006024
Email:contact@resotechindia.com
Website: -www.resotechindia.com

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

E 01: THE PROJECT ROAD

The Project Road is a Section of MP SH-18 which starts from Km 6/8 (from Lalghati Square at Bhopal) to Km 151/6 at junction with NH-3 in Dewas town. The Project Road bypasses the major towns of Sehore, Ashta, Mehatwada and Sonkatchh and has a length of **140.79km**. This Project for strengthening, up-gradation and 4 laning of Bhopal Dewas Section was awarded to ***M/s Dewas Bhopal Corridor Pvt Ltd*** for a Concession Period of 25 years on BOT basis. The Concessionaire had appointed ***M/s MSK Projects (India) Ltd*** & ***M/s Chetak Enterprises Pvt Ltd*** as their EPC Contractors for execution of work under EPC mode. The Concession Agreement was signed on 30th June 2007 and the Project construction commenced on 20th March 2008 and Commercial Operation was started in three different dates for three different sections (Section 1 on 10.02.2009, Section 2 on 17.09.2009 and Section 3 on 30.04.2010). On 22nd December 2015, ***M/s India Infrastructure Fund 2 (IIF-2)*** acquired control of 74% stakes of ***M/s Dewas Bhopal Corridor Pvt Lt*** and balance 26% was acquired on 14th December 2018.Further, on 17thDecember 2021, ***Galaxy Investments II Pte. Ltd*** has acquired control of 100% stakes of ***M/s Dewas Bhopal Corridor Pvt. Ltd.*** from ***M/s IIF-2***.

E02: 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 purpose. 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 Concession Agreement and O&M manual, etc
iii) Evaluation of overall condition of the pavement, structures and other road assets by visual observation 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.

E 03: SALIENT DETAILS OF THE PROJECT ROAD

Table E.01: Salient Details of the Project Road

S. No	Parameter	Description
1	Roadway	4 laned divided Carriageway with raised median/depressed median – 7.0m carriageway plus 2.5m hard shoulder on outer side and 1.0m earthen shoulder on median side in case of depressed medians
2	ROW	Varying from 30m to 60m
3	Pavement Type	Flexible, Rigid (in Toll Plaza area)
4	Bypasses	Sehore (16.35km), Sonda (1.37km), Ashta (4.3km), Dodi (0.9km), Mehatwada (1.6km), Semli (0.6km), Sonkatchh (3.5km), Arniya (0.8km)
5	Service Road/Slip Road (4/5/5.5m)	Total length of 9.090 km
6	Toll Plaza	Fanda (Km 25+000), Amlaha (Km 61+550), Bhourasa (Km 134+600) (4+4 Lanes)

S. No	Parameter	Description
7	Major Junctions	19
8	Minor Junctions	70
9	Bus Bays	3 / 35
10	Truck Laybyes	01 (92+000)
11	VUP	01 (94+330 at Dodi)
12	PUP	01 (67+250 at Kothri)
13	Major Bridges	04 (53+300, 77+850, 121+120, 128+510)
14	Minor Bridges	17
15	Culverts	162 (109 HPC, 53 SC)

E04: MAJOR FINDINGS AND CONCLUSIONS

i) The Project Road has been constructed in accordance with the requirements of the Concession Agreement with MPRDC and it conforms to 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 been carrying out its O&M liabilities in accordance with the requirements of the Concession Agreement.

iii) The Conditions of various assets of the Project Road are in good condition. The Major Maintenance work on the road is presently been carried out 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 and 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 as per Concession Agreement.

v) O & M Cost Projection

Table E.02: Operation& Maintenance Cost Projections

S.No	Year	Periodic Maintenance Costs (in Cr.)	Routine Operations and Maintenance Cost (in Cr.)
1	2022-23		17.87
2	2023-24		17.87
3	2024-25		17.87
4	2025-26		17.87
5	2026-27	35.41	17.53
6	2027-28	37.88	17.53
7	2028-29		17.87
8	2029-30		17.87

S.No	Year	Periodic Maintenance Costs (in Cr.)	Routine Operations and Maintenance Cost (in Cr.)
9	2030-31		17.87
10	2031-32		17.87
11	2032-33	48.06	17.53
12	2033-34	22.97	11.68
		144.31	**225.08**

Note: Rates of MPPWD 2017 SOR have been adopted and the costs are based on 2022-23 base rates.

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MAIN REPORT

Strengthening, Up-gradation and 4 Laning of Bhopal Dewas Section (Km 6/8 to Km 151/6) of SH-18 in the State Madhya Pradesh on Build, Operate and Transfer (BOT) Basis

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
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

Abbreviations	Meaning
DLC	Dry Lean Concrete
DLP	Defect Liability Period
D/s	Downstream
Dwg	Drawing
ECW	Existing Carriageway
Emb	Embankment
EPC	Engineering Procurement Construction
Etc.	Etcetera
ETC	Electronic Toll Collection
Fe415, Fe500	Grade of Steel
Fig.	Figure
FME	Force Majeure Event
FWD	Falling Weight Deflectometer
GOI	Government of India
GOMP	Government of Madhya Pradesh
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
IRC	Indian Road Congress
Jn.	Junction
Kg	Kilogram
Km	Kilometer
Km/h	Kilometer per hour
kVA	Kilo Volt Ampere
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

Abbreviations	Meaning
Max	Maximum
MBCB	Metal Beam Crash Barrier
MCW	Main Carriageway
MDR	Major District Road
Min	Minimum
MoRTH	Ministry of Road Transport & Highways
MP	Mega Pixel
MPRDC	Madhya Pradesh Road Development Corp.
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
NJ CB	New Jersey Crash Barrier
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
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
Rs.	Rupees
SBC	Safe Bearing Capacity
SC	Slab Culvert
Sch.	Schedule

Abbreviations	Meaning
SG	Subgrade
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
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
WIM	Weigh in Motion
WMM	Wet Mix Macadam
WPI	Wholesale Price Index
&	and

CHAPTER 1.0: INTRODUCTION

1.1 BACKGROUND

Madhya Pradesh Road Development Corporation Ltd (MPRDC) has got developed the Bhopal to Dewas Section (Km 6/8 to Km 151/6) of SH-18 in the State of Madhya Pradesh into a 4-lane dual carriageway facility. This Project ***"Reconstruction, Strengthening, Widening & Rehabilitation of Bhopal-Dewas Section including existing bypasses of Bhopal and Dewas from Km 6/8 (from Lalghati Square at Bhopal) to Km 151/6 (Dewas Bypass Junction) on SH-18 to 4-lane Section in the State of Madhya Pradesh on Build, Operate and Transfer (BOT) Basis"*** was awarded to ***M/s Dewas Bhopal Corridor Pvt Ltd*** for a Concession Period of 25 years. The Concession Agreement was signed on 30th June 2007. The Project Commencement Date was recorded as 20th March 2008 and Provisional Completion Certificate was issued in three different dates for three different sections (Section 1 on 10.02.2009, Section 2 on 17.09.2009 and Section 3 on 30.04.2010). The Project is presently under Operation & Maintenance Stage.

1.2 PROJECT ROAD LOCATION

As per the Concession Agreement, the start and end points of Project Road were Km 6/8 (Lalghati Square) and Km 151/6 (Dewas Bypass Junction). However, the start and end points were subsequently revised by a COS Order to Ch 10+000 and junction with NH-3 in Dewas Town (Ch 150+790). Thus Project Road is the Section of MP State Highway -18 starting at Km 10/10 (Ch 10+000) after Bairagarh town near Bhopal (N23°16'11", E77°19'42") and ends at the junction with NH-3 in Dewas town (Ch 150+790) (N22°58'05", E73°03'50") of SH-18. The Length of Project Road is **140.790km**. For Report purpose we have used chainage as per Concession Agreement i.e., Km 6/8 to Km 151/6.

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	Strengthening, up-gradation and Four Laning of Bhopal – Dewas Section of SH-18 in the State of Madhya Pradesh on BOT Basis		
2	State	Madhya Pradesh		
3	SH	SH-18		
4	Section 1	Ch 10.000 to Ch 41.600	Bairagarh to end of Sehore Bypass	31.60 Km
	Section 2	Ch 41.600 to Ch 81.600	End of Sehore Bypass to end of Ashta Bypass	40.00 Km
	Section 3	Ch 81.600 to Ch 150.790	End of Ashta Bypass to junction with NH-3 in Dewas	69.19 Km
5	Total Length of the Project	140.79 km		
B.	**Contract Details**			
1	Authority	Madhya Pradesh Road Development Corporation (MPRDC)		
2	Concessionaire	Dewas Bhopal Corridor Pvt Ltd (DBCPL)		
3	Independent Consultant (during Construction)	M/s SAI Consulting Engineers Pvt Ltd		
4	Independent Consultant (Current)	Yongma Engg. Co Ltd in association with V-PRA Infra Pvt Ltd		
5	Date of Award (LOA)	16thMarch, 2007		
6	Date of signing of Concession Agreement	30th June, 2007		
7	Commencement Date	20th March, 2008		
8	Concession Period	25 years from Commencement Date (including 2.5 years construction period)		
9	Scheduled COD	20th September, 2010		
10	Provisional Completion Date	Section 1	Section 2	Section 3
		10th February 2009	17th September 2009	30th April 2010
11	Final Completion Date	Section 1	Section 2	Section 3
		27th June 2009	15th December 2009	12th August 2010
12	End of Concession Period (Original)	19th March, 2033		
13	Extended Concession End Date	01st December, 2033		

S. No	Parameter	Description
C.	**Project Details**	
1	Roadway	4 laned divided Carriageway with raised median / depressed median –7.0m carriageway plus 2.5m hard shoulder on outer side and 1.0m earthen shoulder on median side in case of depressed medians
2	ROW	Varying from 30m to 60m
3	Pavement Type	Flexible, Rigid (in Toll Plaza area)
4	Bypasses/Realignments	Sehore (16.35km), Sonda (1.37km), Ashta (4.3km), Dodi (0.9km), Mehatwada (1.6km), Semli (0.6km), Sonkatchh (3.5km), Arniya (0.8km)
5	Built-up areas	Total Length of 21.190 km
6	Service Road (4/5/5.5m)	Total length of 9.090 km
7	Toll Plaza	Fanda (Km 25+000), Amlaha (Km 61+550), Bhourasa (Km 134+600) (4+4 Lanes)
8	Major Junctions	19
9	Minor Junctions	70
10	Bus Bays / Bus Shelters	3 / 35
11	Truck Lay-byes	01 (92+000)
12	Rest Areas	Nil
13	VUP	01 (94+330 at Dodi)
14	PUP	01 (67+250 at Kothri)
15	Major Bridges	04 (53+300, 77+850, 121+120, 128+510)
16	Minor Bridges	17
17	Culverts	162 (109 HPC, 53 SC)

*As per the Concession Agreement, the Project Road is a Section of MP State Highway-18. But the Highway has been re-numbered to SH-28 vide a Gazette Notification dated 15th Sept 2017. We have kept SH-18 in the report as per Concession Agreement

1.4 SCOPE OF WORK FOR THE STUDY

The Scope of Work for the Technical Due Diligence is mentioned as under:

1.4.1 General

a. Review of all documents related to Project including but not limited to Concession Agreement, 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 Concession Agreement or O&M Manual and IC Inspection Reports, etc.

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

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

f. In general review the Toll Plaza systems (incl. TMS, HTMS, AVCC, weigh bridge, sensors, ETC, etc.) and the hardware installed therein and comment on the adequacy and level of maintenance of the same to meet the requirements under Concession Agreement.

g. Review of as-built drawings and Design Reports (including stage construction, if any).

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

i. Review the Major Maintenance work undertaken if any, and prepare projections for future Major Maintenance expenses (incl. any hand-back requirements), so as to ensure compliance with the terms of Concession Agreement.

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

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

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

m. Review of O&M Contracts

1.4.2 Assessment of Asset Condition

a. Assessment of road assets in conformance with specifications, standards and codes stipulated in Concession Agreement and O&M Manual, etc.

b. A detailed inventory survey of road assets including main carriageway, structures, service roads, lightings, drains, slope protection works, retaining walls, bus bays, bus shelters, truck lay byes, O&M center, road furniture including signages, MBCB, guard rails, etc., other safety measures, 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. Review the BBD test report provided by the Concessionaire to ascertain the adequacy of the pavement structure for expected traffic loads, pavement life evaluation.

e. Review the Roughness test report provided by the Concessionaire

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

g. 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.

h. Comment on the pavement crust composition (Design vs. Actual) for PQC/BT at Toll Plaza, BC, DBM, overlay and non-bituminous layer, etc.

1.4.4 O&M Assessment

a. Develop a detailed O&M cost forecast for each year of the Concession Period and a detailed Major Maintenance Cost forecast along with estimation of costs towards handover requirements.

CHAPTER 2.0: REVIEW OF DOCUMENTS

2.1 REVIEW OF CONCESSION AGREEMENT

Madhya Pradesh Road Development Corporation (MPRDC)has entered into a Concession Agreement on 30th June 2007 with ***Dewas Bhopal Corridor Private Limited,*** a Special Purpose Vehicle (SPV) formed for implementing this project, a company incorporated under Indian Companies Act, 1956 for "***Reconstruction, Strengthening, Widening & Rehabilitation of Bhopal-Dewas Section including existing bypasses of Bhopal and Dewas from Km 6/8 (from Lalghati square at Bhopal) to Km 151/6 (Dewas Bypass Junction) on SH-18 to 4-lane Section in the State of Madhya Pradesh on Build, Operate and Transfer (BOT) Basis***".

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

2.1.1 SPECIFIC COMMENTS ON ARTICLES OF CONCESSION AGREEMENT

The Project has been completed and is presently under the Operation & Maintenance Period. We have reviewed the major provisions of the Concession Agreement and our specific comments on the same are indicated below clause-wise.

Table 2.1: Comments on Concession Agreement

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
Chapter II, Clause 2.1.3	Scope of Project	Operation and Maintenance of the Project Highway in accordance with the provisions of this Agreement (Schedule-M)	Since all the phases of work have been completed and COD has been issued, the work is presently in O&M stage.
Chapter III, Clause 3.1, Chapter I, Point 20	Grant of Concession, Concession Period	MPRDC hereby grants to the Concessionaire the Concession set forth therein including the exclusive right, licence and authority during the subsistence of this Agreement to construct, operate and maintain the Project Highway for the Concession Period as defined in definition 20 of this Agreement and the Concessionaire hereby accepts the Concession and agrees to implement the Project in accordance with the Terms and Conditions set forth herein. Concession Period as defined under S. No. 20,	The Commencement Date is 20th March 2008; thereby the Concession Period shall end on 19th March 2033. The Concession Period is extended upto 01st December 2033 on account of works under COS Orders and Force Majeure Events.

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
		Chapter 1 of the Concession Agreement, is "The period beginning from Commencement Date and ending at the end of 25 years or any valid extension granted thereof by MPRDC or the Termination Date, whichever is earlier."	
Chapter III, Clause 3.2.3	Liability during Tolling Period	The Concession hereby granted shall entitle the Concessionaire to, upon completion of Project Highway and during the toll period to manage, operate & maintain the Project Highway and so as to allow the use of road appropriately for toll collection and to regulate the use such that no traffic/persons use the highway in a manner detrimental to the road condition.	Concessionaire's liability is operation and maintenance of the road and also to regulate the traffic/persons for proper use of road.
Chapter VI, Clause 6.1	Fees	The Concessionaire shall be entitled during the toll period to levy, collect and appropriate the Fees from the users of the Project Highway pursuant to and in accordance with the Fee Notification set forth in Schedule-C of this Agreement.	Collection of user fees is covered under this clause.
Chapter VI, Clause 6.2	Revision of Fees	The Concessionaire acknowledges that the Fee Notification, inter alia, provides for revision in the Fees by increase in the fees of, @ 7% per year based on the fees charged in the previous accounting year, as per the Fee Notifications, and hereby confirms that save and except as provided in the Fee Notification, the Concessionaire is not entitled to and shall not seek any relief whatsoever from MPRDC, GOI or GOMP on account of increase or otherwise in WPI or on any other account except in accordance with the express provisions of this Agreement.	Revision of fee at fixed rate of 7% per year irrespective of increase of WPI has been specified.
Chapter VI, Clauses 6.3, 6.3.1, 6.3.2	Fees from Local Personal and Commercial Traffic	6.3 The Concessionaire shall collect fees from local personal traffic and local commercial traffic after reducing the fees by the following rates: 6.3.1 For Local Personal Traffic: 75% of the applicable fees for the specific category of vehicle. 6.3.2 For Local Commercial Traffic: 50% of the applicable fees for the specific category of vehicle.	Local Personal and Commercial Traffic means traffic travelling a distance of 10km on either or both sides of Toll Plaza. Discount is available in the issue of monthly pass to such traffic.

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
			Note: In most other projects, a monthly local pass at a fixed fee is issued to Local Personal vehicle residing within a radius of 10km from Toll Plaza.
Chapter VI, Clause 6.10.3	Project Monitoring Fee	The Concessionaire shall pay to MPRDC till end of Concession Period or the termination of this Agreement, an amount equivalent to 1% of annual toll collected as a Project Monitoring Fee for the first 10 years from commencement date and thereafter the amount will increase to 2% from start of 11th year to end of 15th year and to 3% from the 16th year till the end of Concession Period.	As informed by the Concessionaire, this Project Monitoring Fees is being regularly paid to MPRDC.
Chapter VI, Clause 6.11.1	Additional Check posts	Notwithstanding anything to the contrary contained in this Agreement, if any bye-pass/road is built which results in loss of toll fees and leakage of revenue the Concessionaire may be allowed to shift the toll plazas and construct new check posts to minimise such leakage of revenue.	Till the present date, there is no such additional check-post under construction or under operation. There is also no proposal for construction of any additional toll way at this stage.
Chapter XIII, Clause 13.2	Toll Date	Toll date of the Project shall be the date on which MPRDC has issued the Completion Certificate or the Provisional Certificate as the case may be for any or all sections of the Project Highway under this Agreement and the Concessionaire shall not levy or collect any fee until it has received such Completion Certificate or Provisional Certificate.	The Project Road has been divided into three homogeneous sections and accordingly Provisional Completion Certificates and Completion Certificates were issued as under: (a) 1st section: (31.6km) PCOD on 10.03.09, COD on 27.06.09 (b) 2nd section: (40.0km) PCOD on 17.09.09, COD on 15.12.09

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
			(c) 3rdsection: (69.19km) PCOD on 30.04.10, COD on 12.08.10. **Note:** The Project completion is achieved before the SCOD (20.09.10)
Chapter XV, Clause 15.1	Change of Scope	MPRDC may, require provision of such additional works and services on or about the Project Highway which are beyond the Scope of Project (Schedule-I) as contemplated by this Agreement (Change of Scope), to be carried out by the Concessionaire at his own cost during the Concession Period and that there shall be no change in Concession Period or any compensation payable if such changes do not require expenditure exceeding Rs. 2.14 Crores (0.5% of the Project Cost) (Rs. 2.14 Crores) and do not adversely affect the Toll Date.	This implies that if the expenditure exceeds the amount of Rs. 2.14 Crores due to COS work items, then accordingly there shall be a change in Concession Period.
Chapter XV, Clause 15.5	Ceiling of COS expenditure	Change of Scope after the Project completion shall be limited to 20% of the Total Project Cost (based on the Schedule of Rates given in the Detailed Project Report).	The Total Project Cost is Rs. 426.64 Cr excluding IDC and escalation, so the upper ceiling of expenditure on account of COS is Rs. 85.33 Cr. **Note:** The COS Order from MPRDC till date amounts to Rs. 28.85 Cr
Chapter XV, Clause 15.9	Computation of extension / reduction in Concession Period	The calculation for computing the extension or reduction in Concession Period on account of increase / decrease in scope of work beyond Rs. 2.14 Crores will be done on the basis of following formula: Mathematically the steps would be as follows: 1.A = Average daily toll in the first 6 months 2. B = A x (1+annual traffic growth)x(1.07)toll period in year 3. C = B/(1+discount rate) year between expenses and end of toll period	The mathematical formula for estimating the increase / decrease of the Concession Period on account of COS is clearly mentioned. **Note:** However, this mathematical formula has been unilaterally changed by MPRDC

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
		4. D = Cost of change of scope / C D is the number of days to be added to the toll period, rounded to the nearest whole day. It is proposed that traffic growth will be estimated at actual traffic growth or 4% per annum whichever is higher. For computation of traffic growth, the average annual traffic growth for a period of at least 2 years or actual whichever is higher will be taken.	later. The same has been accepted vide Supplementary Agreement dated 26.11.2021 by the Concessionaire.
Chapter XVI, Clauses 16.1 to 16.10	Operation and Maintenance liability	16.1 The Concessionaire shall operate and maintain the Project Highway by itself, or through O&M Contractors and if required modify, repair or otherwise make improvements to the Project Highway to comply with Specifications and Standards, and other requirements set forth in this Agreement, Good Industry Practice, applicable Laws and Applicable Permits and manufacturer's guidelines and instructions with respect to toll systems.	It is the liability of the Concessionaire to operate & maintain the Project Highway and even to make improvements to comply with Specifications and Standards and Good Industry Practice.
Chapter XVI, Clause 16.2	Maintenance Manual	The Concessionaire shall in consultation with the Independent Consultant prepare not later than 180 days before the Scheduled Project Completion Date, the repair and maintenance manual which shall be based on the O&M specification laid down in Schedule-M annexed hereto this Agreement for regular and periodic maintenance and shall ensure and procure that at all times, during the Toll Period, the Project Highway is maintained in a manner that it complies with the specifications and standards and the minimum maintenance requirements as provided in this agreement and schedules thereof and as approved by MPRDC.	The O&M Manual has been prepared and submitted on 28.06.2011.

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
Chapter XVI, Clause 16.3, 16.3.1 to 16.3.6	Maintenance Programme	Not later than forty five (45) days before the beginning of each Accounting Year, the Concessionaire, shall in consultation with the Independent Consultant prepare and provide to MPRDC, its proposed programme of preventive and other scheduled maintenance of the Project Highway subject to the minimum maintenance requirements set forth in Maintenance Manual as approved by MPRDC necessary to maintain the Project Highway at all times in conformity with the Specifications and Standards (the "Maintenance Programme").	The items to be included in Maintenance Programme including safety standards are specified.
Chapter XVI, Clause 16.4	Additional items under Maintenance	Maintenance shall include replacement of equipment/consumables, horticulture maintenance and upkeep of all Project Assets in good order and working condition. Maintenance shall not include the extension of any existing pavements, bridge, structures and other civil works unless part of the Project.	Concessionaire's maintenance liability does not include extension of any existing pavements, bridge, structures and other civil works that are not part of the Project.
Chapter XVI, Clause 16.7	Maintenance of Approach roads	The Concessionaire shall be responsible for the maintenance of the approach roads to and underpasses and overpasses up to 50 meters from the Project Highway in accordance with Good Industry Practice.	Concessionaire is bound by Agreement to maintain these.
Chapter XVI, Clause 16.12	Maintenance Fund	The Concessionaire shall for due and faithful performance of its Obligations during the Toll Period and to cover the cost of repairs and maintenance of the Project Highway shall maintain a "Maintenance Fund" in a separate designated account (in the form of Fixed Deposit with the Bank) in the bank with the lien of MPRDC recorded with the Bank and to be operated by MPRDC.	As informed by the Concessionaire, a separate Maintenance Fund is being maintained.
Chapter XVII, Clause 17.2	O&M Inspection Report	The IC shall review the Maintenance Report and inspect the Project Highway at least once a fortnight during the Toll Period and make out an Inspection Report of such inspection (the "O&M Inspection Report"). IC shall send a copy of its	MPRDC has recently appointed Independent Consultant for the O&M stage and the IC is monitoring the O&M

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
		O&M Inspection Report to MPRDC. The Concessionaire shall within 30 days of the receipt of the O&M Inspection Report from MPRDC remedy the defects and deficiencies, if any, set forth in such O&M Inspection Report and submit its report in respect thereof to MPRDC within the said 30 days period. Where the remedying of such defects or deficiencies is likely to take more than 30 days in accordance with Good Industry Practice, the Concessionaire shall undertake the works in accordance with such practice and submit progress reports of such works every fortnight.	works done by the Concessionaire.
Chapter XVIII, Clause 18.1	Safety, vehicle breakdown and Accident	The Concessionaire shall comply with the provisions of this agreement, applicable laws and applicable permits and conform to Good Industry Practice for securing the safety of the users. In particular, the Concessionaire shall develop, implement and administer a surveillance and safety programme for providing a safe environment on or about the Project Highway, and shall comply with the safety requirements set forth in Schedule – L (the "Safety Requirement")	Concessionaire is bound by Agreement to comply with the Safety requirements.
Chapter XIX, Clause 19.5	Cost of supervising Authority	During the Toll Period, the cost of supervising Authority to be borne by the Concessionaire shall be equal to Rs. 15,000.00 per Crore of the Total Project Cost per year (duly increased every three years by increase in WPI). The said cost for a block of three years shall be payable by the Concessionaire in 6 equal instalments (first instalment to be paid on toll date and balance 5 instalments every 6 months thereafter)	This Clause has been modified as per Pre-bid replies. It shall be 0.15% of Total Project Cost.
Chapter XXIII, Clause 23.1	Revenue Shortfall Loan	If the Realisable Fees in any Accounting Year during the Concession Period shall fall below the subsistence revenue level, MPRDC agrees to allow the Concessionaire to avail accommodation for such shortfall, by way of a loan ("Revenue Shortfall Loan") from any Bank. Any balance of Maintenance Fund of the Concessionaire or any sums received or likely to be received by the	MPRDC is bound by the Agreement to allow Concessionaire to avail this facility if the Realisable Fees in any Accounting Year falls below the Subsistence Revenue Level.

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
		Concessionaire through insurance claims (except insurance payments for physical loss used to carry out requisite repairs) or payments by MPRDC under Clause 28 shall first be deducted and only the balance amount remaining shall be availed as the Revenue Shortfall Loan.	**Note:** The Concessionaire has not opted for Revenue Shortfall Loan.
Chapter XXIII, Clause 23.6	Compensation for loss of revenue	If any sum remains due or outstanding from the Concessionaire under this Clause 23 at any time during a period of one year preceding the Termination Date, MPRDC shall allow the increase in the Concession Period only in the event of such loans being taken to cover the shortfall in Subsistence Revenue Level, proportionately and to the extent approved by MPRDC, to allow the Concessionaire to be compensated for the loss of Revenue and to be able to repay such Revenue Shortfall Loan. In any case, such extended period shall not exceed 3 years. The extension of Concession Period upto 3 years may be considered with prior approval of MPRDC.	Concession Period/Toll Period can be extended.
Chapter XXVI, Clause 26.2	Insurance during Toll Period	Insurance during the Toll Period: Not later than 4 months prior to the anticipated Completion of the Project Highway, the Concessionaire shall obtain and maintain at no cost to MPRDC during the Toll Period in respect of the Project Highway and its operations such insurance as may be required under any of the Financing Documents, Applicable Laws and such insurance as the Concessionaire may insure such risks and such costs as is considered necessary by MPRDC in accordance with Good Industry Practice. Provided, however, the amount and risks covered as well as the level of insurance to be maintained after satisfaction of Lenders dues in full, shall be determined on the same principles as applicable for determining the level of Insurance prior to such date. This level shall be agreed with MPRDC with 90 days of date of this Agreement. The Concessionaire shall also include insurance of all	The Concessionaire has to keep all assets of the Project Highway insured at all times during the entire Concession Period. **Note:** The Concessionaire has obtained the required insurance.

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
		insurable FME as defined in Clause28.	
Chapter XXVII, Clause 28.5.3	Force Majeure Event	Where a Force Majeure Event occurs after Toll Date, the Concessionaire shall continue to make all reasonable efforts to collect Fees, but if he is unable to collect Fees during the subsistence of such Force Majeure Event, the Concession Period shall be extended by the period for which collection of fees remains suspended on account thereof.	There were 02 Force Majeure Events (FME), demonetization and Covid-19. Concession Period is already extended by MPRDC on account of both these FME by 62.5 days. (22.5 days for Demonetization – Order dated 19.06.17 & 40 days for Covid-19 – Order dated 22.09.20)
Chapter XXX, Clause 30.1.1& 30.1.6	Defects Liability (Initial Inspection& Second Inspection)	Not less than 12 months or more than 15 months prior to the expiry of the Concession Period, the Concessionaire and the IC shall conduct a joint inspection (the "Initial Inspection") of the Project Highway and all Project Facilities. Not less than 9 months nor more than 12 months prior to the expiry of the Concession Period, the Concessionaire and the IC shall conduct a joint inspection (the "Second Inspection") of all elements of the Project Highway and Project Facilities (whether or not the Renewal Works have been carried out).	Preventive maintenance may be required to be carried out to avoid major expenditure on this account.
Chapter XXX, Clause 30.2.4	Vesting Certificate	Upon the Concessionaire conforming to all Divestment Requirements and handing over actual or constructive possession of the Project Highway to MPRDC or a person nominated by MPRDC in this regard, MPRDC shall issue a Certificate substantially in the form set forth in Schedule-T (The Vesting Certificate) within 3 months of Concessionaire confirming to all divestment requirement and handing over actual or constructive possession of the Project Highway to MPRDC.	The divestment of all rights, title and lien in the Project Highway shall be deemed to be complete on the date of issue of Vesting Certificate.
Schedule-I, Clause 12.1	Location of Toll Plaza	Homogeneous sections and location of toll plaza For the purpose of tolling the project has been divided into three homogeneous sections as	Although there was some change in the start and end point

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
		under: I Lalghati Square to end of Sehore bypass – 35.80Km Location of Toll Plaza: Start of Sehore bypass II End offshore by pass – End of Ashta bypass – 40.00 Km Location of toll plaza in between Km60-65 III End of Ashta Bypass to Start of Dewas bypass-66.80 Km Location of toll plaza in between km 136-140	through a COS Order, the locations of Toll Plazas remained as per Schedule as under: Fanda (Design Ch.25+000), Amlaha (Design Ch. 61+550), Bhourasa (Design Ch. 134+600)
Schedule-L, Clause 5.2	Highway Safety Management Unit	The Concessionaire shall establish a Highway Safety Management Unit (the "HSMU") to be functional on and after the toll date, and designate one of its officers to be in charge of the HSMU. Such officer shall have specialist knowledge and training in road safety and traffic engineering by having attended a course conducted by a reputed organisation on the subject.	Concessionaire is bound by Agreement to fulfil this. **Note:** As informed by Concessionaire, two Patrolling teams are engaged round the clock providing safety on highway and one Corridor Manager is in-charge of the same.
Schedule-L, Clause 5.3& 5.4	Accident record and reporting	The Concessionaire has to collect copy of every FIR recorded by the Police with respect to any accident occurring and also collect data in the form prescribed by IRC/MoRTH for all cases of accidents not recorded by the Police but where a vehicle rolled over or had to be towed away. The aforesaid data shall be submitted to MPRDC at the conclusion of every quarter and to the IC. 5.4 The Concessionaire shall submit to MPRDC before the 31st May of each year, an annual report (in two copies) containing a detailed listing and analysis of all accidents of the proceeding accounting year and the measures taken by the Concessionaire pursuant to the provisions of paragraph 5.1 of this Schedule L for averting or minimizing such accident in future.	Concessionaire is bound by Agreement to maintain an Accident Reporting System which shall comprise of detailed information of accidents and measures taken for minimizing such accidents in future. MPRDC has developed an Accident Response System and Traffic Management Centre website wherein Concessionaires have to upload real-time data related to Accidents & incidents/congestions.

Review of Concession Agreement			
Article & Clause No.	**Subject**	**Information in Brief**	**Remarks**
Schedule-L, Clause 5.5	Safety Audit	Once in every Accounting Year, a Safety Audit shall be carried out by the IC to be nominated by MPRDC. It shall review and analyse the annual report and accident data of the proceeding years, and undertake an inspection of the Project Highway. The IC shall submit a Safety Report recommending specific improvement if any, required to be made to the road bridge, culverts, marking signs, road furniture and Project Facilities including cattle crossing, and pedestrian crossing.	IC has been appointed by MPRDC during the O&M Stage recently. However, no Safety Audit Report of the IC is available till date. Only a Safety Audit Report got conducted by the Concessionaire in the year 2019 was made available to us for review.

Since the Project has been completed and is presently under the Operation Period, we have separately reviewed the provisions of Schedule-M of the Concession Agreement which pertains to the Operation and Maintenance requirements and our observations on some of the important clauses therein have been brought out in **Table 2.2** below.

Table 2.2: Comments on Schedule-M of Concession Agreement

O&M Requirements - Schedule-M of Concession Agreement		
Clause	**Description of Clause**	**Remark**
Clause 1 (c)	The Concession Agreement stipulates that the Project Road shall be constructed, operated and maintained during the Concession Period by Concessionaire and thereafter transferred to MPRDC. This Schedule elaborates the O&M requirements of the Concession and is to be read together with the Concession Agreement for this purpose. For clarification of doubt, the period during which the Concessionaire shall comply with O&M requirements covers the entire Concession Period including the Construction Period. Particularly, during the Construction Period, the Concessionaire is required to Operate and Maintain the existing road as provided in the Concession Agreement and this Schedule.	This clause specifies that the Operation and Maintenance is to be carried out during entire Concession Period including the Construction Period.
Clause 3.1 (c)	Six weeks prior to the anniversary of Commercial Operation Date of Project (COD) each year. The Concessionaire shall submit an annual O&M plan for the next year of operations.	This clause specifies annual submission of O&M plan. The Concessionaire is submitting these to MPRDC.

O&M Requirements - Schedule-M of Concession Agreement		
Clause	**Description of Clause**	**Remark**
Clause 3.1 (e)	The Manual shall include without limitation the following aspects; Organization structure with responsibilities of key personnel, Traffic Management Plan including the Corridor Control Plan, Safety Management Programme including the Emergency Response Protocol, Inspection Procedure, Maintenance Intervention Levels, Asset Management Project Deliverables and Tolerance Criteria, Environment Management Plan, Maintenance Programme, Management Information System, Report Formats	The details to be included in O&M Manual have been specified.
Clause 3.3.5	**Routine Maintenance** In order to ensure smooth and uninterrupted flow of traffic during normal operating condition for all 24 hours of a day, Routine Maintenance of the Project Facilities shall include all elements of the Project Road.	Routine maintenance has to be carried out as per relevant MORTH/IRC Standards and Specifications, as per Appendix J-1 and J-2 of Schedule-J of Concession Agreement.
Clause 3.3.6	**Preventive Maintenance:** (i) The Concessionaire shall regularly carry out the necessary Preventive Maintenance activities for the Project Facilities to ensure adherence to the Design Requirements and specifications throughout the Concession Period. (ii) Preventive Maintenance shall include the activities related to each element and the system as whole of the Project Highway to ensure that during the Concession Period and at its end, the Project Highway is in sound, durable and functional condition.	Preventive Maintenance has to be carried out to ensure adherence to Standards and Specifications throughout the Concession Period to ensure that at the end of the Concession Period, the Project Highway is in sound, durable and functional condition.
Clause 3.3.7	**Periodic Maintenance** This activity shall be carried out as required and at least once in six years from COD and in the last year of Concession Period. Road marking as specified and other road side features shall be restored to meet the relevant standards to the satisfaction of the IC.	This clause specifies the frequency of Periodic Maintenance.
Clause 3.3.9	**Minimum Maintenance Requirement** 3.9.1 Major Breaches in the Roadway Major breaches in the roadway of any type endanger safety of traffic and cause obstruction in movement of vehicles. These breaches shall be repaired urgently.	Time period for attending to major breaches and minor cuts etc. has been specified.

O&M Requirements - Schedule-M of Concession Agreement		
Clause	**Description of Clause**	**Remark**
	Steps as mentioned in O&M Manual shall be followed by the Concessionaire for repairing the breaches; 3.9.2 Minor cuts, ruts or blockage Minor cuts, ruts and damages on Project Road which do not completely obstruct the traffic but endanger the safety of traffic, shall be attended to on an urgent basis.	
Clause 3.4.2.1	During Operations Period, all the road works and pavements contained in the Project Facilities (including those in the ancillary facilities) shall be maintained in traffic worthy condition as per the Intervention Levels 1 (Desirable)& 2 (Acceptable).	The Intervention Levels for performance parameters like Roughness Index, potholes, cracking, rut depth, deflection, etc., have been defined.
Clause 3.4.2.2 & 3.4.2.3	3.4.2.2 The Road Roughness Value shall be measured at least twice in a year before the monsoon and soon after the monsoon preferably in the months of April and October of every year. The Concessionaire shall ensure that at no point during the Operation Period the roughness in the road surface shall fall below than the prescribed acceptable roughness values given in Table M-2. 3.4.2.3 The structural condition of the flexible pavement of the Project Highway shall be assessed every year by taking Benkelman Beam Deflection and working out characteristic deflections of homogeneous sections of the Project Highway.	Frequency (as per Table M-2 of Schedule-M) for carrying out measurement of and the performance criteria for Roughness Value and BBD test has been specified.
Clause 3.4.2.5	**Pavement Riding Quality** The riding quality of the pavement shall be ensured by satisfying the minimum requirements given herein under: (i) Surface roughness of the Project Highway on newly laid surface shall not exceed 2000 mm/km as measured by Vehicle Mounted Bump Integrator (ROMDAS System) (ii)Surface roughness shall not exceed 3000 mm/km and 1000 mm in any 200 m length during the service life of the pavement at any time. A renewal coat of 25mm of bituminous concrete shall be laid after initial construction whenever the roughness value reaches 3000mm/km to bring it to less than 2000mm/km.	Whenever surface roughness exceeds 3000mm/km and 1000 mm in any 200 m length a renewal coat of 25 mm of Bituminous Concrete has to be applied.

O&M Requirements - Schedule-M of Concession Agreement		
Clause	**Description of Clause**	**Remark**
Clause 3.4.2.5	**Structural condition of the Pavement** (i) 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 homogenous sections of the Project Highway as per IRC 81-1997. Wherever the characteristic deflection exceeds 0.8mm, a bituminous overlay shall be provided appropriately designed according to IRC 81-1997 or its latest version of amendments to it. The characteristic deflection at the end of Concession Period shall not exceed 0.5mm. (ii) In case of cement concrete pavement, joints shall be thoroughly inspected every year and the loss of sealing compounds made good.	If the characteristic deflection exceeds 0.8 mm a suitably designed bituminous overlay has to be provided.
Clause 3.4.2.6	If the shoulders are deformed or scoured and are lower than 25mm from the adjacent carriageway, these shall be corrected.	This Clause specifies the limit for shoulder drop from the Main Carriageway edge.
Clause 4.0	Corridor Control Plans: a) Regular 24 hours patrol/surveillance of the ROW in respect of the Project /Project Facilities shall be required to monitor report and take actions against activities, such as enforcement, unauthorised construction of road or entrance connection, structures, interference with drainage system etc. within 150 m of the highway corridor. b) Surveillance shall also include traffic operation and management of accidents/other incidents.	The Corridor Plan shall be developed in consultation with local administrative authorities and shall form part of the O&M Manual.
Clause 5.0	**Inspections & Frequency** 5.1 Visual Inspection : Visual Inspections are broad general inspections carried out frequently by highway/bridge maintenance engineers having adequate knowledge of road structures. The purpose of visual inspection is to report the obstacles to traffic and fairly obvious deficiencies, which could lead to accidents or maintenance problems. 5.2 Close Inspection: Close Inspections may be visual and or by standard instrumental aids for assessment of defects/deficiencies of Project Highway with careful	This clause requires a system to be developed for visual inspections, close inspections and thorough inspections, desired frequencies of inspection for various elements of the Highway. Based on Inspection, preventive maintenance should be carried out. Concessionaire is doing all these inspections and submitting to the Authority

O&M Requirements - Schedule-M of Concession Agreement		
Clause	**Description of Clause**	**Remark**
	observations of specific elements. The close inspection is more intensive and would require detailed examination of element of the project highway against a checklist. 5.3 Thorough Inspection: A Thorough Inspection is comprehensive and detailed for assessment of defects/deficiencies of the project highway by visual inspection or with and of standard equipment and non destructive testing where necessary. The thorough inspection should be undertaken during the critical weather condition which is generally rainy season in India. The inspection carried out during the said period offer to the client critical evaluation of the performance of the structure. 5.4 Frequency of Inspection: The type of inspection and related frequency of various items of Project Highway and its facilities have been indicated. The frequency of inspection can be suitably revised in consultation with the IC if the situation so warrants.	along with Monthly Progress Report (MPR).

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. It is seen that the provisions in the Agreement are spelt out clearly without ambiguities.

2.2 REVIEW OF EPC AGREEMENT

The Project SPV Company (***M/s Dewas Bhopal Corridor Pvt Ltd***) entered into EPC Agreement with two Contractors (***M/s MSK Projects (India) Ltd & M/s Chetak Enterprises Pvt Ltd***) on 2nd April 2008 & 6th December 2008 respectively, for the construction of the facilities and maintenance of all assets. The EPC Agreements with both the Contractors has been done for a fixed price lump sum contract of ***Rs. 248.61 Cr*** each.

Broadly, the EPC Agreement has to be formulated in such a way that the overall requirements and obligations of the SPV as spelt out in the Concession Agreement are taken care of. This Agreement is generally in line with the Concession Agreement and binds the EPC Contractor to the obligations of the SPV under the Concession Agreement.

2.2.1 SPECIFIC COMMENTS ON ARTICLES OF EPC AGREEMENT

We have studied both the EPC Agreements bearing in mind that the Project has been completed and is presently under O&M Stage. The concerned clauses and our comments are listed in the **Table2.3** below.

Table 2.3: Comments on EPC Agreement

Clause No.	Brief Description of Clause	Remarks
Clause 4.1 – Contractor's General Obligations	The Contractor shall design, execute and complete the Works in accordance with the Contract, and shall remedy the any defects in the Works. The Contractor shall be responsible for the adequacy, stability and safety of all site operations, of all methods of construction and of all the Works.	The overall responsibility for construction activities is on the Contractor.
Clause 4.7 – Contractor's Documents	The Contractor shall make available to the Employer, all the Contractor's Documents as may be necessary for review, verification, inspection, carrying out tests, as the case may be. The works shall not be treated complete until the Employer has received all the Contractor's Documents.	The Clause specifies that Work shall not be considered to be completed for the purposes of taking-over until the Employer has received these documents.
Clause 9.1 (b) – Works Completion	The Contractor acknowledges that the Punch List items are to be completed within 120 calendar days of the date of issue of Provisional Certificate. Upon completion of all Punch List items and all further Tests on Completion to the satisfaction of IE, the IE shall issue the Completion Certificate to the Employer.	The issuance of Completion Certificate by the IE shall occur only upon completion of all punch list items appended with Provisional Completion Certificate.
Clause 9.3 – Defects Liability	The Defects Notification Period for the Works is 12 months. The Contractor has to complete any work which is outstanding or required to remedy defects or damage on or before the expiry date of the Defects Notification Period. If a defect appears or damage occurs, the Employer shall notify the Contractor accordingly.	The Defect Notification Period is over. There is presently no obligation of pending of defective works on the Contractor.
Clause 9.9 (a) & (d) – Performance Certificate	Performance of the Contractor's obligations shall not be considered to have been completed until the Employer has issued the Performance Certificate to the Contractor, stating the date on which the Contractor completed his obligations under the Agreement. Only this Performance Certificate shall be deemed to constitute acceptance of Works.	Since the Project construction has been completed long back, it is expected that the said Performance Certificate has been issued to the Contractor.

2.2.2 CONCLUSIONS ON OBSERVATIONS ON EPC AGREEMENT

a) The Agreement with each of the two Contractors has been done for a fixed price lump sum contract of ***Rs. 248.61 Cr.*** This being a lump sum contract; there was no price variation/escalation in the Contract Price. The scope of works in the Agreements for both the Contractors was defined as the full stretch of the Project Road. The stretch-wise detail of the works to be carried out by the two EPC contractors was not made available to us.

b) The provisions of both the EPC Agreements are broadly consistent with the provisions of the Concession Agreement. The obligations of both the Contractors under the EPC Agreement are limited to design, execute and complete the works and remedy any defects therein in conformity with the provisions of the Contract. The Project has been completed and is presently under O&M Stage, thereby indicating clearly that the Contractors have successfully completed their obligations under this Contract.

2.3 REVIEW OF O&M MANUAL

The O&M Manual describes guidelines for implementing the O&M requirements successfully by prescribing the procedures and systems for activities involved in the Concession Period. This objective of this Manual is to ensure the safety of personnel deployed on and users of the Project Facilities and to keep the Project activities from undue deterioration and wear. The Manual is a guide for performance of statutory duties and functions of any party in relation to the Project. Certain forms and procedures have been annexed therein, which facilitate proper supervision and also enable the maintenance works to progress in an orderly and efficient manner.

The broad scope of works as per the Manual is as under:

a) Operations

i) Toll Systems – Functioning of Toll System, Charging and collecting fees from road users. Provision of appropriate equipment for computerized toll collection.

ii) Traffic – Permitting smooth and uninterrupted flow of traffic during normal operating conditions.

iii) Incident Management System – Road patrols and surveillance, wireless facility, road safety works.

iv) Functioning of rescue and medical aid service – Ambulance, Fire Brigade, Tow away trucks and cranes.

v) Functioning of Project Facilities – Administrative, operation and Maintenance Camp, Pickup bus stop, Parking Lay byes, Potable water supply system with supply of drinking water at Truck Lay byes, Public toilets, and Solid waste disposal systems.

b) Maintenance

i) Road Maintenance – This includes routine, periodic and preventive maintenance. Routine would include maintenance of shoulders and slopes, side drains, CD works, carriageway, crust and horticulture maintenance in median and ROW.

ii) Road Property Maintenance – Identification of encroachments and ribbon development. Land Acquisition as desired by MPRDC, enforcement of regulations, Liaison with relevant authorities for above and maintenance of road furniture and road signs.
iii) Engineering Improvements – Junction improvement, providing fencing along road boundary, providing Crash Barriers, Provision of Truck Lay byes and management of access.

2.3.1 ROUTINE MAINTENANCE

As per the Manual immediately after COD, the highway will be subject to Routine Maintenance by the Concessionaire. This Routine Maintenance shall be carried out as and when necessary and as advised by the Authority after joint inspection with Concessionaire. The Routine Maintenance of the Project Facilities includes the following items as described in **Table 2.4** below.

Table 2.4: Routine Maintenance of Project Facilities

S.No.	Description of work item
1	Prompt repair of Toll Plazas, Concrete joints, Drains, Lane marking, Signages, Patching, Raised berms, Repairing of signs, Road marking, repair of pavement cracks by sealing, Barricading, Railing, etc.
2	Replacement of equipments / consumables, Horticultural maintenance, repairs to pavements, elevated highways, overpasses, bridges, structures
3	Preventing any unauthorized entry to and exit from including any encroachments on the ROW / Project site.
4	Keeping the site in a clean, tidy and orderly, condition free of litter and debris
5	Taking all reasonable measures for safety of all workmen, material, supplies and equipment brought to Project site. Explosives, if any, shall be stored, transported and disposed off in accordance with applicable laws.
6	Maintenance of road furniture viz., Km & hectometre stones, ROW pillar
7	All traffic signs and marking shall always be kept clear, visible and in correct alignment and position.

2.3.2 PERIODIC MAINTENANCE

The Periodic Maintenance of the Project Facilities includes the following items as described in **Table 2.5** below.

Table 2.5: Periodic Maintenance of Project Facilities

S.No.	Description of work item
A	**Carriageway**
1	This activity shall be carried out as required and at least one in six years (from COD) and in the last year of Concession Period. Road marking and other road side features shall be restored to meet the relevant standard.
2	Profile corrective course of overlay with the periodic renewal of the wearing course of BC minimum 25mm thickness of the road pavement. The same shall be undertaken on all roads and pavements in Project Facilities including truck lay byes, bus bays and wayside amenities – Service Area.
3	The periodic renewal shall result in improvement of the riding quality, meeting road roughness values as specified at the time of COD.
4	Separator islands shall be restored to design cross section.
5	Road markings as specified and other roadside features wherever required shall be restored to meet the relevant standard specified.
B	**Crash Barriers & Pedestrian Guard Rails**
6	Crash Barriers should require minimum maintenance except in case of damage due to impact.
7	Concrete posts and Steel Beam Crash barriers will require repairs or replacement from low to medium impact damage caused by vehicles. Periodic painting of Crash Barriers, Posts, and Steel Beam Crash Barriers is required.
C	**Major Breaches in the Roadway**
8	Major breaches in the roadway of any type that endanger safety of traffic and cause obstruction in movement of vehicles. These breaches shall be repaired urgently. The Concessionaire shall ensure speedy restoration of traffic which shall be made within 24 hours of the incidence.
D	**Minor cuts, ruts or blockage**
9	Minor cuts, ruts and damages on Project Road which do not completely obstruct the traffic but endanger the safety of traffic, shall be attended to on an urgent basis. For this purpose, any cut which is in width more than 1m shall be repaired within 24 hours.
E	**Periodic Maintenance of Pavement**
10	Surface roughness of the Project Highway on completion of construction shall not exceed 2000mm/km as measured by the 5th wheel Bump Integrator.
11	Surface roughness shall not exceed 3000mm/km and 1000mm in any 200m length during the service life of the pavement at any time. A renewal coat of 25mm BC shall be laid after initial construction whenever the roughness value reaches 3000mm/km to bring it to less than 2000mm/km.

S.No.	Description of work item
F	**Maintenance of Buildings**
12	This shall include cleaning, repair and maintenance of various parts of building, service and facilities in a wholesome and hygienic condition at all times. Shall include replacement of irreparable items of work, cleaning and disinfecting of the water supply system, inspection and maintenance of drainage/sanitation systems, illumination and electrical installation, landscaping, painting and shall be as per relevant clauses of NBC. Maintenance of pavement of parking lot with road marking shall be carried out.
13	Maintenance of all furniture, furnishing items and equipments shall mean periodic servicing, checking and replacement, repairs, replenishment of the consumables and other incidentals.
14	Laboratory shall be maintained and operated efficiently to carry out requisite tests till end of Concession Period.

2.3.3 MAINTENANCE STANDARD

During Operation Period, all the road-works and pavements contained in the Project Facilities shall be maintained in traffic worthy condition as per the Intervention Level 1 (Desirable) & 2 (Acceptable) as provided in the Table M-2 of Schedule-M of Concession Agreement.

a) **Pavement Distress** – Maintenance procedure for correcting distress in bituminous pavement shall include patching, crack sealing, surface treatment and pot hole filling have been described.

b) **Pavement Riding Quality** - The Road Roughness value shall be measured at least twice in a year by a properly calibrated Bump Integrator device before and soon after the monsoon every year. The Concessionaire is required to ensure that at no point during the Operations Period, the Roughness in the road surface shall fall below the acceptable Roughness Values given in Schedule-M.

c) **Structural condition of the flexible pavement–** This 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 0.8mm, a bituminous overlay shall be provided appropriately designed according to IRC: 81-1997 or its latest versions or amendments to it. The characteristic deflection at the end of Concession Period shall not exceed 0.5mm. In case of CC pavements, joints shall be thoroughly inspected every year and the loss of sealing compounds made good.

d) **Shoulders -** If the shoulders are deformed or scoured and are lower than 25mm from the adjacent carriageway, these shall be corrected by excavation, filling, dressing and compacting with a material matching the existing material. It shall be ensured that no earth is borrowed from road side land.

e) Bridges and other structures – The Concessionaire shall maintain and carry out required repairs of the various elements of the structures in accordance with IRC SP: 35-1990.

f) Roadside Drains – This shall cover pipe drainage systems, slot drains, porous drains, gullies, catch pits, open grills, side drains and median drainage, etc. If these side drains and / or other drainage structures have been silted such that it is causing obstruction in flow of water, the same shall be cleared regularly in order to keep drains free from obstruction all the times.

g) Cross Drainage works – When the bed of a culvert gets silted up and causes obstruction in flow of water, the de-silting operation shall be done regularly. The scouring of piers & abutments of bridges and culverts shall be observed carefully particularly before and after rainy season and suitable remedial measures as deemed fit shall be taken.

h) Landscaping – Trees shall be maintained as per guidelines in IRC SP: 21-1979. This shall include cutting or clearance to safeguard visibility at road bends, accesses and signs. Turfing shall be mown as to achieve a visual pattern in harmony with adjacent areas.

i) Lighting and Signages – The lighting wherever provided shall be maintained by Concessionaire in condition nearly similar to original condition. The faults to be repaired instantly, missing and damaged items to be replaced instantly. Proper servicing of stand-by power generation units shall be carried out regularly.

Line marking with thermo-plastic paint shall be carried out soon after any overlay / renewal coat is provided and in situation when adequate reflectivity is lost under poor weather conditions, adequate wet reflectivity should be ensured.

j) Control Centre, Buildings and other Facilities – Maintenance of Emergency Telephone Systems including equipment and its periodic servicing, checking, replacement of components shall be done to keep the system in working condition. All the vehicles shall be maintained in smooth running condition at all times. On account of breakdown of any vehicle, a substitute vehicle shall be provided immediately. At the end of Concession Period, the Control Centre together with all equipments in working order shall be handed over to MPRDC.

k) Corridor Control Plan – Regular 24 hours patrol / surveillance of the ROW in respect of the Project / Facilities shall be required to monitor, report and take action against activities such as encroachments, unauthorized construction of road or entrance connection, structures, interference with drainage systems, etc within 150m of the Highway Corridor. The surveillance shall include traffic operation and management of accidents / other incidents.

During Operations Period, all the road works and pavements contained in the Project facilities (including those in the ancillary facilities) shall be maintained in traffic-worthy conditions as per the Intervention Levels 1 & 2 as presented in **Table 2.6** below, through the various maintenance activities.

Table 2.6: Intervention Levels – Operation Period, Schedule-M

S. No.	Service factor	Level 1 (Desirable)	Level 2 (Acceptable)
1.	Roughness by Vehicle Mounted Bump Integrator	2000mm/km (Allowable tolerance +5%)	3000mm/km
2.	Potholes/km (max)		
	a) Less than 75mm deep	Nil	2 nos of size < 5sqm
	b) More than 75mm deep	Nil	Nil
3.	Percent Cracking	Nil	No unsealed cracks > 6mm wide on 95% Project Highway
4.	Rut Depth not exceeding 10mm	Length not more than 5% of Project Highway	Upto 10% of length of Project Highway
5.	User Information	All road signs, Km post & road marking in good condition in 3 language formula	All road signs, Km post & road marking in good condition in 3 language formula
6.	Percentage Defective Bridge area & bump at approach	Nil	Nil
7.	Camber – Mainline	(+/-) or 0.05% variation from the camber as per design requirements	(+/-) or 0.15% variation from the camber as per design requirements
8.	Drainage (including shoulders)	No visible water pool within the Project Highway	No visible water pool within the Project Highway
9.	Characteristic Deflection as per IRC:81-1997	Upto 0.5mm	Upto 0.8mm
10.	Pavement Marking	Full reflectivity in wet conditions	Adequate wet reflectivity

2.3.4 REPORTING REQUIREMENTS OF MAINTENANCE ACTIVITIES

The Reporting requirements and frequency for inspection of Road Maintenance Activities is presented as **Table 2.7** below.

Table 2.7: Frequency of Inspection for Road Maintenance Activities

FREQUENCY OF INSPECTION FOR ROAD MAINTENANCE ACTIVITIES –DEWAS BHOPAL						
S.No.	**Object**	**Item**	**Daily**	**Monthly**	**Quarterly**	**Before & after rainy season**
1	Riding surface	Pavement	0	#	*	
		Expansion joints	0	#	*	
2	Median	Kerb	0	#	*	
3	Side slopes	Shape	0	#	*	
		Turfing	0		*	
		Pitching & Masonry	0		*	
		Retaining Wall	#		*	
4	Drainage	Side drain	&	#		
		Gullies & Catch pits	&	#		
5	Bridges	Superstructure	#	*		
		Substructure	#	*		
		Head, wing walls & aprons	#	*		
		Painting		*		
		Hand rail	#	*		
6	Culverts			*		
7	Safety Barrier		&	#	*	
8	Traffic operation facilities	Signs	*	*		
		Marking	&	#	#	*
		Delineator	&	#	#	*
		Lighting	&	#	*	
9	Other facilities	Vegetation/landscaping/Toll Plaza/Wayside amenities	&	#	*	
10	Traffic conditions		&	*	#	
11	Encroachments		&	*		

S. No.	Symbol	Legend	S. No.	Symbol	Legend
1.	0	Visual Inspection	3.	*	Thorough Inspection
2.	#	Close Inspection	4.	&	Visual Inspection during rainy season only

2.3.5 CONCLUSIONS ON OBSERVATIONS ON O&M MANUAL

The O&M Manual is comprehensively covering all the aspects of maintenance requirements for the Project Road.

2.4 REVIEW OF SAFETY AUDIT REPORT (O&M STAGE)

Safety requirements as per Concession Agreement have been given in Clause 4 of Schedule-L for requirement of safety during Construction Period. Safety measures to be observed for highway safety during Operation and Maintenance are provided in Clause 5 of Schedule-L of Concession Agreement.

The provision of safety measures as per Schedule-L have been audited by the Safety Auditor (***M/s GK Consulting Engineers, Hyderabad***) appointed by the Concessionaire and their Report dated September 2019 has been reviewed by us.
The Audit Team had come up with certain recommendations for long term measures to be adopted for overall improvement in the Project infrastructure. These recommendations like providing partial access control, new underpasses/foot over bridges and provision of paved shoulders were not part of the Scope of Work under the Concession Agreement. The Concessionaire has submitted the Safety Audit Report to MPRDC for necessary action.

The other recommendations like installing of sign boards, hazard markers and lighting at bus stop locations are being taken up by the Concessionaire.

2.5 REVIEW OF CHANGE OF SCOPE ORDERS

2.5.1 WORK ITEMS UNDER CHANGE OF SCOPE

Some work items were approved under Change of Scope. The Change of Scope Orders issued by MPRDC for the Project has been summarized in **Table 2.8** below. Financial implication of COS had been finalized by MPRDC as Rs. 29.05 Cr. and Rs. 1.93 Cr. (for ETC lanes) i.e., total Rs. 30.98 Cr. including Rs. 2.14 Cr. (0.5% of TPC).

As per Clause 15.1 of the Concession Agreement, the COS amount beyond Rs. 2.14 Cr is to be considered for computation of additional days in the Concession Period. Hence, amount of COS of Rs. 28.85 Cr. has been considered by MPRDC for computation of additional days.

Table 2.8: COS work items

S. No.	Description of COS work	Date of Work Order for COS	Net COS considered (Rs.)
1.	Reduction of 4.2km length from Lalghati Chouraha to Km 10/10 & Addition of 2.70km length from Dewas bypass end to NH-3 junction in Dewas town	20.07.2008	7,46,81,207
2.	Pipe culvert on road from Dewas bypass NH-3 junction at Km 153/6	01.06.2009	12,93,108
3.	Service Road provided in urban area of Amlaha and Kotri village (TCS 3 & 4)	06.02.2009	5,91,40,067
4.	Additional Pipe culverts, Box culvert in homo section 1	19.05.2009	39,86,371
5.	Reconstruction of 0.6m span cut stone slab culverts to 1000mm dia pipe culverts at Ch. 24+045 & Ch 24+245	18.12.2008	2,92,785
6.	Provision of PUP size 4.0m x 3.0m at Ch. 41+480 in village Kotri	20.04.2009	47,37,825

S. No.	Description of COS work	Date of Work Order for COS	Net COS considered (Rs.)
7.	Development of Junction at Highway Treat Restaurant Dodi (Intersections / Junctions at Ch. 68+500 & 67+900) homogeneous section 2	20.05.2009	99,92,734
8.	4 Intersections / Junctions in homo section 2	16.07.2009	1,63,02,428
9.	Underpass at Ch. 68+840 at village Dodi	24.12.2009	93,78,534
10.	Construction of 3 culverts	10.03.2010	40,97,983
11.	Development Junctions at 12th km (RHS)	27.03.2010	30,37,079
12.	Increase in width of shoulders 2.5m instead of 1.0m in road length with open median – homo section 1 & 2	30.03.2010	6,71,92,344
13.	Provision of T-Junction at 94+800	09.04.2010	40,01,885
14.	Junction improvement – Four legged Junction at Ch. 123+100 and T-Junction at Ch. 125+290	15.04.2010	11,20,875
15.	Development of Truck Lay bye at Km 92 (RHS) Dodi Ghat	23.06.2010	98,92,237
16.	Electronic Toll Collection Lanes*	07.01.2016	1,93,29,000
	Total Amount		**28,84,76,460**

*A COS proposal seeking post-facto approval for conversion of all Toll Lanes to hybrid ETC has been submitted by the Concessionaire to MPRDC which is presently under review.

All the works specified in the table have been completed on field by the Concessionaire.

2.5.2 CHANGE OF CONCESSION PERIOD

2.5.2.1 ISSUES RELATED TO MATHEMATICAL COMPUTATION

As per Clause 15.9 of the Concession Agreement, the calculation for computing the extension or reduction in Concession Period on account of increase or decrease in scope of work beyond Rs. 2.14 Cr will be done on basis of following mathematical formula.

1. A = Average daily toll in the first 6 months
2. B = A x (1+annual traffic growth) x $(1.07)^{\text{Toll period in year}}$
3. C = B/$(1+\text{discount rate})^{\text{Year between expenses and end of toll period}}$
4. D = Cost of change of scope / C

   Where, D = No. of days to be added to the toll period, rounded to nearest whole day

It is also mentioned in the Clause 15.9 that traffic growth will be estimated at actual traffic growth or 4% per annum whichever is higher. (For computation of traffic growth, the average annual traffic growth for a period of at least 2 years or actual whichever is higher will be taken).

MPRDC vide their Order dated 12.06.2017, has considered the amount of Rs. 28.84 Cr for computing additional days in the Concession Period. MPRDC has also modified the

mathematical formula by citing a typographical error in the specified Clause. The modified formula is as under:

1. A = Average daily toll in the first 6 months
2. B = $\{A \times (1+\text{annual traffic growth}) \times (1.07)\}^{\text{Toll period in year}}$
3. C = $B/(1+\text{discount rate})^{\text{Year between expenses and end of toll period}}$
4. D = Cost of change of scope / C

MPRDC has also mentioned that since the toll period is quite long and future traffic growth cannot be estimated accurately at present, also since the annual average traffic growth rate may fluctuate more than 4%, therefore calculation of additional tolling days shall be done 6 months prior to expiry of Concession Period.
The Concessionaire has accepted the modification vide Supplementary Agreement dated 26.11.2021.

2.5.2.2 EXTENSION IN CONCESSION PERIOD

The Concession Period for the Project is for a period of 25 years from the Commencement Date. The Commencement Date for the Project has been notified as 20.03.2008, therefore the end of Concession Period (or transfer date) for the Project is 19.03.2033. However an ambiguity has now been created in respect of the commencement data by MPRDC Order No. 02/MPRDC/ BOT/B-D/2020 dated 22.09.2020 wherein Commencement Date of the Project is mentioned as 27.11.2007 and the transfer date is mentioned as 26.11.2032. However there have been two Force Majeure Events and execution of some work items under COS (as brought out in **Table 2.7** above), which required Extension of the Concession Period. The details of the orders issued by MPRDC in this regard are as under:

a) On account of Force Majeure Event of demonetization of currency notes, an extension of **22.5 days** have been granted to the Concessionaire vide Order No. 02/MPRDC/BOT/D-B/2017/4946 dated 19.06.2017 and the revised transfer date became 11th April 2033.
b) On account of work items under COS (as brought out in **Table 2.8** above), the Concession Period was further extended by **195 days** by MPRDC vide Order No. 11617/Maint/Bhopal-Dewas/MPRDC/2018 dated 25.10.2018.While working out this period of 195 days MPRDC has made use of formula modified by them but not acceptable to the Concessionaire.
c) Owing to Covid-19 another Force Majeure Event, the toll collection was suspended for a total of 40 days. MPRDC vide Order No. 02/MPRDC/ BOT/B-D/2020 dated 22.09.2020 has granted an extension of **40 days** in the Concession Period, revising the transfer date to 21st May 2033.

   It is pertinent to note here that this MPRDC Order does not take into account the extension of 195 days approved vide MPRDC Letter dated 25.10.2018. However, in the supplementary Concession Agreement dated 26.11.2021 it has been stated that 195 days extension is already provided.

2.6 REVIEW OF CLEARANCES

The Concessionaire had to obtain necessary permits and clearances from all the concerned Authorities as mentioned in Schedule-A of the Concession Agreement. The Concessionaire had obtained the necessary clearances. Some of the important clearances obtained by the Concessionaire are mentioned below.

a) Environmental Clearance – Accorded by MoEF: Order No, 5-43/2006-IA-III dated 31.01.07.

b) Tree cutting Permission – Accorded by FO, Sehore Dist. Order No. 76 dated 07.09.2009.

c) Tree cutting Permission – Accorded by FO, Dewas Dist. Order No. 1031/2009 dated 30.01.09.

d) Tree cutting Permission – Accorded by Commissioner, Dewas Municipal Corporation Order No. 175/10 dated 29.01.10.

CHAPTER 3.0: EXISTING INVENTORY & CONDITION SURVEY

3.1 PROJECT DETAILS

The Project Road is the Section of SH-18 starting just beyond the built-up area of Bairagarh town near Bhopal (Design Chainage 10+000) and ends at the junction with NH-3 in Dewas town (Design Chainage 150+790). The Length of Project Road is **140.790km**. The notable built-up areas which the Project Road bypasses are Sehore, Sonda, Ashta, Dodi, Mehatwada, Semli, Sonkatchh and Arniya.

The road traverses through mainly plain terrain. The road alignment has mostly easy gradients. The major details of the Project are presented in **Table 3.1** below.

Table 3.1: Major Details of Project Road

S. No	Parameter	Description	
1.	Main Carriageway Details	4 laned divided Carriageway with raised median and depressed median – 7.0m carriageway plus 2.5m hard shoulder on outer side and 1.0m earthen shoulder on depressed median side	
2.	ROW	Varying between 30m - 60m	
3.	Service Road (4m /5m /5.5m wide) Total both side Length = 9.090km	4m/5m/5.5m wide	
		57+270 to 58+350 (LHS) - 5m	57+270 to 58+350 (RHS) – 5m
		66+280 to 67+500 (LHS) – 5m/4m	66+280 to 67+500 (RHS) – 5m/4m
		148+700 to 150+790 (LHS) – 5.5m	148+700 to 150+790 (RHS) – 5.5m

3.1.1 LENGTH OF PROJECT

i) As per the Schedule-E of the Concession Agreement, the Project Road starts at Km stone 6/8 (Lalghati square at Bhopal) of SH-18 and ends at the existing Km stone 151/6 (Dewas bypass junction). The total length of the Project Road along SH-18 is 140.790 km (Design Length). This length of 140.790 km consisted of following three sections as per existing kilometre stones.

Section 1 – 19.6km : Bhopal –Sehore existing 4 lane section (Km 6/8 to Km 26/4)
Section 2 – 16.1km : Existing Sehore bypass 2 lane section (Ch 0.0 to Ch 16+100)
Section 3 – 106.9km : Existing 2 lane road from end of Sehore bypass to Dewas bypass junction (Ch 16+100 to Ch 123+000) including bypass of Ashta, Mehatwada & Sonkatchh and re-aligned stretches.

ii) During construction, there was a COS Order by MPRDC wherein the start point was changed to Km stone 10/10 at Bairagarh town, thereby a reduction of 4.2km length. Similarly the end point was changed to Junction of NH-3 at Dewas town, thereby an addition of 2.7km length. This resulted in a net decrease of 1.5km length.

iii) The tolling length of the Project Road is **140.79km** which has been verified on ground by us during carrying out highway inventory. The Completion Certificates issued by MPRDC for the three homogeneous sections also add up to 140.79km.

3.2 COMMENCEMENT AND COMPLETION OF WORK

The work at site was commenced by the Concessionaire from 20th March 2008. As per Project Completion Schedule given in Chapter XIII of Concession Agreement, completion period of 30 months from Commencement Date has been mentioned. Thus the Scheduled Completion Date was 20th September 2010. The ***Provisional Completion Certificates*** as per the Concession Agreement for the Project was issued by MPRDC for three stretches on three dates (Section 1 on 10.02.09, Section 2 on 17.09.09, Section 3 on 30.04.10) along with Punch List items covering the balance items of incomplete works. These balance items of incomplete works were completed by the Concessionaire and subsequently, MPRDC issued the ***Completion Certificates*** (Section 1 on 27.07.09, Section 2 on 15.12.09, Section 3 on 12.08.10) in accordance with Clause 15 of the Concession Agreement.

3.2.1 WORK ITEMS UNDER CHANGE OF SCOPE

During the construction, some work items were approved under Change of Scope. The brief description of Change of Scope work items and their date of Work Order have been summarized in **Table 3.2** below.

Table 3.2: COS work items

S. No.	Description of COS work	Date of Work Order for COS
1.	Reduction of 4.2km length from Lalghati Chouraha to Km 10/10 & Addition of 2.70km length from Dewas bypass end to NH-3 junction in Dewas town.	20.07.2008
2.	Pipe culvert on road from Dewas bypass NH-3 junction at Km 153/6	01.06.2009
3.	Service Road provided in urban area of Amlaha and Kotri village (TCS 3 & 4)	06.02.2009
4.	Additional Pipe culverts, Box culvert in homogeneous section 1	19.05.2009
5.	Reconstruction of 0.6m span cut stone slab culverts to 1000mm dia pipe culverts at Ch. 24+045 & Ch 24+245	18.12.2008
6.	Provision of PUP size 4.0m x 3.0m at Ch. 41+480 in village Kotri	20.04.2009
7.	Development of junction at Highway Treat Restaurant Dodi (Intersections/Junctions at Ch. 68+500 & 67+900) homo. section 2	20.05.2009
8.	Four intersections/junctions in homo section 2	16.07.2009
9.	Underpass at Ch. 68+840 at village Dodi	24.12.2009
10.	Construction of 3 culverts	10.03.2010
11.	Development junctions at 12th km (RHS)	27.03.2010
12.	Increase in width of shoulders 2.5m instead of 1.0m in road length with open median – homogeneous section 1 & 2	30.03.2010
13.	Provision of T-Junction at 94+800	09.04.2010
14.	Junction improvement – Four legged Junction at Ch. 123+100 and T-Junction at Ch. 125+290	15.04.2010
15.	Development of Truck Lay bye at Km 92 (RHS) Dodi Ghat	23.06.2010

3.3 OVERVIEW OF ROAD ASSETS AND APPURTENANCES

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

Status of various road furniture items, painting, road markings, safety fixtures, way-side amenities, 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. The inventory details pertaining to the highway inventory have been summarized in the following paras.

3.3.1 HIGHWAY INVENTORY

The Roadway Inventory for the Project Road was studied and noted for every 100m intervals. Summary of this inventory pertaining to the Carriageway widths, shoulders, Embankment height, Median, etc. were noted and this information has been presented in **Table 3.3** below. The condition of the road is found to be generally good and the renewal work was also seen to be ongoing. Representative photographs of the road in each 5km stretch are presented in **Figures** below.

Fig 3.1: Start of the Project

Fig 3.2: Road Stretch between Ch.10-15

Fig 3.3: Road Stretch between Ch.15-20

Fig 3.4: Road Stretch between Ch.20-25

Fig 3.5: Road Stretch between Ch.25-30

Fig 3.6: Road Stretch between Ch.30-35

Fig 3.7: Road Stretch between Ch. 35-40

Fig 3.8: Road Stretch between Ch. 40-45

Fig 3.9: Road Stretch between Ch. 45-50

Fig 3.10: Road Stretch between Ch 50-55

Fig 3.11: Road Stretch between Ch. 55-60

Fig 3.12: Road Stretch between Ch. 60-65

Fig 3.13: Road Stretch between Ch. 65-70

Fig 3.14: Road Stretch between Ch. 70-75

Fig 3.15: Road Stretch between Ch. 75-80

Fig 3.16: Road Stretch between Ch. 80-85

Fig 3.17: Road Stretch between Ch. 85-90

Fig 3.18: Road Stretch between Ch. 90-95

Fig 3.19: Road Stretch between Ch. 95-100

Fig 3.20: Road Stretch between Ch. 100-105

Fig 3.21: Road Stretch between Ch. 105-110

Fig 3.22: Road Stretch between Ch. 110-115

Fig 3.23: Road Stretch between Ch. 115-120

Fig 3.24: Road Stretch between Ch. 120-125

Fig 3.25: Road Stretch between Ch. 125-130

Fig 3.26: Road Stretch between Ch. 130-135

Fig 3.27: Road Stretch between Ch. 135-140

Fig 3.28: Road Stretch between Ch. 140-145

Fig 3.29: Road Stretch between Ch. 145-150

Fig 3.30: End point of Project Road

Table 3.3: Details of Highway Inventory

S.No.	Chainage (Km)		LHS					Median		RHS				
	From	To	Land Use	Embankment Height (m)	LHS Earthen Shoulder (m)	MCW Width (m)	RHS Earthen Shoulder (m)	Depressed/ Raised/ NJ Barrier	Width (m)	LHS Earthen Shoulder (m)	MCW Width (m)	RHS Earthen Shoulder (m)	Embankment Height (m)	Land Use
1	10000	15800	Barren, Agri, Built up, House	0.00-5.0	1.5	7-9	0.0	Raised	1.25	0.0	7-9	0.0	0.00-5.0	Barren, Agri, Built up, House
2	15800	18100	Agri, Comm	0.5-1.0	2.0	7-9	1.5	Depressed	13.50	1.5-2.0	7.0	2.0	0.00-0.5	Agri, Comm
3	18100	20000	Agri, Comm, Built up	0-0.3	1-2	7.0	0.0	Raised	1.50	0.0	7.0	2.0	0.0	Agri, Comm, Built up
4	20000	25000	Agri, Comm, Barren	0-0.2	1-1.5	7-22	1-1.5	Depressed	10-29	2.0	7-22	2.0	0-1.5	Agri, Comm, Barren
5	25000	25100	Toll Admin	0.0	0.0	20.0	0.0	Raised	1.8	0.0	21.0	0.0	0.0	Toll Admin
6	25100	36600	Agri, Comm, Barren	0-3.0	1-2	7.2-14	0.0	Raised	1.8-4.4	0.0	7.2-19	0-2	0-4.5	Agri, Comm, Barren
7	36600	37000	Short Length - Only 600m length seen between Km 36 & Km 37							Short Length - Only 600m length seen between Km 36 & Km 37				
8	37000	42200	Agri, Barren, Comm	0-4.5	1-2	7-10.7	0.0	Raised	1.3-4.5	0.0	7-13.4	2.0	1-4.5	Agri, Barren, Comm
9	42200	53200	Agri, Barren, Comm	0-2.7	2-3.0	7.0	0-3	Depressed	12.6-14.5	0-2	7.0	1.6-3.2	0-2.8	Agri, Barren, Comm
10	53200	54600	Agri, Built up	0.6-8.5	1.5-2.8	7.0	0-2.0	Raised	4.3-10.4	0-2.3	7.0	1.5-2.6	1.2-8.5	Agri, Built up
11	54600	56700	Agri	0.2-2.0	2.0-2.5	7.0	0-2.5	Depressed	11.5-12.8	0-2.5	7.0	1.4-2.5	0.5-1.5	Agri
12	56700	57200	Agri	0.4-0.5	2.5	7.0	0.0	Raised	1.6-5.9	0.0	7.0	2.5	0.8-1.5	Agri
13	57200	58300	Built up	S.R	0.0	7.0	0.0	NJ C.B	0.6	0.0	7.0	0.0	S.R	Built up
14	58300	60100	Agri	0-0.5	2.5-2.6	7.0	0-2.7	Raised	1.2-8.3	0-2.5	7.0	2.5	0.1-0.6	Agri, Comm
15	60100	61400	Agri, Built up	0.3-2.5	2.5	7.0	0-2.5	Depressed	8.5-14.9	0-2.5	7.0	2.5	0.5-2.5	Agri
16	61400	61800	Toll Admin,	0.5-1.2	0-2.5	7-20	0-2.5	Raised	0.5-3.4	0-2.5	7-20.0	0-2.5	0.5-1.2	Toll Admin,

S.No.	Chainage (Km)		LHS					Median		RHS				
	From	To	Land Use	Embankment Height (m)	LHS Earthen Shoulder (m)	MCW Width (m)	RHS Earthen Shoulder (m)	Depressed/ Raised/ NJ Barrier	Width (m)	LHS Earthen Shoulder (m)	MCW Width (m)	RHS Earthen Shoulder (m)	Embankment Height (m)	Land Use
			Agri											Agri
17	61800	65300	Agri, Comm	0.2-2.0	2.5-2.6	7-7.2	2.5-2.6	Depressed	6.2-13	0-2.5	7-7.2	2.4-2.5	0.3-2.0	Agri, Comm
18	65300	66400	Agri, Built up, Comm	0-0.2	0-2.5	7.1-7.3	0.0	Raised	1.7-3.5	0.0	7.1-7.3	0-2.5	0-0.2	Agri, Built up, Comm
19	66400	67600	Agri, Built up	S.R	0.0	7.1-7.3	0.0	NJ C.B	0.6	0.0	7.1-7.4	0-2.5	S.R	Agri, Built up
20	67600	69700	Agri, Comm	0.2-1.7	2.4-2.7	7.0-7.4	0-2.6	Raised	1.6-4.9	0-2.6	7.0-7.4	1.3-2.7	0.5-1.8	Agri, Comm, Built up
21	69700	77100	Agri, Comm, Built-up	0-1.5	1.2-2.8	7-7.3	0-2.6	Depressed	9-13.5	0-2.7	7-10.3	2.4-2.8	0.2-7.0	Agri, Comm, Built up
22	77100	82200	Agri, Built up, Barren	0-4.1	2.0-3.2	7.1-10.0	0-4.0	Raised	0.4-8	0-3.2	7-11	2.1-3.0	0-4.5	Agri, Built up
23	82200	85200	Agri, Built up	1-1.5	2.5-3.0	7.0-7.3	2.5-4	Depressed	5.0-12.5	2.5-2.8	7-7.3	2.5-3	0.8-1.5	Agri, Built up
24	85200	86300	Agri, Barren	1-1.5	3.0	7-7.3	0-2.5	Raised	2.3-3.8	3.0-3.5	7.0-7.3	0-2.5	1.0	Agri
25	86300	89500	Agri, Barren	0.3-5.0	2-4.5	7.0	2.5	Depressed	6-13	2.0-4.0	7.0	2.0-3.0	0.4-2.0	Agri, Barren
26	89500	95000	Agri, Barren, Built up	0.3-4.0	1-4.0	7.0	0.0	Raised	4.2-7.5	0.0	7-10.5	2-4.0	0.5-4	Agri, Barren, Built up
27	95000	104000	Agri, Built up	0.2-1.5	2.0-3.5	7.0	2.0-4.5	Depressed	6-12.0	1.5-3.5	7.0	2.0-3.5	0.2-2.5	Agri, Built up
28	104000	106000	Agri, Built up	0.5-1	2.0-2.8	7.0	0.0	Raised	4.0-7	0.0	7.0	2.0-3	0.5-1.0	Agri, Built up
29	106000	106500	Agri	1.2-2.0	2.5-3	7.0	0.0	Depressed	6.0-12	3.0	7.0	2.5	1-3.0	Agri
30	106500	108500	Agri	0.5-2.0	1.0-3.0	7.0	0.0	Raised	3.5-6.0	0.0	7.0	0.5-3.0	1-3	Agri
31	108500	118900	Agri, Barren, Built up	0-3.3	1-3.3	7.0	2-3.5	Depressed	6.3-13.5	0.5-3.5	7.0	2.0-3.5	0-3.0	Agri, Barren, Built up
32	118900	122800	Agri, Built up	0-3.3	2.5-3.3	7.0	0.0	Raised	0.75-4.6	0.0	7-7.5	2.5-2.5	0-2.0	Agri, Built up
33	122800	128900	Agri, Built up	0-2.0	2.5	7.0	2-3.0	Depressed	10-14.0	2.5-3.0	7.0-7.5	2.5-3	0-2.0	Agri, Built up

S.No.	Chainage (Km)		LHS					Median		RHS				
	From	To	Land Use	Embankment Height (m)	LHS Earthen Shoulder (m)	MCW Width (m)	RHS Earthen Shoulder (m)	Depressed/ Raised/ NJ Barrier	Width (m)	LHS Earthen Shoulder (m)	MCW Width (m)	RHS Earthen Shoulder (m)	Embankment Height (m)	Land Use
34	128900	130100	Agri	0-0.2	2.5-2.8	7.0	0.0	Raised	4-5.5	0.0	7.0	2.5	0.0-0.5	Agri
35	130100	134600	Agri	0.00-1.0	2.0-3.0	7-10.5	2.0-3	Depressed	12-14.5	2.5	7-10.5	2.5	0.0-0.8	Agri
36	134600	134900	Toll	0.0	Toll	10.5-20.0	Toll	-	-	Toll	10.5-20.0	Toll	0.0	Toll Admin
37	134900	148200	Agri + Built up	0-2.0	0-3.5	7.0	0-3.5	Depressed	9-12	2.5-3.5	7.0	0.5-3.5	0-3.0	Agri + Built up
38	148200	148800	Agri + Built-up	0.0	3.0	7.0	0.0	Raised	0.5-4	0.0	7.0	3.5	0.0	Agri + Built up
39	148800	150790	Built up	S.R.	0-3	7-8.0	0.0	NJ C.B	0.6	0.0	7-8.0	3.5	S.R	Built up

3.3.2 MAJOR JUNCTIONS

During our site inventory, we have found 19 numbers of Major Junctions which are same as the numbers of Major Junctions with respect to the inventory details of the Concessionaire. As per Schedule-E of the Concession Agreement however, only 10 numbers of Major Junctions are mentioned. The details of Major Junctions are presented in **Table 3.4** below. Representative photographs of some of the Major Junctions are presented in **Figures** below.

Fig 3.31: 17+400 RHS - Bhopal bypass

Fig 3.32: 25+450 RHS Sehore Bypass start

Fig 3.33: 28+450 LHS Lasudia Parihar

Fig 3.34: 34+150 LHS to Sehore

Fig 3.35: 36+050 LHS to Sehore

Fig 3.36: 39+700 LHS Sehore Ichhawar

Fig 3.37: 41+800 LHS Sehore bypass end

Fig 3.38: 53+080 RHS Sonda bypass

Fig 3.39: 77+210 LHS Ashta bypass start

Fig 3.40: 80+175 Ashta Shujalpur road

Fig 3.41: 81+510 Ashta bypass end

Fig 3.42: 93+300 Highway Treat Dodi

Fig 3.43: 94+600 Dodi Arniyaganj

Fig 3.44: 102+100 Jawar Gwala Gwali

Fig 3.45: 104+400 Mehatwada Bypass start

Fig 3.46: 119+050 Sonkatchh bypass start

Fig 3.47: 120+300 To Sonkatchh town

Fig 3.48: 120+550 Sonkatchh bypass end

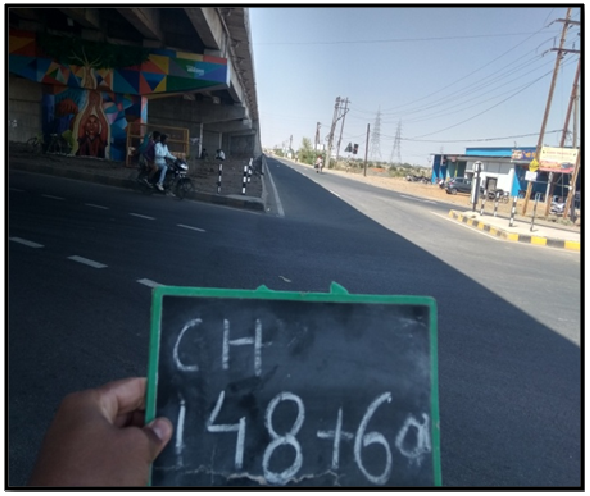

Fig 3.49: 148+600 Dewas bypass crossing

Fig 3.50: 150+790 Junction with NH-3

Table 3.4: Details of Major Junctions

S. No	Chainage	Type (T/X/Y)	Side Road LHS		Side Road RHS		No. of Islands		Auxiliary Lane / Deceleration Lane / Acceleration Lane				Type of Lighting	Associated Signage	Associated Marking
									LHS		RHS				
			Pavement Type	Width (m)	Pavement Type	Width (m)	LHS	RHS	L (m)	W (m)	L (m)	W (m)	High Mast/Single Double Arm		
1	17+400 - Bhopal Bypass Starts	Y	-	-	BT (4-Lane Divided)	16	-	1	-	-	-	-	-	Yes	No
2	25+450 - Sehore Bypass Starts	T	-	-	BT (Poor cond near rotary)	13	-	2	-	-	-	-	1 HM	Yes	No

S. No	Chainage	Type (T/X/Y)	Side Road LHS		Side Road RHS		No. of Islands		Auxiliary Lane / Deceleration Lane / Acceleration Lane				Type of Lighting	Associated Signage	Associated Marking
									LHS		RHS				
			Pavement Type	Width (m)	Pavement Type	Width (m)	LHS	RHS	L (m)	W (m)	L (m)	W (m)	High Mast/Single Double Arm		
3	28+450 - Lasudia Parihar	+	BT	9.5	CC	5	-	-	-	-	-	-	-	Yes	No
4	34+150- To Sehore	+	BT	8.5	CC (4Lane Divided)	16	-	-	-	-	-	-	-	Yes	No
5	36+050 - To Sehore	+	BT	7.5	BT	7.5	-	-	-	-	-	-	-	No	No
6	39+700 - Sehore, Ichhawar	+	BT	4.5	BT	8.5	-	-	-	-	-	-	-	Yes	Faded
7	41+800 - Sehore Bypass Ends	Y	-	-	CC (4Lane Divided)	16	-	2	-	-	-	-	1 HM	Yes	Faded
8	53+080 Sonda Bypass Start	Y	BT	6	-	-	2		25	3.5	-	-		Yes	No
9	77+210 Ashta Bypass Start	Y	BT	10.8	-	-	2		110	4.5	-	-	1 HM	Yes	Faded
10	80+175 Ashta, Shujalpur	+	BT	7	BT	5.5	2	2	32	3	33	3	1 HM	Yes	No
11	81+510 Ashta Bypass End	Y	BT	7.9	-	-	2	-	100	3.5	-	-	-	Yes	Faded
12	93+300 - Highway Treat Dodi	Y	BT	5.5	-	-	-	-	28	8.5	-	-	-	Yes	No
13	94+600 Dodi, Arniya Ganj	+	CC	7	BT	6	-	-	-	-	-	-	-	Yes	No
14	102+100 -Jawar,	+	BT	4.5	CC	7	-	-	-	-	-	-	-	Yes	No

S. No	Chainage	Type (T/X/Y)	Side Road LHS		Side Road RHS		No. of Islands		Auxiliary Lane / Deceleration Lane / Acceleration Lane				Type of Lighting	Associated Signage	Associated Marking
									LHS		RHS				
			Pavement Type	Width (m)	Pavement Type	Width (m)	LHS	RHS	L (m)	W (m)	L (m)	W (m)	High Mast/Single Double Arm		
	Gwala Gwali														
15	104+400 Mehatwada bypass Starts	Y	BT	7	-	-	3	-	100	6.5	-	-	-	Yes	Faded
16	119+050 Sonkatchh Bypass Start	Y	BT	10	-	-	3	-	135	10	-	-	1 HM	Yes	Faded
17	120+300 To Sonkatchh	Y	BT	7.5	-	-	2	-	44	7.4	-	-	-	Yes	Faded
18	122+550 - Sonkatchh Bypass End	Y	BT	7	-	-	3	-	135	3.75	-	-	-	Yes	Faded
19	148+600 - Indore Ujjain (Grade Sepe.)	+	BT	7	BT	7	-	1	23	8.5	-	-	1 HM	Yes	Y

3.3.3 MINOR JUNCTIONS

During our site inventory, we have found 70 numbers of Minor Junctions as against 31 numbers of Minor Junctions with respect to the inventory details of the Concessionaire. Therefore, we have found 39 additional numbers of Junctions. Schedule-E of the Concession Agreement mentions 35 numbers of Minor Junctions. On a number of Junctions, markings are not provided and on some of the Junctions, sign boards are also missing. Summary of Minor Junctions is presented in **Table 3.5** below. Representative photographs of some of the Minor Junctions are presented in **Figures** below.

Fig 3.51: 19+310 LHS

Fig 3.52: 36+050 LHS

Fig 3.53: 44+900 RHS

Fig 3.54: 64+200 LHS

Fig 3.55: 118+350 LHS

Fig 3.56: 136+200 LHS

Table 3.5: Details of Minor Junctions

S.No.	Project Road Section	No. of Minor Junctions	T-Type	Y-Type	+ Type	Remarks
1	Km 10+000 to Km 45+000	16 nos.	13	0	3	7nos. found additional at site
2	Km 45+000 to Km 80+000	24 nos.	18	2	4	14nos. found additional at site
3	Km 80+000 to Km 115+000	08 nos.	5	2	1	3nos. found additional at site
4	Km 115+000 to Km 150+790	22 nos.	20	0	2	15nos. found additional at site

3.3.4 SERVICE ROADS

Service Road/Slip Road are provided at four locations with total length of 9.09km. Representative photographs of some of the stretches of Service Roads are presented in **Figures** below.

Fig 3.57: Service road at Ch. 66+700 LHS

Fig 3.58: Service road at Ch. 57+300 RHS

Fig 3.59: Service road at Ch. 66+500 RHS

Fig 3.60: Service road at Ch. 149+500 LHS

Fig 3.61: Service road at Ch. 149+500 RHS

Fig 3.62: Service road at Ch.150+000 RHS

Summary of Service /Slip Roads is presented in **Table 3.6** below.

Table 3.6: Details of Service/Slip Roads

S. No.	Village Name	Chainage (Km)		Side	Length (m)	Width (m)	Drain cum Footpath	Separator/PGR/RCC CB	Condition of S.R.
		From	To	LHS/RHS			LHS/RHS	LHS/RHS	
1	Amlaha	57.270	58.350	Both Sides	1080	5	Cover Drain B/s	PGR B/s	Good
2	Kothri	66.280	67.200	Both Sides	920	5	Cover Drain B/s	PGR B/s	Good
		67.200	67.500	Both Sides	300	4	Cover Drain B/s	-	Improvement required
3	Ashta	76.990	77.300	LHS	310	5	Cover Drain LHS	-	Good
4	Dewas	148.700	150.790	Both Sides	2090	5.5	Cover Drain B/s	PGR B/s	Improvement required
		Total Length B/s (m)			**9090**				

3.3.5 MEDIAN OPENINGS

Summary of Median Openings is presented in **Table 3.7** below. Besides the provisioned Median Openings, a number of Unauthorized Median Openings are also seen to have been created. Representative photographs of some of the Median Openings are presented in **Figures** below:

Fig 3.63: Median Opening in Ch.15-20

Fig 3.64: Un-auth. Median Opening in Ch.15-20

Fig 3.65: Depressed Median in Ch. 15-20

Fig 3.66: Median Opening in Ch. 45-50

Fig 3.67: Median Opening in Ch. 70-75

Fig 3.68: Median Opening in Ch. 80-85

Table 3.7: Details of Median Openings

S.No.	Chainage Stretch (Km)		Median Openings		Type	Sign Board	Paved / Unpaved	Remarks
	Between		Length (m)	Width (m)	Depressed/ Raised/NJ CB			
1	10.200	10.300	15	1.6	Raised	Yes	Paved	-
2	10.300	10.400	18.5	1.8	Raised	Yes	Paved	-
3	10.700	10.800	20	1.7	Raised	Yes	Paved	-
4	11.100	11.200	30	1.6	Raised	Yes	Paved	-
5	11.400	11.500	5	1.6	Raised	Yes	Paved	-
6	11.500	11.600	10	1.6	Raised	Yes	Paved	-
7	11.700	11.800	10	1.6	Raised	Yes	Paved	-
8	11.900	12.000	17.5	1.7	Raised	Yes	Paved	-
9	13.100	13.200	13.5	1.5	Raised	Yes	Paved	Solar Blinkers Provided
10	15.000	15.100	13	1.6	Raised	Yes	Paved	-
11	15.400	15.500	11.2	1.6	Raised	Yes	Paved	-
12	15.500	15.600	17.5	1.7	Raised	Yes	Paved	-
13	17.400	17.500	70	17.5	Depressed	Yes	Paved	-
14	17.800	17.900	9	7.0	Depressed	-	Unpaved	Unauthorized
15	19.200	19.300	11.2	1.6	Raised	Yes	Paved	-
16	19.300	19.400	20.5	1.6	Raised	Yes	Paved	-
17	19.400	19.500	9	1.6	Raised	Yes	Paved	-
18	19.500	19.600	20	1.6	Raised	Yes	Paved	-
19	19.700	19.800	15	1.5	Raised	Yes	Paved	-
20	20.200	20.300	10	18	Depressed	-	Unpaved	Unauthorized
21	22.000	22.100	14.3	3	Depressed	-	Unpaved	Unauthorized

S.No.	Chainage Stretch (Km)		Median Openings		Type	Sign Board	Paved / Unpaved	Remarks
	Between		Length (m)	Width (m)	Depressed/ Raised/NJ CB			
22	22.800	22.900	14.5	4	Depressed	-	Unpaved	Unauthorized
23	23.300	23.400	23.5	17	Depressed	Yes	Paved	-
24	24.000	24.100	28	15.5	Depressed	Yes	Paved	-
25	24.900	25.000	18.5	4	Depressed	Yes	Unpaved	Unauthorized
26	28.400	28.500	30	5	Raised	Yes	Paved	Storage Lane Provided, L=60m, W=3m, Solar Blinkers Provided
27	30.800	30.900	5.7	4.4	Raised	-	Unpaved	Unauthorized
28	34.000	34.100	30	5	Raised	Yes	Paved	Storage Lane Provided, L=60m, W=3m, Solar Blinkers Provided
29	36.000	36.100	30	5	Raised	Yes	Paved	Storage Lane Provided, L=60m, W=3m, Solar Blinkers Provided
30	37.400	37.500	8	5	Raised	Yes	Paved	-
31	37.900	38.000	20.6	5	Raised	Yes	Paved	-
32	39.700	39.800	41	5	Raised	Yes	Paved	Storage Lane Provided, L=60m, W=3m, Solar Blinkers Provided
33	41.200	41.300	4	3	Raised	-	Unpaved	Unauthorized
34	41.800	41.900	25	2.7	Raised	Yes	Paved	Solar Blinkers Provided
35	42.900	43.000	13	3	Depressed	-	Unpaved	Unauthorized
36	43.000	43.100	13	3	Depressed	-	Unpaved	Unauthorized
37	44.900	45.000	14.5	3.5	Depressed	-	Unpaved	Unauthorized
38	45.700	45.800	19	18.2	Depressed	Yes	Paved	-
39	48.100	48.200	15.1	4.2	Depressed	-	Paved	-
40	49.000	49.100	17.8	13.5	Depressed	-	Paved	-
41	50.600	50.700	17.8	13.5	Depressed	Yes	Paved	-

S.No.	Chainage Stretch (Km)		Median Openings		Type	Sign Board	Paved / Unpaved	Remarks
	Between		Length (m)	Width (m)	Depressed/ Raised/NJ CB			
42	53.100	53.200	4.8	2.1	Raised	Yes	Paved	-
43	54.000	54.100	2.2	4.4	Raised	-	Unpaved	Unauthorized
44	54.500	54.600	17	15	Raised	Yes	Paved	-
45	55.200	55.300	17.5	12.2	Depressed	-	Paved	-
46	56.600	56.700	4	5	Depressed	-	Unpaved	Unauthorized
47	57.200	57.300	24.5	1	NJ CB	Yes	Paved	-
48	57.800	57.900	22.5	0.5	NJ CB	-	Paved	-
49	58.000	58.100	23	0.5	NJ CB	-	Paved	-
50	58.300	58.400	23.8	1.2	NJ CB	-	Paved	-
51	59.900	60.000	21.7	13.8	Raised	Yes	Paved	-
52	62.100	62.200	17.5	8	Depressed	Yes	Paved	-
53	62.900	63.000	3	17.8	Depressed	-	Unpaved	Unauthorized
54	64.200	64.300	17.5	17.5	Depressed	Yes	Paved	-
55	65.200	65.300	11.5	11	Depressed	Yes	Paved	-
56	65.600	65.700	22.9	1.7	Raised	-	Paved	-
57	65.800	65.900	17.2	1.8	Raised	Yes	Paved	-
58	66.300	66.400	23	0.7	Raised	-	Paved	-
59	66.400	66.500	15	0.7	NJ CB	-	Paved	-
60	67.100	67.200	21	0.7	NJ CB	-	Paved	-
61	67.400	67.500	20	0.7	NJ CB	-	Paved	-
62	69.800	69.900	22	14.8	Depressed	-	Paved	-
63	70.900	71.000	18.8	17.5	Depressed	Yes	Paved	-
64	71.700	71.800	5	18	Depressed	-	Unpaved	Unauthorized

S.No.	Chainage Stretch (Km)		Median Openings		Type	Sign Board	Paved / Unpaved	Remarks
	Between		Length (m)	Width (m)	Depressed/ Raised/NJ CB			
65	72.500	72.600	17.5	16	Depressed	-	Paved	-
66	74.400	74.500	19.8	15	Depressed	-	Paved	-
67	75.200	75.300	20.5	17.5	Depressed	-	Paved	-
68	76.800	76.900	22	17.3	Depressed	Yes	Unpaved	Unauthorized
69	76.900	77.000	22	17.3	Depressed	-	Unpaved	Unauthorized
70	77.300	77.400	7.3	0.5	Raised	Yes	Paved	Storage Lane Provided, L=100m, W=3.5m
71	78.600	78.700	20.3	3.8	Raised	Yes	Paved	-
72	80.200	80.300	42.2	4.5	Raised	-	Paved	Storage Lane Provided, L=50m, W=3.5m
73	85.100	85.200	50	5	Depressed	Yes	Unpaved	Unauthorized
74	86.200	86.300	9	6.5	Raised	Yes	Paved	-
75	86.400	86.500	10	8.4	Depressed	-	Paved	-
76	86.800	86.900	17.4	13.3	Depressed	Yes	Unpaved	Unauthorized
77	92.400	92.500	11	5	Raised	Yes	Paved	-
78	95.500	95.600	17.5	17.6	Depressed	Yes	Unpaved	Unauthorized
79	95.700	95.800	5	17.5	Depressed	-	Unpaved	Unauthorized
80	96.400	96.500	12	5	Depressed	-	Paved	-
81	98.000	98.100	5	12	Depressed	-	Unpaved	Unauthorized
82	98.100	98.200	8.5	17.5	Depressed	Yes	Paved	-
83	99.500	99.600	4	12	Depressed	Yes	Unpaved	Unauthorized
84	99.600	99.700	4	12.5	Depressed	-	Unpaved	Unauthorized
85	100.100	100.200	3.5	13.5	Depressed	-	Unpaved	Unauthorized

S.No.	Chainage Stretch (Km)		Median Openings		Type	Sign Board	Paved / Unpaved	Remarks
	Between		Length (m)	Width (m)	Depressed/ Raised/NJ CB			
86	100.300	100.400	18.5	17.5	Depressed	-	Paved	-
87	101.000	101.100	3.5	13.5	Depressed	-	Unpaved	Unauthorized
88	101.300	101.400	3	11	Depressed	-	Unpaved	Unauthorized
89	101.900	102.000	3	11	Depressed	Yes	Unpaved	Unauthorized
90	102.600	102.700	4	10.5	Depressed	-	Unpaved	Unauthorized
91	102.700	102.800	14.1	5	Depressed	-	Paved	-
92	102.800	102.900	3	12	Depressed	-	Unpaved	Unauthorized
93	103.100	103.200	3.5	12	Depressed	-	Unpaved	Unauthorized
94	103.200	103.300	15	7	Depressed	-	Paved	-
95	104.300	104.400	17	8	Raised	Yes	Paved	-
96	104.800	104.900	5	4	Raised	-	Unpaved	Unauthorized
97	105.300	105.400	10	4.5	Raised	-	Unpaved	Unauthorized
98	105.900	106.000	4	12	Raised	Yes	Unpaved	Unauthorized
99	108.700	108.800	3	10	Depressed	Yes	Unpaved	Unauthorized
100	112.700	112.800	10	17	Depressed	-	Paved	-
101	115.100	115.200	25	13.5	Depressed	Yes	Paved	-
102	116.000	116.100	21	13.5	Depressed	-	Unpaved	Unauthorized
103	116.400	116.500	11.5	13.5	Depressed	-	Unpaved	Unauthorized
104	116.500	116.600	23	13.5	Depressed	-	Unpaved	Unauthorized
105	118.300	118.400	25	10.5	Depressed	-	Unpaved	Unauthorized
106	118.700	118.800	8	6.3	Depressed	Yes	Unpaved	Unauthorized
107	118.800	118.900	17	4.6	Depressed	Yes	Unpaved	Unauthorized
108	118.900	119.000	17	4.6	Raised	Yes	Unpaved	Unauthorized

S.No.	Chainage Stretch (Km)		Median Openings		Type	Sign Board	Paved / Unpaved	Remarks
	Between		Length (m)	Width (m)	Depressed/ Raised/NJ CB			
109	119.000	119.100	6	4.6	Raised	Yes	Unpaved	Unauthorized
110	119.100	119.200	6	4.6	Raised	Yes	Unpaved	Unauthorized, Storage Lane Provided, L=80m, W= 3.5m
111	120.800	120.900	5	4.5	Raised		Unpaved	Unauthorized
112	122.500	122.600	35	2	Raised	Yes	Unpaved	Unauthorized
113	122.600	122.700	35	2	Raised	Yes	Unpaved	Unauthorized, Storage Lane Provided, L=100m, W= 3.5m
114	123.600	123.700	10	14	Depressed	-	Unpaved	Unauthorized
115	125.300	125.400	21	14	Depressed	-	Unpaved	Unauthorized
116	125.800	125.900	20	14	Depressed	Yes	Unpaved	Unauthorized
117	126.600	126.700	26	14	Depressed	Yes	Paved	-
118	127.700	127.800	27.2	14	Depressed	Yes	Unpaved	Unauthorized
119	129.000	129.100	23	5.5	Raised	Yes	Unpaved	Unauthorized
120	129.700	129.800	80	4.5	Raised	-	Unpaved	Unauthorized
121	129.800	129.900	40	4.5	Raised	Yes	Unpaved	Unauthorized
122	131.000	131.100	13	12	Depressed	-	Unpaved	Unauthorized
123	132.300	132.400	28	12	Depressed	Yes	Unpaved	Unauthorized
124	133.200	133.300	40	12	Depressed	Yes	Unpaved	Unauthorized
125	133.400	133.500	5	12	Depressed	Yes	Unpaved	Unauthorized
126	135.200	135.300	25	14	Depressed	Yes	Unpaved	Unauthorized
127	136.900	137.000	38	14	Depressed	Yes	Unpaved	Unauthorized
128	137.300	137.400	7	14	Depressed	-	Unpaved	Unauthorized
129	140.000	140.100	15	9	Depressed	Yes	Unpaved	Unauthorized

S.No.	Chainage Stretch (Km)		Median Openings		Type	Sign Board	Paved / Unpaved	Remarks
	Between		Length (m)	Width (m)	Depressed/ Raised/NJ CB			
130	140.400	140.500	4	10	Depressed	-	Unpaved	Unauthorized
131	140.800	140.900	5.5	11	Depressed	-	Unpaved	Unauthorized
132	141.400	141.500	7.5	11	Depressed	-	Unpaved	Unauthorized
133	141.800	141.900	5	11	Depressed	-	Unpaved	Unauthorized
134	142.100	142.200	7.5	11	Depressed	-	Unpaved	Unauthorized
135	142.300	142.400	4	10	Depressed	-	Unpaved	Unauthorized
136	143.000	143.100	6	10	Depressed	-	Unpaved	Unauthorized
137	143.800	143.900	8	11	Depressed	Yes	Unpaved	Unauthorized
138	144.100	144.200	14	11	Depressed	-	Unpaved	Unauthorized
139	145.500	145.600	6	11	Depressed	-	Unpaved	Unauthorized
140	146.900	147.000	17	10	Depressed	Yes	Unpaved	Unauthorized
141	148.200	148.300	7	10	Raised	-	Unpaved	Unauthorized
142	148.800	148.900	20	0.6	Raised	-	Paved	-
143	149.400	149.500	10	0.6	NJ CB	-	Paved	-
144	149.500	149.600	10	0.6	NJ CB	-	Paved	-
145	149.600	149.700	10	0.6	NJ CB	-	Paved	-
146	149.800	149.900	10	0.6	NJ CB	-	Paved	-
147	150.500	150.600	15	0.6	NJ CB	-	Paved	-

3.3.6 BUS BAYS / SHELTERS

During our site inventory, we have found 35 numbers of Bus Shelters as against 18 numbers of Bus Shelters with respect to the inventory details of the Concessionaire. Some of the shelters may have been constructed by local villagers.

The shelters seen at the site are of different variety. Some of them are of RCC structure, some of them have steel roof. The additional shelters appear to have been constructed recently and are also of a different design than those constructed by the Concessionaire initially. Also, it may be noted that proper bus bays are at only three locations. Summary of the Bus shelters is presented in **Table 3.8** below. Representative photographs of some of the Bus Shelters are presented in **Figures** below:

Fig 3.69: Bus Shelter at Ch 28+450

Fig 3.70: Bus Shelter at Ch 39+700

Fig 3.71: Bus Shelter at Ch 45+700

Fig 3.72: Bus Shelter at Ch 94+900

Fig 3.73: Bus Shelter at Ch 106+100

Fig 3.74: Bus Shelter at Ch 150+790

Table 3.8: Details of Bus Bays/Shelters

S.No.	Chainage (Km)	Side	Passenger Shelter Type		Passenger Shelter Condition		Entry / Exit (Taper Y/N)	Remark
			RCC	Steel	RCC	Steel		
1	26.300	LHS	-	Yes	-	Good	-	
2	28.450	LHS	-	Yes	-	Good	-	
3	39.700	LHS	-	Yes	-	Good	-	
4	44.800	RHS	-	Yes	-	Good	-	
5	45.700	LHS	-	Yes	-	Good	Yes	Bus Bay Provided, L=180m, W=3.5m
6	45.750	RHS	-	Yes	-	Good	-	

S.No.	Chainage (Km)	Side	Passenger Shelter Type		Passenger Shelter Condition		Entry / Exit (Taper Y/N)	Remark
			RCC	Steel	RCC	Steel		
7	45.900	RHS	-	Yes	-	Good	-	
8	49.150	LHS	-	Yes	-	Good		
9		RHS	-	Yes	-	Good	-	
10	50.660	RHS	-	Yes	-	Improvement Reqd.	-	
11	53.040	RHS	Yes	-	Improvement Reqd.	-	-	
12	53.050	LHS	Yes	-	Improvement Reqd.	-	-	
13	55.220	RHS		Yes	-	Good	-	
14	63.370	LHS	Yes	-	Improvement Reqd.	-	-	
15	65.625	LHS	-	Yes	-	Good	-	
16	71.010	LHS	-	Yes	-	Improvement Reqd.	Yes	Bus Bay Provided, L=150m, W=3.0m
17	71.053	RHS	-	Yes	-	Improvement Reqd.	Yes	Bus Bay Provided, L=180m, W=3.5m
18	76.930	LHS	-	Yes	-	Improvement Reqd.	-	
19	77.010	RHS	-	Yes	-	Improvement Reqd.	-	
20	88.500	LHS	-	Yes	-	Good	-	
21	93.400	LHS	-	Yes	-	Good	-	
22	94.900	LHS	Yes	-	Improvement Reqd.	-	-	
23	95.900	RHS	Yes	-	Good	-	-	
24	99.700	LHS	Yes	-	Good	-	-	
25	100.200	RHS	Yes	-	Good	-	-	
26	106.100	LHS	-	Yes	-	Good	-	
27	110.000	RHS	-	Yes	-	Good	-	

S.No.	Chainage (Km)	Side	Passenger Shelter Type		Passenger Shelter Condition		Entry / Exit (Taper Y/N)	Remark
			RCC	Steel	RCC	Steel		
28	112.700	LHS	-	Yes	-	Good	-	
29		RHS	Yes	-	Good	-	-	
30	115.100	LHS	-	Yes	-	Good	-	
31		RHS	-	Yes	-	Good	-	
32	124.300	LHS	-	Yes	-	Improvement Reqd.	-	
33	136.900	RHS	-	Yes	-	Improvement Reqd.	-	
34	140.250	RHS	-	Yes	-	Improvement Reqd.	-	
35	150.790	RHS	-	Yes	-	Good	Yes	

3.3.7 LONGITUDINAL ROADSIDE RCCPUCCA DRAIN

Representative photographs of some of the roadside drain sections are presented in **Figures** below:

Fig 3.75: Condition of Drain at Ch 57+500

Fig 3.76: Condition of Drain at Ch 134+500

Fig 3.77: Condition of Drain at Ch 149+500

Summary of Longitudinal Roadside RCC Drain is presented in **Table 3.9** below.

Table 3.9: Details of Longitudinal Roadside Pucca Drain

S.No.	Chainage (Km)		Length (m)	LHS /RHS / Median	Type	Cover / Open	Condition
	From	To					
1	15.500	15.800	300	Both Sides	CC	Cover	Cleaning required
2	18.900	19.500	600	Both Sides	CC	Cover	Cleaning required
3	57.250	58.350	1100	Both Sides	CC	Cover	Working
4	61.450	61.600	150	Both Sides	CC	Cover	Working
5	66.000	67.200	1200	Both Sides	CC	Cover	Working
6	134.300	134.900	600	Both Sides	CC	Cover	Working
7	148.900	150.710	1810	Both Sides	CC	Cover	Working
	Total Length (m)		**11520**				

3.3.8 SIGN BOARDS

Representative photographs of some of the sign boards are presented in **Figures** below:

Fig 3.78: Sign Board in Ch. 10-15

Fig 3.79: Sign Board in Ch. 25-30

Fig 3.80: Sign Board in Ch. 30-35

Fig 3.81: Sign Board at Ch. 46+050

Fig 3.82: Sign Board at Ch. 61+200

Fig 3.83: Sign Board at Ch. 65+300

Fig 3.84: Sign Board at Ch. 74+400

Fig 3.85: Sign Board at Ch. 98+750

Fig 3.86: Sign Board at Ch. 119+000

Fig 3.87: Sign Board at Ch. 124+500

Fig 3.88: Sign Board at Ch. 128+600

Fig 3.89: Sign Board at Ch. 140+000

The numbers of various types of Mandatory, Cautionary & Informatory Sign boards installed at site are summarized in **Table 3.10A** & **Table 3.10B** below.

Table 3.10A: Summary of Sign Boards Km 10 to Km 80

Sign Boards / Chainage (Km)	Total	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 55	55 to 60	60 to 65	65 to 70	70 to 75	75 to 80
Junction Ahead/Direction Informatory	**125**	17	9	9	6	8	10	8	4	11	5	7	7	10	14
Chevron	**143**	5	3	6	26	15	20	16	3	15	1	5	9	2	17
Go slow	**33**	2	2	2	2	1	4	2	1	6	1		5	2	3
State Highway	**47**	5	4	5	2	2	3	4	2	3	5	5		4	3
T/Y/+ -Junction	**25**	4	3		1	1	6	2	2	3		1			2
STOP	**5**			1	1					2				1	
Accident Prone area	**39**	2	1	2	4	2	5	3	2	3	4		3	3	5
OHM	**69**	20	15				5	1	5	11	3	4	1	1	3
Delineators	**22**	20													2
Gap in Median	**27**	10	5			2	3			2	2		3		
Solar Blinker	**11**	2			3	2	2	2							
Left/ Right Hand Curve	**49**	2	1	3	8	4	2	3	7	4	2	3	2		8
School Ahead	**7**	1	4	1					1						
Helpline No.	**11**	3	1	1			4		1						1
Stray Animal	**4**	1	2							1					
Overhead Gantry	**3**	1	1					1							
Cantilever Gantry	**5**		1				3	1							
Petrol Pump Sign Board	**6**		1	2	1					1		1			
Hotel Sign Board	**6**			3	1		2								
Toll Ahead Sign Board	**6**			2	1							3			

Sign Boards / Chainage (Km)	Total	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 55	55 to 60	60 to 65	65 to 70	70 to 75	75 to 80
Speed Breaker/Rumble Strip	**2**	1		1											
Toll rates/Exempt Veh.	**11**			3	3							5			
Rotary Sign Board	**3**				3										
Police Check Post	**7**		1				1		3		1				1
Pedestrian Crossing	**9**									1	4		2	1	1
Hospital	**2**								1				1		
Speed limit	**1**												1		

Table 3.10B: Summary of Sign Boards Km 80 to Km 150

Sign Boards / Chainage (Km)	Total	80 to 85	85 to 90	90 to 95	95 to 100	100 to 105	105 to 110	110 to 115	115 to 120	120 to 125	125 to 130	130 to 135	135 to 140	140 to 145	145 to 150
Junction Ahead/Direction Informatory	**124**	5	6	8	9	9	6	8	12	10	9	10	8	7	17
Chevron	**254**	18	40	40	6	4	52	18	13	22	14	5		21	1
Go slow	**32**	3	1	4	3	5		1	4	2		3	3		3
State Highway	**48**	1	5	2	5	4	3	5	7	5	2	3	2	1	3
T/Y/+ -Junction	**21**	4	1		2				5	1		2	2	2	2
U-Turn	**1**	1													
STOP	**1**	1													
Accident Prone area	**42**	1	1	5	4	5	2	3	3	4	1	4	4	2	3
OHM	**28**								1		7	5	4	8	3
Gap in Median	**20**	2	1	6	1	2	2			4					2
Solar Blinker	**3**									3					
Left/ Right Hand Curve	**89**	4	8	20	2	2	17	8	5	7	2		3	10	1

Sign Boards / Chainage (Km)	Total	80 to 85	85 to 90	90 to 95	95 to 100	100 to 105	105 to 110	110 to 115	115 to 120	120 to 125	125 to 130	130 to 135	135 to 140	140 to 145	145 to 150
School Ahead	**7**								2					3	2
Stray Animal	**10**	1		2	1	4	1	1							
Overhead Gantry	**1**														1
Cantilever Gantry	**6**										1			1	4
Petrol Pump Sign Board	**21**					5			2	4		1	4	1	4
Hotel Sign Board	**16**							1	2		2	1	1	5	4
Toll Ahead Sign Board	**3**											2	1		
Speed Breaker/Rumble Strip	**2**														2
Toll rates/Exempt Veh.	**5**											5			
Rotary Sign Board	**2**														2
Police Check Post	**7**			2				1		1	1	1	1		
Pedestrian Crossing	**1**														1
Hospital	**2**								2						
Bollard	**1**		1												
Speed limit	**5**						1	1	1	1		1			
Busbay/Shelter	**10**		3	1				2	2				2		

3.3.9 OVERHEAD GANTRY

Representative photographs of some of the cantilever gantries are presented in **Figures** below:

Fig 3.90: Overhead Signboard Ch. 17+400

Fig 3.91: Overhead Signboard Ch. 39+700

Fig 3.92: Overhead Signboard Ch. 149+200

Details of Cantilever gantries on the Project Road are presented in **Table 3.11** below.

Table 3.11: Details of Cantilever Gantries

S.No.	Chainage (Km)	CANTILEVER		S. No.	Chainage (Km)	CANTILEVER	
		LHS/RHS	Condition			LHS/RHS	Condition
1	17+400	RHS	Ok	6	140+200	LHS	Good
2	36+000	LHS	Ok	7	145+400	RHS	Fair
3	39+600	LHS	Ok	8	149+200	LHS	Good
4	39+700	RHS	Ok	9	149+900	LHS	Fair
5	127+700	LHS	Ok	10	150+500	LHS	Good

3.3.10 METAL BEAM CRASH BARRIERS

Representative photographs of some of the locations where MBCB has been provided are presented in **Figures** below:

Fig 3.93: MBCB at Ch. 34+600

Fig 3.94: MBCB at Ch. 38+300

Fig 3.95: MBCB at Ch. 41+650

Fig 3.96: MBCB at Ch. 88+850

Fig 3.97: MBCB at Ch. 105+100

Fig 3.98: MBCB at Ch. 117+960

Details of Metal Beam Crash Barriers (8619m length) at various locations are presented in **Table 3.12** below.

Table 3.12: Details of Metal Beam Crash Barriers

S.No.	Chainage (Km)		Total Length (m)	Side of MCW	End Treatment	Condition (Length of damage)	S.No.	Chainage (Km)		Total Length (m)	Side of MCW	End Treatment	Condition (Length of damage)
	From	To						From	To				
1	32+900	33+000	50	LHS	Yes	Good	48	89+300	89+400	100	LHS	Yes	Good
2	33+000	33+100	50	LHS	Yes	Good	49	89+400	89+500	100	LHS	Yes	Good
3	33+700	33+800	30	LHS	Yes	Good	50	89+900	90+000	100	LHS	Yes	Good
4	34+400	34+500	60	LHS	Yes	Good	51	90+000	90+100	70	LHS	Yes	Good
5	34+600	34+700	60	LHS	Yes	Good	52	91+300	91+400	100	LHS	Yes	Good
6	34+600	34+700	70	RHS	Yes	Good	53	91+300	91+400	100	RHS	Yes	Good
7	38+300	38+400	70	LHS	Damaged	10m damaged	54	91+400	91+500	100	LHS	Yes	Good
8	38+300	38+400	70	RHS	Yes	Good	55	91+400	91+500	100	RHS	Yes	Good
9	38+800	38+900	60	LHS	Yes	Good	56	91+500	91+600	100	LHS	Yes	Good
10	38+800	38+900	60	RHS	Yes	Good	57	91+500	91+600	100	RHS	Yes	Good
11	39+500	39+600	50	LHS	Yes	Good	58	91+600	91+700	100	LHS	Yes	Good
12	41+600	41+750	150	LHS	Damaged	10m damaged	59	91+600	91+700	100	RHS	Yes	Good
13	41+550	41+750	200	RHS	Yes	20m damaged	60	92+900	93+000	100	LHS	Yes	Good
14	44+300	44+400	50	RHS	Yes	20m damaged	61	92+900	93+000	100	RHS	Yes	Good
15	45+100	45+200	50	RHS	Yes	Good	62	93+000	93+100	100	LHS	Yes	Good
16	45+200	45+300	190	LHS	Yes	30m damaged	63	93+000	93+100	100	RHS	Yes	Good
17	45+200	45+300	190	RHS	Yes	30m damaged	64	93+100	93+200	100	LHS	Yes	Good
18	45+300	45+400	90	LHS	Yes	Good	65	93+100	93+200	100	RHS	Yes	Good
19	45+300	45+400	90	RHS	Yes	Good	66	93+200	93+300	100	LHS	Yes	Good
20	53+300	53+400	100	LHS	Yes	100m damaged	67	93+200	93+300	100	RHS	Yes	Good
21	53+300	53+400	100	RHS	Yes	Good	68	93+700	93+800	100	RHS	Yes	Good

S.No.	Chainage (Km)		Total Length (m)	Side of MCW	End Treatment	Condition (Length of damage)	S.No.	Chainage (Km)		Total Length (m)	Side of MCW	End Treatment	Condition (Length of damage)
	From	To						From	To				
22	53+400	53+500	100	LHS	Yes	Good	69	94+100	94+200	100	LHS	Yes	Good
23	53+400	53+500	100	RHS	Yes	Good	70	94+100	94+200	100	RHS	Yes	Good
24	53+500	53+600	100	LHS	Yes	30m damaged	71	94+200	94+300	100	LHS	Yes	Good
25	53+500	53+600	100	RHS	Yes	Good	72	94+200	94+300	100	RHS	Yes	Good
26	53+600	53+700	100	LHS	Yes	Good	73	94+300	94+400	100	LHS	Yes	Good
27	53+600	53+700	100	RHS	Yes	Good	74	94+300	94+400	100	RHS	Yes	Good
28	60+800	60+900	100	LHS	Yes	Good	75	94+400	94+500	100	LHS	Yes	Good
29	60+800	60+900	100	RHS	Yes	Good	76	94+400	94+500	100	RHS	Yes	Good
30	60+900	61+000	100	LHS	Yes	Good	77	105+000	105+100	100	LHS	Yes	Good
31	60+900	61+000	100	RHS	Yes	Good	78	105+000	105+100	100	RHS	Yes	Good
32	61+000	61+100	100	LHS	Yes	Good	79	105+100	105+200	100	LHS	Yes	Good
33	61+000	61+100	100	RHS	Yes	Good	80	105+100	105+200	100	RHS	Yes	Good
34	63+500	63+600	124	LHS	Yes	Good	81	107+800	107+900	50	LHS	Yes	Good
35	63+500	63+600	124	RHS	Yes	Good	82	107+800	107+900	50	RHS	Yes	Good
36	63+600	63+700	48	LHS	Yes	Good	83	117+900	118+000	60	LHS	Yes	Good
37	63+600	63+700	88	RHS	Yes	Good	84	117+900	118+000	60	RHS	Yes	Good
38	67+400	67+500	15	RHS	Yes	Good	85	118+000	118+100	70	LHS	Yes	Good
39	71+300	71+400	80	LHS	Yes	Good	86	125+900	126+000	60	RHS	Yes	Good
40	71+300	71+400	80	RHS	Yes	Good	87	126+000	126+100	70	RHS	Yes	Good
41	71+400	71+500	180	LHS	Yes	Good	88	126+600	126+700	80	RHS	Yes	Good
42	71+400	71+500	180	RHS	Yes	Good	89	126+900	127+000	60	LHS	Yes	Good
43	88+800	88+900	100	LHS	Yes	Good	90	127+000	127+100	60	RHS	Yes	Good
44	88+900	89+000	100	LHS	Yes	Good	91	127+100	127+200	60	LHS	Yes	Good

S.No.	Chainage (Km)		Total Length (m)	Side of MCW	End Treatment	Condition (Length of damage)	S.No.	Chainage (Km)		Total Length (m)	Side of MCW	End Treatment	Condition (Length of damage)
	From	To						From	To				
45	89+000	89+100	100	LHS	Yes	Good	92	128+500	128+600	80	RHS	Yes	30m damaged
46	89+100	89+200	100	LHS	Yes	Good	93	143+400	143+500	60	LHS	Yes	Good
47	89+200	89+300	100	LHS	Yes	Good	94	143+600	143+700	70	RHS	Yes	Good

3.3.11 HIGH MASTS

Representative photographs of some of the locations where high masts have been provided are presented in **Figures** below.

Fig 3.99: High mast at Ch. 25+400

Fig 3.100: High mast at Ch. 61+550

Fig 3.101: High mast at Ch. 148+600

Details of High Masts at various locations are presented in **Table 3.13** below.

Table 3.13: Details of High Masts

S.No	Chainage (Km)	Side	Village / Location	Height (m)	Lamps	Condition
1	25+400	LHS	Sehore Bypass Starts	15	4	Ok
2	41+800	RHS	Sehore Bypass Ends	15	4	Ok
3	61+550	RHS	Amlaha Toll Plaza	15	3	Ok
4	80+175	RHS	Shujalpur, Ashta	15	4	Ok
5	134+600	RHS	Bhourasa Toll Plaza	15	3	Ok
6	148+600	LHS	Indore Ujjain Flyover	15	6	Ok

3.3.12 KM STONES

Representative photographs of some of the Kilometre stones are presented in **Figures** below. It may be noted that the number of State Highway on the kilometre stones have been painted as SH-18.

Fig 3.102: Km. Stone at 13+000

Fig 3.103: Km. Stone at 32+000

Fig 3.104:Km. Stone at 39+000

Fig 3.105:Km. Stone at 43+000

Fig 3.106: Km. Stone at 119+000

Fig 3.107: Km. Stone at 148+000

Summary of numbers of Kilometre and Hectometre stones on the Project Road is presented in **Table 3.14** below.

Table 3.14: Details of Km / Hm Stones

S.No.	Chainage (Km)		No. of Kilometer Stone	No. of Hectometer Stone	S. No.	Chainage (Km)		No. of Kilometer Stone	No. of Hectometer Stone
	From	To				From	To		
1	10.000	20.000	18	69	9	90.000	100.000	20	65
2	20.000	30.000	17	61	10	100.000	110.000	19	64
3	30.000	40.000	18	62	11	110.000	120.000	20	54
4	40.000	50.000	20	72	12	120.000	130.000	20	69
5	50.000	60.000	13	59	13	130.000	140.000	19	70
6	60.000	70.000	18	56	14	140.000	150.000	13	45
7	70.000	80.000	20	65	15	150.000	150.790	-	0
8	80.000	90.000	20	74	-	-	-	-	-

3.4 OBSERVATIONS PERTAINING TO STRUCTURES

3.4.1 MAJOR BRIDGES

There are 4 numbers of Major Bridges on the Project Road. The condition survey of all these bridges on both the sides was conducted by us by visual inspection. The broad details of these Major Bridges have been outlined in **Table 3.15** below and some representative photographs presented in the **Figures** below.

Table 3.15: Details of Major Bridges

S. No	Location	Site Ch.	Str. No.	Type of Str.	Span Arrangement	Overall Length (m)	Carriageway Width (m) Each side	Overall width (m) Each side	Type of Super Structure	Type of Sub Structure	Railing / Crash Barrier
1	Ajnar River	53+300	54/1	MjB	4x21.6 m (LHS)	86.4 m	11.0m	12.0 m	RCC Slab with Girder	RCC Wall Type Abutments & RCC Piers with Circular Shaft	RCC Crash Barrier
					4x21.6 m (RHS)	86.4 m	11.0m	12.0 m			
2	Parvati River	77+850	78/1	MjB	5x21.6 m (LHS)	108 m	11.0m	12.0 m	RCC Slab with Girder	RCC Wall Type Abutments & RCC Piers with Circular Shaft	RCC Crash Barrier
					5x21.6 m (RHS)	109 m	11.0m	12.0 m			
3	Kalisindh River	121+120	122/1	MjB	5x21.6 m (LHS)	108 m	11.0m	12.0 m	RCC Slab with Girder	RCC Wall Type Abutments & RCC Piers with Circular Shaft	RCC Crash Barrier
					5x21.6 m (RHS)	109 m	11.0m	12.0 m			
4	Lodri River	128+510	129/1	MjB	4x13.5 m (LHS)	54 m	7.4m	8.4 m	RCC Slab with Girder	Stone Masonry Wall Type Abutments & Piers	RCC Crash Barrier
					6x12.6 m (RHS)	75.6 m	11.0m	12.0 m		RCC Wall Type Abutments & RCC Piers with Circular Shaft	

Fig 3.108A: MjB at Ch. 53+300 -Expansion joint, Deck view, MBCB

Fig 3.108B: MjB at Ch. 53+300–View of deck slab, View of underside of superstructure of bridge

Fig 3.109A: MjB at Ch. 77+850 –Condition of deck, crash barrier

Fig 3.109B: MjB at Ch. 77+850 –Drainage spout, View of underside of superstructure of bridge

Fig 3.110A: MjB at Ch 121+120–View of deck and underside of bridge

Fig 3.110B: MjB at Ch 121+120–Expansion joints & drainage spout, underside of superstructure of bridge

Fig 3.111A: MjB at Ch 128+510 – View of deck and underside of bridge

Fig 3.111B: MjB at Ch 128+510–Vegetation on abutments, minor repairs of substructure underway

3.4.2 MINOR BRIDGES

There are 17 numbers of Minor Bridges on the Project Road. The condition survey of all these bridges on both the sides was conducted by us by visual inspection. The broad details of these Minor Bridges have been outlined in **Table 3.16** below and some representative photographs presented in the **Figures** below.

Table 3.16: Details of Minor Bridges

S. No.	Chainage	Str. No.	Span Arrange-ment	Overall Length (m)	Carriageway Width (m) Each side	Overall width (m) Each side	Type of Super Structure	Type of Substructure	Railing / Crash Barrier
1	34+680	35/2	3x14.6 m (LHS)	43.8 m	11.0m	12.0 m	RCC Deck Slab with Girder	RCC Wall Type Abutments &RCC Piers with Circular Shaft	RCC Railings
			3x14.6 m (RHS)	43.8 m	11.0m	12.0 m			RCC Crash Barriers
2	38+350	39/1	1x21.0 m (LHS)	21.0 m	11.0m	12.0 m	RCC Deck Slab with Girder	PCC Wall Type Abutments	RCC Railings
			1x21.0 m (RHS)	21.0 m	11.0m	12.0 m			RCC Crash Barriers
3	38+850	39/2	2x14.7 m (LHS)	29.4 m	11.0m	12.0 m	RCC Deck Slab with Girder	PCC Wall Type Abutments & RCC Piers with Circular Shaft	RCC Railings
			2x14.7 m (RHS)	29.4 m	11.0m	12.0 m			RCC Crash Barriers
4	45+250	46/1	1x9.5 m (LHS)	9.5 m	11.0m	12.0 m	RCC Solid Slab	PCC Wall Type Abutments	RCC Crash Barriers
			1x9.5 m (RHS)	9.5 m	11.0m	12.0 m			
5	60+970	61/1	1x12.6 m (LHS)	12.6 m	11.0m	12.0 m	RCC Deck Slab with Girder	PCC Wall Type Abutments	RCC Crash Barriers
			1x12.6 m (RHS)	12.6 m	11.0m	12.0 m			

S. No.	Chainage	Str. No.	Span Arrange-ment	Overall Length (m)	Carriageway Width (m) Each side	Overall width (m) Each side	Type of Super Structure	Type of Substructure	Railing / Crash Barrier
6	63+550	64/1	1x12.6 m (LHS)	12.6 m	7.4m	8.4 m	RCC Solid Slab	Stone Masonry Wall Type Abutments	RCC Crash Barriers
			2x7.0 m (RHS)	14.0 m	11.0m	12.0 m		PCC Wall Type Abutments and Piers	
7	67+420	68/2	2x9.0 m	18.0 m	10.2m both sides	25.2m	RCC Solid Slab	Stone Masonry Wall Type Abutments and Pier widened with PCC	RCC Crash Barriers
8	71+450	72/1	3x12.5 m (LHS)	37.5 m	7.4m	8.4 m	RCC Solid Slab	PCC Wall Type Abutments and Piers	RCC Crash Barriers
			3x12.5 m (RHS)	37.5 m	11.0m	12.0 m	RCC Deck Slab with RCC Girder	RCC Wall Type Abutments & RCC Piers with Circular Shaft	
9	94+230	95/1	5x10.42 m (LHS)	52.1 m	9.7m	12.3 m	RCC Solid Slab	PCC Wall Type Abutments and Piers	RCC Crash Barriers
			5x10.42 m (RHS)	52.1 m	9.7m	12.3 m			
10	105+190	106/1	3x10.42 m (LHS)	31.26 m	11.0m	12.0 m	RCC Solid Slab	PCC Wall Type Abutments and Piers	RCC Crash Barriers
			3x10.42 m (RHS)	31.26 m	11.0m	12.0 m			
11	107+900	108/3	3x10.42 m (LHS)	31.26 m	11.0m	12.0 m	RCC Solid Slab	PCC Wall Type Abutments and Piers	RCC Crash Barriers
			3x10.42 m (RHS)	31.26 m	11.0m	12.0 m			
12	117+960	118/2	1x11.35 m (LHS)	11.35 m	11.0m	12.0 m	RCC Deck	PCC Wall Type	RCC Crash

S. No.	Chainage	Str. No.	Span Arrange-ment	Overall Length (m)	Carriageway Width (m) Each side	Overall width (m) Each side	Type of Super Structure	Type of Substructure	Railing / Crash Barrier
			1x11.35 m (RHS)	11.35 m	11.0m	12.0 m	Slab with Girder	Abutments	Barriers
13	122+860	123/1	1x12.6 m (LHS)	12.6 m	11.0m	12.0 m	RCC Deck Slab with Girder	PCC Wall Type Abutments	RCC Crash Barriers
			1x12.6 m (RHS)	12.6 m	11.0m	12.0 m			
14	126+570	127/2	1x10.6 m (LHS)	10.6 m	11.0m	12.0 m	RCC Solid Slab	PCC Wall Type Abutments	RCC Crash Barriers
			1x10.6 m (RHS)	10.6 m	11.0m	12.0 m			
15	127+010	128/1	2x4.5 m (LHS)	9.0 m	11.0m	12.0 m	Box Type	Box Type	RCC Crash Barriers
			2x4.5 m (RHS)	9.0 m	11.0m	12.0 m			
16	140+205	141/1	2x6.0 m (LHS)	12.0 m	11.0m	12.0 m	RCC Solid Slab	PCC Wall Type Abutments and Piers	RCC Crash Barriers
			2x6.0 m (RHS)	12.0 m	11.0m	12.0 m			
17	143+410	144/1	2x10.8 m (LHS)	21.6 m	11.0m	12.0 m	RCC Solid Slab	PCC Wall Type Abutments and Piers	RCC Crash Barriers
			2x10.8 m (RHS)	21.6 m	11.0m	12.0 m			

Fig 3.112: MnB Ch. 34+680–View of deck slab, underside of bridge

Fig 3.113: MnB Ch.38+350–Condition of expansion joints, View of deck slab and underside of bridge

Fig 3.114: MnB Ch.38+850–View of deck slab, drainage spout cleaning required, hazard marker

Fig 3.115: MnB Ch.45+250–Status of quadrant pitching & toe wall, erosion of embankment, view of deck slab

Fig 3.116: MnB Ch.60+970–View of underside of bridge, condition of expansion joints

Fig 3.117: MnB Ch.63+550 – View of deck slab, minor damages in crash barrier, view of underside of slab

Fig 3.118: MnB at 67+420–View of deck slab, minor damages in crash barrier, underside of box

Fig 3.119: MnB at 71+450–View of deck slab, view of underside of superstructure of bridge

Fig 3.120: MnB at 94+230–View of footpath and deck slab, view of underside of bridge

Fig 3.121: MnB at 105+190–View of deck slab, Minor repairs required on expansion joints, view of underside of bridge

Fig 3.122: MnB at 107+900–View of deck slab and underside of bridge, expansion joints buried

Fig 3.123: MnB at 117+960 – Condition of approaches, expansion joints buried, view of underside of bridge

Fig 3.124: MnB at 122+860–View of deck slab, condition of expansion joint, view of underside of bridge

Fig 3.125: MnB at 126+570–View of deck slab & approaches, view of underside of bridge

Fig 3.126: MnB at 127+010 – View of deck slab & approaches, view of underside of bridge

Fig 3.127: MnB at 140+205 – View of deck slab, minor vegetation in quadrants, view of underside of bridge

Fig 3.128: MnB at 143+410 – View of deck slab & underside of bridge

3.4.3 UNDERPASSES

There are 2 numbers of Underpasses on the Project Road. The condition survey of both these underpasses was conducted by us by visual inspection. The broad details of these Underpasses have been outlined in **Table 3.17** below and some representative photographs presented in the **Figures** below.

Table 3.17: Details of Underpasses

S. No.	Chainage	Type of Str.	Span Arrange-ment	Overall width of Structure	Type of Super Str.	Railing / Crash Barrier
1	94+330 (95/2)	VUP at Dodi	1x7.0mx4.5m	29.5m	Box Type	RCC Crash Barriers
2	67+250 (68/1)	PUP at Kotri	1x4.0mx3.5m	18 m	Box Type	RCC Crash Barriers at both sides and at the Median

Fig 3.129: VUP at 94+330 – General cleaning required in Quadrants, view of underside & deck slab of VUP

Fig 3.130: PUP at 67+250–View of underside of PUP, minor damages in crash barrier

3.4.4 SLAB CULVERTS

There are 53 numbers of Slab Culverts on the Project Road, the summarized information of which is presented in **Table 3.18** and some representative photographs presented in the **Figures** below.

Fig 3.131: SC at 10+050

Fig 3.132: SC at 13+370

Fig 3.133: SC at 15+850

Fig 3.134: SC at 16+830

Fig 3.135: SC at 21+580

Fig 3.136: SC at 39+820

Fig 3.137: SC at 49+750

Fig 3.138: SC at 51+500

Fig 3.139: SC at 62+160

Fig 3.140: SC at 100+600

Fig 3.141: SC at 102+870

Fig 3.142: SC at 114+900

Fig 3.143: SC at 115+650

Fig 3.144: SC at 125+400

Fig 3.145: SC at 142+050

Table 3.18: Summary of Slab Culverts

S. No.	Ch.	Type of Str.	Span Arrangement	S. No.	Ch.	Type of Str.	Span Arrangement
1	10+050	SC	1x5m	28	84+700	SC	1x4m
2	12+050	SC	1x8m	29	97+410	SC	1x3m
3	13+370	SC	1x5m	30	100+600	SC	1x3m
4	15+300	SC	1x4m	31	101+370	SC	1x5m
5	15+850	SC	3x3.4m	32	102+870	SC	1x6m
6	16+830	SC	3x3.2m (LHS), 3x2.5m (RHS)	33	111+140	SC	1x5m
7	17+135	SC	2x3.2m	34	112+240	SC	1x5m
8	18+560	SC	1x8.2m	35	112+960	SC	1x5m

S. No.	Ch.	Type of Str.	Span Arrangement	S. No.	Ch.	Type of Str.	Span Arrangement
9	20+600	SC	2x2.4m (LHS), 2x3.2m (RHS)	36	114+440	SC	1x5m
10	21+580	SC	2x2.4m (LHS), 2x2m (RHS)	37	114+900	SC	1x6m
11	22+670	SC	3x2.3m	38	115+650	SC	1x6m
12	24+650	SC	3x3m	39	116+040	SC	1x4m
13	33+100	SC	1x3m	40	119+030	SC	1x5m
14	36+250	SC	1x3m	41	125+400	SC	1x5m
15	39+820	SC	1x3m	42	125+995	SC	1x5m
16	42+000	SC	1x5m	43	130+800	SC	1x3m
17	42+550	SC	2x2.0m (LHS), 1x4m (RHS)	44	133+770	SC	1x4m
18	46+820	SC	1x3m	45	134+430	SC	1x3m
19	49+750	SC	1x5m	46	135+050	SC	1x3m
20	51+500	SC	1x5m	47	136+800	SC	1x4m
21	52+080	SC	1x6m	48	139+400	SC	1x6m
22	52+600	SC	1x6m	49	141+760	SC	1x4m
23	57+940	SC	1x3m	50	142+050	SC	1x4m
24	58+430	SC	1x3m	51	142+640	SC	1x6m
25	62+160	SC	1x5m (LHS), 1x4m (RHS)	52	143+940	SC	1x4m
26	75+525	SC	1x5m	53	144+370	SC	1x4m
27	76+850	SC	1x4m	---	---	---	---

3.4.5 HUME PIPE CULVERTS

There are 109 numbers of Hume Pipe Culverts on the Project Road, the summarized information of which is presented in **Table 3.19** and some representative photographs presented in the **Figures** below.

Fig 3.146: HPC at 14+100

Fig 3.147: HPC at 22+350

Fig 3.148: HPC at 32+010

Fig 3.149: HPC at 32+700

Fig 3.150: HPC at 48+150

Fig 3.151: HPC at 66+105

Fig 3.152: HPC at 84+470

Fig 3.153: HPC at 113+800

Fig 3.154: HPC at 121+730

Fig 3.155: HPC at 123+840

Fig 3.156: HPC at 141+510

Table 3.19: Summary of Hume Pipe Culverts

S. No.	Ch.	Type of Str.	Span Arrangement	S. No.	Ch.	Type of Str.	Span Arrangement
1	11+350	HPC	5x1.2m	56	79+510	HPC	3x1.2m
2	14+100	HPC	1x0.9m	57	79+620	HPC	3x1.2m
3	14+550	HPC	4x0.9m	58	80+975	HPC	3x1.2m
4	16+180	HPC	3x0.9m	59	81+205	HPC	3x1.2m
5	20+300	HPC	5x0.9m	60	81+620	HPC	3x1.2m
6	22+350	HPC	4x0.9m	61	82+100	HPC	2x1.0m
7	24+045	HPC	1x1.0m	62	84+200	HPC	1x1.0m
8	24+245	HPC	1x1.0m	63	84+470	HPC	2x1.0m
9	25+450	HPC	1x1.0m	64	86+800	HPC	1x1.0m
10	26+220	HPC	2x1.0m	65	87+900	HPC	2x1.0m
11	26+440	HPC	2x1.0m	66	89+040	HPC	1x1.0m
12	26+850	HPC	2x1.0m	67	89+300	HPC	1x1.0m
13	27+450	HPC	2x1.0m	68	91+270	HPC	2x1.0m
14	27+870	HPC	1x1.0m	69	96+440	HPC	2x1.0m
15	28+720	HPC	3x1.0m	70	97+850	HPC	1x1.0m
16	28+930	HPC	1x1.0m	71	98+610	HPC	1x1.0m
17	29+230	HPC	2x1.0m	72	99+320	HPC	3x1.2m
18	29+680	HPC	2x1.0m	73	100+100	HPC	1x1.0m

S. No.	Ch.	Type of Str.	Span Arrangement	S. No.	Ch.	Type of Str.	Span Arrangement
19	30+200	HPC	1x1.0m	74	100+270	HPC	2x1.2m
20	31+020	HPC	2x1.0m	75	103+260	HPC	1x1.0m
21	32+010	HPC	3x1.0m	76	104+075	HPC	1x1.0m
22	32+250	HPC	1x1.0m	77	105+895	HPC	1x1.0m
23	32+700	HPC	2x1.0m	78	107+010	HPC	2x1.0m
24	33+330	HPC	2x1.0m	79	107+640	HPC	1x1.0m
25	33+450	HPC	2x1.0m	80	108+540	HPC	2x1.0m
26	34+100	HPC	1x1.0m	81	108+540	HPC	2x1.0m
27	35+130	HPC	2x1.0m	82	109+710	HPC	2x1.0m
28	36+050	HPC	1x1.0m	83	113+400	HPC	1x1.0m
29	37+150	HPC	1x1.0m	84	113+800	HPC	3x1.2m
30	39+630	HPC	1x1.0m	85	113+950	HPC	3x1.2m
31	41+350	HPC	3x1.0m	86	116+550	HPC	1x1.0m
32	41+700	HPC	1x1.0m	87	117+420	HPC	1x1.0m
33	43+150	HPC	4x1.2m	88	119+190	HPC	2x1.0m
34	43+650	HPC	1x1.0m	89	119+600	HPC	1x1.0m
35	48+150	HPC	2x1.2m	90	119+830	HPC	2x1.0m
36	53+400	HPC	6x1.0m	91	120+540	HPC	2x1.2m
37	53+900	HPC	2x1.2m	92	121+730	HPC	1x1.2m
38	54+620	HPC	1x1.2m	93	123+500	HPC	2x1.0m

S. No.	Ch.	Type of Str.	Span Arrangement	S. No.	Ch.	Type of Str.	Span Arrangement
39	55+805	HPC	3x1.0m	94	123+840	HPC	1x1.2m
40	56+610	HPC	3x1.0m	95	124+730	HPC	2x1.2m
41	64+630	HPC	3x1.0m	96	125+050	HPC	3x1.2m
42	65+210	HPC	3x1.0m	97	126+100	HPC	1x1.2m
43	66+105	HPC	3x1.0m	98	129+080	HPC	2x1.2m
44	68+080	HPC	1x1.0m	99	129+220	HPC	3x1.2m
45	68+510	HPC	2x1.0m	100	133+150	HPC	1x1.0m
46	68+800	HPC	1x1.0m	101	138+300	HPC	1x1.0m
47	70+150	HPC	1x1.0m	102	138+870	HPC	4x1.2m
48	73+155	HPC	2x1.0m	103	141+510	HPC	2x1.2m
49	74+180	HPC	3x1.0m	104	144+820	HPC	1x1.2m
50	74+590	HPC	1x1.0m	105	145+650	HPC	3x1.2m
51	74+830	HPC	2x1.0m	106	146+070	HPC	2x1.2m
52	75+200	HPC	2x1.0m	107	146+660	HPC	1x1.2m
53	76+020	HPC	1x1.0m	108	147+100	HPC	2x1.2m
54	78+280	HPC	1x1.2m	109	147+620	HPC	4x1.2m
55	78+950	HPC	3x1.2m	---	---	---	---

It is found that the structures are mostly in good condition with requirements pertaining mainly to routine maintenance/minor repairs. The issues identified during the condition assessment are summarized as under.

a) Quadrant pitching is seen to be covered with vegetation. At some locations, minor repairs are required at quadrant pitching and toe wall.
b) Some expansion joints have been covered with the wearing coat and are required to be cleaned.
c) Minor repairs are required at some locations on Railing /RCC Crash Barrier/Parapets.
d) Repairs are required in the bed protection work at some locations.
e) Cleaning/clearing of the waterway is required.

As informed by the Concessionaire, the routine cleaning of the structures and waterway is carried out before and after monsoon. The observations pertaining to cleaning of the waterway/quadrant pitching, etc will be taken up by the Concessionaire before monsoon and other minor repairs are being taken up by the Concessionaire under Routine Maintenance. Moreover, it is noted that the Concessionaire had awarded a Contract for all such rectification & repair works other than the routine maintenance works for major structures to ***M/s Sunrise Engineering,*** Ghaziabad. The same has been completed.

3.5 SUMMARY OF INVENTORY

The summary of the Project Road inventory assessed by RCSPL is presented in **Table 3.20** below.

Table 3.20: Summary of Project Road inventory assessed by RCSPL

S. No	Description	Unit	Assessed by RCSPL
1	Service Roads	km	9.09
2	Major Junctions	Nos.	19
3	Minor Junctions	Nos.	70
4	Hume Pipe Culverts	Nos.	109
5	Slab Culverts	Nos.	53
6	Major Bridges	Nos.	4

S. No	Description	Unit	Assessed by RCSPL
7	Minor Bridges	Nos.	17
8	Underpasses – VUP	Nos.	1
9	Underpasses – PUP	Nos.	1
10	Service Roads Drains (RCC Drain)	m	10620
11	Overhead Gantry	Nos.	4
12	High mast lighting	Nos.	6
13	W-beam Steel Crash Barriers	m	8619
14	Bus Shelters	Nos.	35
15	Truck Lay Byes	Nos.	1
16	By Pass details	Km	29.420

3.6 TOLL PLAZA WORKING STATUS

There are three Toll Plazas, at Km 25+000 (Village Fanda), at Km 61+550 (Village Amlaha) and at Km 134+600 (Bhourasa) on the Project Road. Open system of Toll collection has been provided at the Plazas. There are total of 8 (eight) lanes having a Semi-automated System with the necessary equipment for registering vehicle classification, ticket issuing, data processing and power supply.

Fig 3.157A: Toll Plaza at Fanda (Km 25+000)

Fig 3.157B: Toll Plaza at Fanda (Km 25+000)


Fig 3.158A: Toll Plaza at Amlaha (Km 61+550)



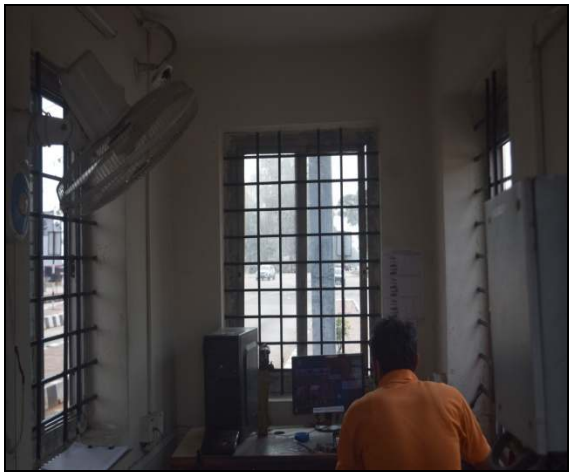

Fig 3.158B: Toll Plaza at Amlaha (Km 61+550)

Fig 3.159A: Toll Plaza at Bhourasa (Km 134+600)


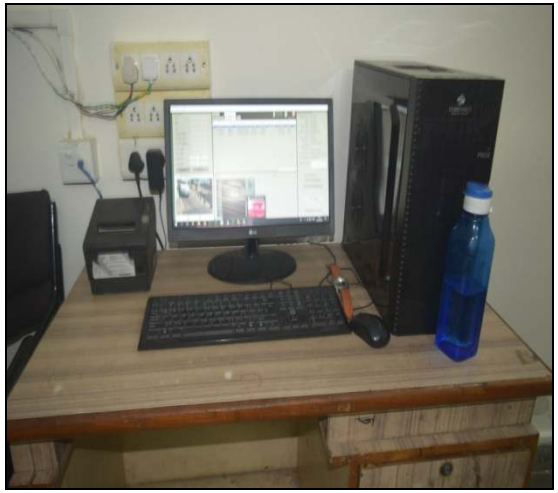
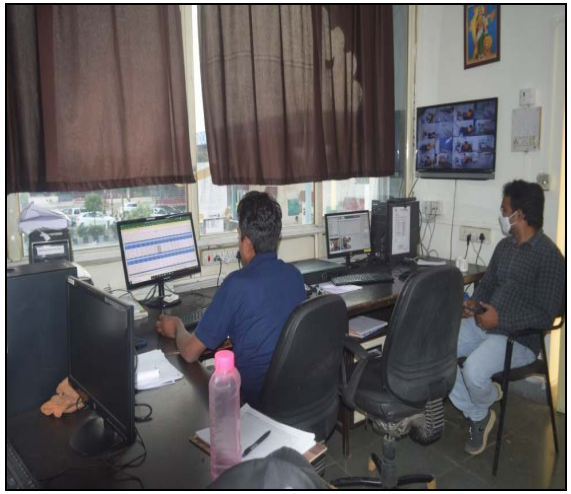

Fig 3.159B: Toll Plaza at Bhourasa (Km 134+600)

3.6.1 Toll Management System

The Concessionaire has installed a semi-automatic and hybrid system for toll collection, such that manual collection and Electronic (Fastag) collection can be done on the same lane.

3.6.2 Available modes of toll collection

In semi-automatic lanes, Toll can be collected via cash, smart card (monthly pass), Paytm. Hybrid lanes are facilitated with Fastag for payments.

3.6.3 Booth Operational steps in Semi-Automatic Lane (TMS)

(i) Operator after login activates the lane and its equipment like Boom barriers, OHLS (Over Head Lane Status), and AVC, etc.
(ii) The vehicle stops near the booth window and provides either cash, smart card, or scans the QR code for payment through the wallet.
(iii) In the case of cash the required fee is deducted by the operator and desired change amount is returned.
(iv) A transaction receipt is provided as proof of fee payment.
(v) During the transaction process the LPR camera records the License plate details.
(vi) The boom barrier opens-up and the vehicle then moves towards the Loop sensor.
(vii) Once the vehicle crosses over the sensor section the boom barrier closes automatically and vehicle classification is done simultaneously.
(viii) The incident camera captures the details of the vehicle while it exits the sensor loop.

3.6.4 Booth Operational steps in Hybrid Lane (ETMS)

(i) The RFID trans-receiver reads the Fastag data and deducts the desired amount directly from the bank account linked with Fastag and the user receives the transaction message for the same.
(ii) In case of any violation or un-readable Fastag, a handheld Fastag reader is used to complete the transaction.
(iii) Other steps are the same as mentioned in the above section (i) & (ii)

3.6.5 Review on Fanda, Amlaha and Bhourasa Toll Plaza

The primary focus of the exercise was to check the various equipments installed in Toll Plaza and their functioning. Details pertaining to lane level equipments for all the three plazas are furnished in the Volume-II of this Report.

3.6.5.1 Condition of the Equipments in Fanda and Amlaha Toll Plaza

All 8 lanes are hybrid with ETMS i.e. equipped with RFID trans-receivers. Toll lane controllers are facilitated with the latest desired industrial-grade equipments. All desired cameras including the plaza surveillance camera were working satisfactorily.

AVC, Loop sensors are working satisfactorily in all lanes. All lanes are equipped with desired cameras like LPR, Incident Capturing and Booth Camera, etc., and are working satisfactorily.

Plaza surveillance camera is installed at desired distance and height and found working satisfactorily. All live recordings can be observed in the control room.

Both the toll plazas have dedicated workstation and room for Server, MIS, and validators. Computers being used in all the workstations are configured as per requirement and provided with Licensed Softwares. The servers of both the toll plaza are secured with the firewall security system.

Concessionaire has already given a proposal to MPRDC for up-gradation of the Toll Management System at Fanda and Amlaha Toll Plaza under COS. However, the up-gradation of Fanda and Amlaha Toll Plaza has been completed by the Concessionaire on its own cost as the COS is not approved by MPRDC.

3.6.5.2 Condition of the Equipments in Bhourasa Toll Plaza

All 8 lanes are hybrid with ETMS i.e. equipped with RFID trans-receivers. Toll lane controllers are facilitated with the latest desired industrial-grade equipments. All desired cameras including the plaza surveillance camera were working satisfactorily. Some of the Overhead Lane status lights need up-gradation. All other equipments like boom barrier, pole traffic light are working satisfactorily.

3.6.6 EDI Connectivity

In all three Toll Plazas a database access has been provided to the Authority where they can view their desired data with simple database login credentials.

Tunnels have not been provided in any of the 3 Toll Plazas.

3.6.7 Comments and Observations

Up-gradation of Toll collection system is in progress at site. Now all 24 lanes are ETC enabled. AVCC will be there in all 24 lanes. The summarized details in respect of Toll Plazas are presented in **Table 3.21** below.

Table 3.21: Details of Toll Plazas

S. No.	Description		Toll Plaza-1, (Fanda)	Toll Plaza-2, (Amlaha)	Toll Plaza-3, (Bhourasa)	Remarks
1	Location (Design Chainage)		25+000	61+550	134+600	
2	Total Length (m)		100m	300m	300m	
3	Type (Staggered / Straight)		Straight	Straight	Straight	
4	Straight Dimension	Length (m)	100	300	300	
		Width (m)	50	50	50	
5	Toll Lane Width - Left	Lane-1	3.5	3.5	3.5	
		Lane-2	3.5	3.5	3.5	
		Lane-3	3.5	3.5	3.5	
		Lane-4	5.5	5.5	5.5	For large veh.
6	Toll Lane Width - Right	Lane-1	3.5	3.5	3.5	
		Lane-2	3.5	3.5	3.5	
		Lane-3	3.5	3.5	3.5	
		Lane-4	5.5	5.5	5.5	For large veh.

S. No.	Description		Toll Plaza-1, (Fanda)	Toll Plaza-2, (Amlaha)	Toll Plaza-3, (Bhourasa)	Remarks
7	Toll Island	Width of Island	1.9	1.9	1.9	
		Width of Centre Island	1.9	1.9	1.9	
		Condition	Okay	Okay	Okay	
8	Pavement	Type	CC	CC	CC	
		Condition	LHS Panel damaged	Panels damaged on B/s	LHS Panel damaged	
9	Toll Booths	Numbers	7	7	7	
		Condition	Okay	Okay	Okay	
10	Condition of Sign Boards at the Plaza		Okay	Okay	Okay	
11	Lifting Barriers	Numbers	4+4	4+4	4+4	
		Condition	Okay	Okay	Okay	
12	Signal Posts	Numbers	4+4	4+4	4+4	
		Condition	Okay	Okay	Okay	
13	WIM	Numbers	Not Prov.	Not Prov.	Not Prov.	
		Condition	-	-	-	
14	Whether ATMS Installed and Condition		No	No	No	
15	Condition of Lined Drain		-	Fair	-	
16	Lighting Facilities		Yes	Yes	Yes	
17	Any Other Remarks		Nil	Nil	Nil	

The details pertaining to Toll Plaza equipments, WIM, TMS installed on the site are presented in **Table 3.22A, B & C** below.

Table 3.22A: Details of Equipments at Fanda Toll Plaza

Plaza Level Equipment: Fanda Toll Plaza			
S. No	**Item / Equipment Description**	**Working / Non-working / Qty**	**Remark**
1	Plaza Server in hot standby configuration	1	4GB, 32GB, 2012, R2 HP, Xenon Licensed
2	Network Printer	Yes / 3	
3	Static Weigh Bridge	No	
4	Broadband Internet connection with minimum 2Mbps	Yes / 2	Broadband + FTTH
5	Working of Software - Plaza Level	Yes	
6	42" /55" LED Display for CCTV monitoring	Yes	
7	Network Video Recorder (NVR) for CCTV	Yes	
8	CCTV Camera for Plaza Building surveillance	Yes	
9	Work station for POS	Yes	2500, D2, Win7
10	Work station for Auditor	Yes	4500, i3, W10
11	Work station for MIS	Yes	4500, i3, W10
12	Intercom in Control Room	Yes	
13	Hand-held RFID readers	Yes / 2	
14	Outdoor Wi-Fi access point	Yes	
15	Plaza surveillances PTZ Camera	Yes	Above section of booth not clear, lighting issue
16	Internet router for connection to the CCH	Yes	
17	Plaza UPS	Yes	15KV/45 minute Backup
18	24 Port Network switches	Yes	
19	Any additional / special arrangement for Fastag Link		No
20	Any MPRDC Guidelines pertaining to Fastag		No
21	High mast lights		No
22	Length of cable from booths to plaza via any other way		70m
23	Equipments and staff insurance		Yes

Table 3.22B: Details of Equipments at Amlaha Toll Plaza

Plaza Level Equipment: Amlaha Toll Plaza			
S. No	**Item / Equipment Description**	**Working / Non-working / Qty**	**Remark**
1	Plaza Server in hot standby configuration	1	3GB, 1TB, 2012, R2 HP, Xenon Licensed
2	Network Printer	Yes / 3	
3	Static Weigh Bridge	No	
4	Broadband Internet connection with minimum 2Mbps	Yes / 2	Broadband + FTTH
5	Working of Software - Plaza Level	Yes	
6	42" /55" LED Display for CCTV monitoring	Yes	
7	Network Video Recorder (NVR) for CCTV	Yes	
8	CCTV Camera for Plaza Building surveillance	Yes	
9	Work station for POS	Yes	4GB, 500GB, core i3, Win10
10	Work station for Auditor	Yes	4500, i3, W10
11	Work station for MIS	Yes	4500, i3, W10
12	Intercom in Control Room	Yes	
13	Hand-held RFID readers	Yes /2	
14	Outdoor Wi-Fi access point	Yes	
15	Plaza surveillance PTZ Camera	Yes	
16	Internet router for connection to the CCH	Yes	
17	Plaza UPS	Yes	15KV/45 minute Backup
18	24 Port Network switches	Yes	
19	Any additional / special arrangement for Fastag Link		No
20	Any MPRDC Guidelines pertaining to Fastag		No
21	High mast lights		Yes
22	Length of cable from booths to plaza via any other way		70m
23	Equipments and staff insurance		Yes

Table 3.22C: Details of Equipments at Bhourasa Toll Plaza

Plaza Level Equipment: Bhourasa Toll Plaza			
S. No	**Item / Equipment Description**	**Working / Non-working / Qty**	**Remark**
1	Plaza Server in hot standby configuration	1	3GB, 1TB, 2012, R2 HP, Xenon Licensed
2	Network Printer	Yes/3	
3	Static Weigh Bridge	No	

Plaza Level Equipment: Bhourasa Toll Plaza			
S. No	**Item / Equipment Description**	**Working / Non-working / Qty**	**Remark**
4	Broadband Internet connection with minimum 2Mbps	Yes/2	Broadband + FTTH
5	Working of Software - Plaza Level	Yes	
6	42" /55" LED Display for CCTV monitoring	Yes	
7	Network Video Recorder (NVR) for CCTV	Yes	
8	CCTV Camera for Plaza Building surveillance	Yes	
9	Work station for POS	Yes	4GB, 500GB, core i3, Win10
10	Work station for Auditor	Yes	4500, i3, W10
11	Work station for MIS	Yes	4500, i3, W10
12	Intercom in Control Room	Yes	
13	Hand-held RFID readers	Yes/2	
14	Outdoor Wi-Fi access point	Yes	
15	Plaza surveillances PTZ Camera	Yes	
16	Internet router for connection to the CCH	Yes	
17	Plaza UPS	Yes	15KV/45 minute Backup
18	24 Port Network switches	Yes	
19	Any additional / special arrangement for Fastag Link		No
20	Any MPRDC Guidelines pertaining to Fastag		No
21	High mast lights		Yes
22	Length of cable from booths to plaza via any other way		70m
23	Equipments and staff insurance		Yes

CHAPTER 4.0: REVIEW OF AS-BUILT DRAWINGS

4.1 REVIEW OF DESIGNS AND AS-BUILT DRAWINGS

Following as-built drawings for highways and structures prepared and furnished by the Concessionaire (as per **Table 4.1** below) were studied by us and our observations for the same have been presented in the subsequent paragraphs below. The remaining drawings could not be provided as the same were not available with the Concessionaire.

Table 4.1: List of reviewed as-built drawings

S. No.	Highways	S. No.	Structures	
A.	P&P of section: Bairagarh (10+000) to Start of Sehore Bypass (25+400)	A.	Drawings of Homogeneous Section 3 (D. Ch 81+600 to D. Ch 150+790)	
B.	P&P of section: Start of Sehore Bypass (25+400) to crossing of Dewas Bypass (148+500)	i)	Major Bridges	2 Nos.
	---	ii)	Minor Bridges	9 Nos.
	---	iii)	Slab Culverts	26 Nos.

4.1.1 AS-BUILT DRAWINGS OF HIGHWAYS

We have received the Plan & Profile as-built drawings from Ch 10+000 (Bairagarh) to Ch 25+400 (Start of Sehore Bypass) and from Km Ch 25+400 (Start of Sehore Bypass) to Ch 148+500 (crossing of Dewas bypass).A comparison on the development provisions mentioned in the Technical Schedules of Concession Agreement and as provided in the as-built drawings have been presented in **Table 4.2** below.

Table 4.2: Review of As-Built drawings for Highways

S. No.	Name of Item		As per Agreement Schedule		As per as-built Drawing				Deficiency	Remarks
1	Project Length		142.60km		140.790km but as-built P&P drawing reviewed for 138.50km (P&P drawing of stretch from Dewas bypass to Junction with NH-3 not reviewed)					Length got revised as per COS Order
2	Design Speed		IRC: 73-1980		IRC: 73-1980				Nil	
	i) Plain Ter.		100/80		100/80					
3	Hori. Curves		360/230		6 nos. curves are having radius below desirable limits (less than 360m): 13+960 (355m), 48+000 (290m), 57+260 (290m), 78+810 (350m), 118+590 (230m) & 123+000 (250m)				Nil	All curves improved as per plain terrain
	i) Plain Ter.									
4	Max. Grade of Vert. Curves		Ruling 3.3% for Plain & Rolling		Under Limits				Nil	
5	Sharp horizontal curve improvement	S. No	Chainage	Location	S. No.	Chainage	Location	Radius	Nil	All curves radii have been improved as per IRC-73.
		1	40.3	Existing Bypass	1	40+300	Sharp curve improved by introducing horizontal curve having radius as mentioned in the column to the right	355m		
		2	42.6	Existing Bypass Rafiqgunj	2	42+600		400m		
		3	54.3	Near Sonda Village	3	54+300		400m		
		4	68.1	Near Kotri Village	4	68+100		400m		
		5	78.1	Ashta Bypass	5	78+100		500m		
		6	86.3	Near Hotel Midway	6	86+300		400m		
		7	86.8	Near Hotel Midway-Pagriyachor Village- Hill	7	86+800		400m		
		8	88.7	Hill	8	88+700		400m		
		9	89.7	Rupeta Village	9	89+700		350m		
		10	90	Rupeta Village	10	90+000		350m		

S. No.	Name of Item	As per Agreement Schedule			As per as-built Drawing				Deficiency	Remarks
		11	91.8	Fudra Village	11	91.8		400m		
		12	92.1	Fudra Village	12	92.1		400m		
		13	92.8	Fudra Village	13	92.8		400m		
		14	93.5	Up to Dodi Village	14	93.5		350m		
		15	94.9	Up to Dodi Village	15	94.9		400m		
		16	95.5	Up to Dodi Village	16	95.5		400m		
6	Design of pavement (Design MSA and crust details)	Flexible pavement design as per IRC-37 or AASHTO			Flexible pavement design as per IRC-37. Overlay over existing carriageway.					The Pavement Design Report & the TCS drawings were not available for review. This crust composition is seen as per unsigned documents available.
		Rigid pavement as per IRC or AASHTO			Rigid pavement as per IRC 58-2002					
		90 MSA for flexible pavement			90 MSA for flexible pavement (CBR 10%)					
		10 MSA for Service road			10 MSA for Service road (CBR 10%)					
		The composition and thickness of various layers of pavement shall not be less than those required as per IRC 37.			**MCW**			**Service Road**		
					BC = 40mm			BC = 40mm		
					DBM = 140mm			DBM = 85mm		
					WMM = 250mm			WMM = 250mm		
					GSB = 200mm			GSB = 200mm		
					SG = 500mm			SG = 500mm		
					Total = 1130mm			Total = 1075mm		
7	Major Junctions	**S. No**	**Ch.**	**Location of the Junction**	**S. No.**	**Ch.**	**Location of the Junction**		It is seen from the P&P that most of the Major Junctions do not	As-built drawings of junctions not available. We have reviewed the P&P drawings of
		1	18/6	Bakaniya Bypass	1	17+400	Bakaniya/Bhopal Bypass			
		2	26/4	Start of Sehore Bypass	2	25+450	Start of Sehore Bypass			
		3	43/2	End of Sehore Bypass	3	41+800	End of Sehore Bypass			
		4	78/8	Start of Ashta Bypass	4	77+210	Start of Ashta Bypass			
		5	84/4	End of Ashta Bypass	5	81+510	End of Ashta Bypass			

S. No.	Name of Item	As per Agreement Schedule			As per as-built Drawing			Deficiency	Remarks
		6	106/8	Start of Mehatwada Bypass	6	104+400	Start of Mehatwada Bypass	have provision of acc/dec lanes & channelizing islands.	the Main Carriageway.
		7	108/6	End of Mehatwada Bypass	7	106+000	End of Mehatwada Bypass		
		8	122/4	Start of Sonkatchh Bypass	8	119+050	Start of Sonkatchh Bypass		
		9	124/8	End of Sonkatchh Bypass	9	122+550	End of Sonkatchh Bypass		
		10	150/8	Dewas Bypass NH-3 + SH	10	148+600	Start of Dewas Bypass		
8	Minor Junctions	All Minor intersections given in Annexure-E-3 (35nos) shall be improved			39 Nos. Minor junctions as per as-built drawing.				
9	Truck Lay-bye	One Truck lay-bye is proposed in the Project Road. (Given at Ch. 92+000 on RHS).			No Truck lay-bye is shown in the as-built drawing. However, one non-standard Truck lay-bye is seen at site at Ch 92+000 on RHS.			Non-standard	
10	Bus Bays	18 nos. Bus bays are proposed on the Project Road.			No Bus bays have been shown in the as-built drawing. However, 35 bus shelters including 3 bus-bays are seen at site.			No island seen in bus-bays	
11	Toll Plaza	**S. No**	**Chainage**		**S.No**	**Design Chainage**		The tapering portion is not as per Manual	
		1	Between Lalghati Sq to End of Sehore Bypass		1	25+000 Fanda village (450m before the start of Sehore Bypass)			
			(Location of TP: Start of Sehore Bypass)						
		2	End of Sehore Bypass to End of Ashta Bypass		2	61+550 (Amlaha village)			
			(Location of TP: in Between Km. 60-65)						
		3	End of Ashta Bypass to Start of Dewas Bypass		3	134+600 (Bhourasa village)			
			(Location of TP: in between Km. 136 to 140)						

4.1.2 AS-BUILT DRAWINGS OF STRUCTURES

As-built drawings of structures in homogeneous section 3 (Ch 81+600 to Ch 150+790) were made available to us for review. Our observations on the development provisions mentioned in the Technical Schedules of Concession Agreement with respect to as-built drawings/site inventory have been presented in **Table 4.3** below.

Table 4.3: Review of As-Built details for Structures

S. No.	Type of Str.	Proposal as per Agreement Schedule							As per Site Inventory					
		S. No	Old Str No.	Type of Bridge	Prop. Span	Prop. Length	Proposal	Remarks	S. No	Design Ch.	Type of Bridge	Span	Prov. Length	Remarks
1	Major Bridge		**4 Nos.**							**4 Nos.**				
		1	55/4	RCC T-Girder	5x16.6	83	New	Ajnar River	1	53+300	RCC T-Girder	4x21.6	86	Ajnar River
		2	79/4	RCC T-Girder	5x21.6	108	New	Parvati River	2	77+850	RCC T-Girder	5x21.6	108	Parvati River
		3	124/2	RCC T-Girder	5x21.6	108	New	Kalisindh River	3	121+120	RCC T-Girder	5x21.6	108	Kalisindh River
		4	131/8	RCC T-Girder	6x21.6	75.6	New on one side	Lodri River	4	128+510	RCC T-Girder	6x12.6	75.6	Lodri River
2	Minor Bridge		**16 Nos.**							**17 Nos.**				
		1	37/2	Girder	3x14.5	43.5	New		1	34+680	Girder	3x14.6	43.8	It is noted that there is lot of variation in
		2	40/2	Girder	1x21.5	21.5	New		2	38+350	Girder	1x21.0	21	
		3	40/10	Girder	1x15	15	New		3	38+850	Girder	2x14.7	29.4	
		4	46/10	Slab	1x9	9	Recon		4	45+250	Slab	1x9.5	9.5	
		5	62/8	Slab	1x9	9	Recon		5	60+970	Slab	1x12.6	12.6	

S. No.	Type of Str.	Proposal as per Agreement Schedule							As per Site Inventory					
		S. No	Old Str No.	Type of Bridge	Prop. Span	Prop. Length	Proposal	Remarks	S. No	Design Ch.	Type of Bridge	Span	Prov. Length	Remarks
		6	65/4	Girder	1x12.6	12.6	Recon		6	63+550	Slab	1x12.6 (LHS), 2x7.0 (RHS)	12.6, 14.0	the chainages, span length and span arrangement of the as-built structures as compared to the provision in the Schedule.
		7	69/2	Slab	2x9	18	Recon		7	67+420	Slab	2x9.0	18	
		8	73/2	Girder	3x12.6	37.8	Recon		8	71+450	Slab	3x12.5	37.5	
		9	97/6	Girder	3x16.6	49.8	Recon		9	94+230	Slab	5x10.42	52.1	
		10	108/6	Girder	3x12.6	37.8	Recon		10	105+190	Slab	3x10.42	31.26	
		11	111/2	Girder	3x12.6	37.8	Recon		11	107+900	Slab	3x10.42	31.26	
		12	121/2	Girder	1x12.6	12.6	Recon		12	117+960	Girder	1x11.35	11.35	
		13	126/2	Girder	1x12.6	12.6	Recon		13	122+860	Girder	1x12.6	12.6	
		14	129/8	Slab	1x9	9	Recon		14	126+570	Slab	1x10.6	10.6	
		15	130/2	Slab	1x9	9	Recon		15	127+010	Box	2x4.5	9	
		16	131/8	Girder	4x12.6	50.4	Recon		16	140+205	Slab	2x6.0	12	
									17	143+410	Slab	2x10.8	21.6	
3	Underpasses		**Nil**							**2 Nos.**				
									1	94+230	VUP	1x7x4.5	7	Under COS
									2	67+250	PUP	1x4x3.5	4	
4	Culverts	1	79 Nos.	Slab					1	53 Nos.	Slab			
		2	86 Nos.	HPC					2	109 Nos.	HPC			

4.2 REVIEW OF PAVEMENT DESIGN REQUIREMENTS

As per Clause 5.1 of Schedule-J of the Concession Agreement, the Pavement Design was to be based on the following two parameters:

a) Traffic Forecast : As per Detailed Project Report or any higher value as assessed by the Concessionaire (minimum 90MSA for MCW and 25MSA for Service Roads) – As per revised specification, Design Traffic for Service Road is to be kept as 10MSA instead of 25MSA.

b) Design Life : ***20 years*** for Flexible Pavement, ***30 years*** for Rigid Pavement

It is noted that the Design Life specified is 20 years whereas the Design Period is 25 years. However, the Concession Agreement also provides minimum Design MSA of 90 MSA. Looking to the traffic on the Project Road, the Pavement Design of 90 MSA will be adequate even for 25 years.

4.2.1 FLEXIBLE PAVEMENT REQUIREMENTS – MCW & SERVICE ROADS

The Flexible Pavement for Main Carriageway and Service Roads has been provisioned to be designed as per IRC method or the AASHTO method. The composition and thickness of various layers of pavement shall not be less than those required as per IRC: 37 for minimum design traffic of 90MSA for MCW and 25MSA for Service Roads.(As per revised specification, design traffic for Service Road is to be kept as 10MSA instead of 25MSA).The Concessionaire should however satisfy himself in this regard and should consider higher traffic (than minimum specified 90MSA) for design purposes in case required, as per projected traffic considering 20 years design life. In the Appendix J-2 of Schedule J of the Concession Agreement, the geometric parameters and standards have been specified.

4.2.2 FLEXIBLE PAVEMENT REQUIREMENTS – EXISTING CARRIAGEWAY

Strengthening of existing Flexible Pavement was provisioned to be done with a bituminous overlay designed in accordance with IRC: 81 or procedures specified by the Asphalt Institute, USA or any other international method. However the Clause 5.1 (c) (ii) specifies minimum requirements of profile: camber of 2.5% minimum for the cross profile and vertical curves as per geometric design with minimum 30m straight length between two curves for the longitudinal profile.

4.2.3 RIGID PAVEMENT REQUIREMENTS

Rigid Pavement was provisioned to be done in accordance with IRC, AASHTO or any other international code/specification considering 30 years Design Life. However, the table in Appendix J-1 of Schedule-J of the Concession Agreement specifies the IRC codes to be followed in the design of road works.

4.2.4 PAVEMENT DESIGN FOR MAIN CARRIAGEWAY

The Pavement Design Report and the TCS drawings were not available for review. We have however; been able to procure some unsigned documents of the TCS. Based on the documents available, it was observed that the Flexible Pavement for Main Carriageway and Service Roads seems to have been designed as per IRC: 37-2001. The composition and thickness of various layers of pavement appears to have been provided as per charts given in the code. On the new carriageway, the pavement crust was for a traffic of 90MSA and the provided crust composition was 40mm BC, 140mm DBM, 250mm WMM, 200mm GSB over 500mm Subgrade having 10% CBR.

4.2.5 PAVEMENT CRUST FOR MAIN CARRIAGEWAY

The Pavement Design Report prepared by the Concessionaire and submitted to the IE was not available with us for review. The entire road was to be designed as flexible pavement except for Toll Plaza area where it was to be designed as rigid pavement.

The Concession Agreement specifies that the Flexible Pavement has to be designed in accordance with IRC 37 for minimum design traffic of 90MSA for Main Carriageway and 10MSA for Service Roads. The road is to be designed for a design life of 20 years. With a Subgrade having 10% CBR, the pavement design as per IRC: 37-2001 gives a total pavement crust thickness of 630mm (50mm BC, 130mm DBM, 250mm WMM, 200mm GSB) for a design traffic of 100MSA.The total bituminous layer is 180mm. We have been able to obtain some unsigned TCS drawings of the Project Road (The approved/as-built TCS drawings are not available with the Concessionaire). The pavement crust adopted as per these TCS is summarized in the **Table 4.4** below. The provided crust thickness is 630mm (with total bituminous layer being 180mm) and so the adopted crust composition in accordance with the codal provisions.

Table 4.4: Summary of Flexible Pavement Design

:

Typical Cross Section Bhopal-Dewas							
Sr. No.	**TCS Type**	**Description**	**LHS**		**RHS**		**Service Road Crust**
			Proposal	**Crust Composition**	**Proposal**	**Crust Composition**	
1	TCS-1	Sehore Bypass (Strengthening the existing Carriageway and provided additional Carriageway	Strengthening of existing Carriageway	BC - 40 mm DBM- 50 to 100 mm (Camber/Profile correction from BM)	Additional New Carriageway	BC - 40 mm DBM - 150 mm WMM - 250 mm GSB - 200 mm SG - 500 mm	

Typical Cross Section Bhopal-Dewas							
Sr. No.	**TCS Type**	**Description**	**LHS**		**RHS**		**Service Road Crust**
			Proposal	**Crust Composition**	**Proposal**	**Crust Composition**	
2	TCS-2	Raising Existing Road and Providing Additional Carriageway in Rural Area	New Carriageway	BC - 40 mm DBM - 140 mm WMM - 250 mm GSB - 200 mm SG - 500 mm	New Carriage way	BC - 40 mm DBM - 140 mm WMM - 250 mm GSB - 200 mm SG - 500 mm	
3	TCS-3	TCS for Bypasses (Ashta, Mehatwada, Sonkatchh, Sonda, Dodi)&Realign ment Sections	New Carriageway	BC - 40 mm DBM - 140 mm WMM - 250 mm GSB - 200 mm SG - 500 mm	New Carriage way	BC - 40 mm DBM - 140 mm WMM - 250 mm GSB - 200 mm SG - 500 mm	
4	TCS-4	Concentric Widening with Rigid Pavement in Urban Area	Widening	PQC - 320 mm DLC - 150 mm GSB - 200 mm SG - 500 mm	Widenin g	PQC - 320 mm DLC - 150 mm GSB - 200 mm SG - 500 mm	BC - 40 mm DBM - 85 mm WMM - 250 mm GSB - 200 mm SG - 500 mm
5	TCS-5	Strengthening the Existing Carriageway and Providing Additional Carriageway	Strengthe ning of existing Carriageway	BC - 40 mm DBM- 100 mm	Addition al New Carriage way	BC - 40 mm DBM - 140 mm WMM - 250 mm GSB - 200 mm SG - 500 mm	
6	TCS-6	Concentric Widening - Rural Areas	Widening	BC - 40 mm DBM - 140 mm WMM - 250 mm GSB - 200 mm SG - 500 mm	Widenin g	BC - 40 mm DBM - 140 mm WMM - 250 mm GSB - 200 mm SG - 500 mm	
7	TCS-7	Strengthening of Existing Road from Km. 6/800 to Km. 26/400 (Lalghati to Sehore Bypass Start)	Strengthe ning of existing Carriageway	BC - 40 mm DBM - 50 to 80 mm (Camber/Profil e Correction with BM)	Strength ening of existing Carriage way	BC - 40 mm DBM - 50 to 80 mm (Camber/Profi le Correction with BM)	

Typical Cross Section Bhopal-Dewas							
Sr. No.	TCS Type	Description	LHS		RHS		Service Road Crust
			Proposal	Crust Composition	Proposal	Crust Composition	
8	TCS-8	Concentric Widening with Flexible Pavement in Dewas Town Portion from Km. 151/300 to 154/000 (2.7 km)	Widening	BC - 40 mm DBM - 140 mm WMM - 250 mm GSB - 200 mm SG - 500 mm	Widening	BC - 40 mm DBM - 140 mm WMM - 250 mm GSB - 200 mm SG - 500 mm	BC - 40 mm DBM - 85 mm WMM - 250 mm GSB - 200 mm SG - 500 mm

4.2.6 RIGID PAVEMENT DESIGN FOR TOLL PLAZA AREAS

The Rigid Pavement for MCW seems to have been designed with thickness of PQC as 320mm over DLC layer of thickness 150mm and GSB of 200mm thickness. The CC road has been designed for 30 years. The crust composition is in line with the codal requirements. The summary of pavement design has been shown below in **Table 4.5**.

Table 4.5: Summary of Rigid Pavement Crust Composition

CBR	10	%
Granular Sub Base (GSB)	200	mm
Dry Lean Concrete layer	150	mm
Polythene Layer between PQC and DLC	125	micron
Thickness of Pavement Quality Concrete	320	mm

4.2.7 CONCLUSIONS ON REVIEW OF PAVEMENT DESIGN

The Pavement Design of the Flexible and Rigid Pavements seems to have been done in accordance with the relevant codes and also satisfying the provisions laid down in the Concession Agreement.

4.3 REVIEW OF STRUCTURE DESIGN REQUIREMENTS

4.3.1 GENERAL DESIGN REQUIREMENTS

As per Schedule-J of the Concession Agreement, the design standards and loading to be considered for culverts, bridges, underpasses and retaining walls shall be those laid down in the relevant IRC codes. Any existing bridge found to be structurally unsafe and / or deficient to carry the IRC design load shall be replaced or rehabilitated. The table in Appendix J-1 of Schedule-J of the Concession Agreement specifies the IRC codes to be followed in the design of structures.

Note by RCSPL: The Detailed Design Calculations of the Project Road were not available with us for review, so we have no information related to the design basis for the existing structures required to be retained/widened. In the absence of this information, it is not possible to ascertain the design life of such structures. However, the Clause 7.1 of Schedule-J of Concession Agreement has specified that any existing bridge found to be structurally unsafe and/or deficient to carry the IRC design load (based on Non-Destructive Testing including full scale load testing) shall be replaced or rehabilitated. The Concessionaire with the consultation of IE during construction therefore can be deemed to have made an appropriate assessment related to the structural condition of the structures. The assessment of the condition of structures is also the responsibility of the Concessionaire during the O&M period also.

4.3.2 SPECIAL DESIGN REQUIREMENTS

a) As per the Schedule-J of the Concession Agreement, NP4 pipes are to be used for all pipe culverts that are required to be reconstructed. In case of existing culverts which are in sound condition functioning satisfactorily, be extended using NP4 class pipes of existing diameter. For all pipe culverts having pipe diameter less than 900mm, these shall be replaced by pipes of 1000mm diameter (NP4) under both the carriageways. Also, the minimum diameter of pipes for new/reconstruction pipe culverts shall be of 1200mm.
b) Where a new structure is constructed alongside an existing structure or culvert, the profiles of the new and existing structures and their approaches shall be same. Also, suitable protection of the embankment between the structures in the median portion shall be provided either by extending the abutment wall or by a median wall.
c) Bridge superstructure may be of RCC, PCS or steel-concrete composite construction. The substructure and foundations may also be concrete, steel or steel-concrete composite construction.
d) Bearings of all bridges shall be easily accessible for inspection and maintenance.
e) Existing expansion joints should be working at all times and shall be timely replaced without causing additional stresses for the structure.

4.4 REVIEW OF STRUCTURE DRAWINGS

4.4.1 MAJOR AND MINOR BRIDGES

There are 4 Major Bridges and 17 Minor Bridges which have been reconstructed 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 Features have been considered.

The abutments for the Major Bridges have been designed as box type. Piers have been designed as circular columns. The Foundations are open type and the superstructure is T-Type Girder with RCC slabs. Following design parameters have been considered.

a) Material :M30 Concrete for Piers, Abutments, Pier & Abutment Caps, Superstructure, M35 for Bearing Pedestal, M40 for Crash Barrier, PCC M15 for Return Walls.
b) Cover R/f : 75mm on earthen face & foundation, 40mm on front face of stem
c) Loading : DL, Earth pressure, SIDL, Impact Load, Vehicular Load (One lane of Class 70R plus one lane of IRC Class A OR three lanes of IRC Class A loads)
d) SBC considered : Varying from 70T/m^2 to 90T/m^2
e) Bearings : Elastomeric bearings
f) Expansion joints : Strip seal type

The abutments and piers for the Minor Bridges have been designed as PCC Type. The Foundations are open type and the superstructure is RCC slabs. Following design parameters have been considered.

a) Material : PCC M15 for Piers, Abutments, M30 for Pier & Abutment Caps, Superstructure, M35 for Bearing Pedestal, M40 for Crash Barrier, PCC M15 for Return Walls.
b) Cover R/f : 75mm on earthen face & foundation, 40mm on front face of stem
c) Loading : DL, Earth pressure, SIDL, Impact Load, Vehicular Load (One lane of Class 70R plus one lane of IRC Class A OR three lanes of IRC Class A loads)
d) SBC considered : Varying from 30/m^2 to 90T/m^2
e) Bearings : Tar paper
f) Expansion joints : Strip seal type

4.4.2 REVIEW OF AS-BUILT DRAWINGS OF MAJOR STRUCTURES

The as-built drawings of some of the major structures have been studied and the constructed structures appear to be in order.

4.4.3 SLAB CULVERTS

There are 53Slab Culverts constructed at site. The codes which have been followed for the design are IRC: 78-2000, IRC: 6-2000 and IRC: 21-2000. Following Design Features have been considered.

a) Material : PCC M15 for Abutments & wing walls, M30 for Abutment caps and Superstructure, M40 for Crash Barrier
b) Reinforcement : Skin reinforcement provided
c) Loading : DL, Earth Pressure, Vertical load due to backfill soil, LL Surcharge

4.4.4 REVIEW OF AS-BUILT DRAWINGS OF SLAB CULVERTS

The as-built drawings of some of the Slab Culverts have been studied and the constructed culverts appear to be in order.

4.4.5 HYDROLOGICAL ADEQUACY OF STRUCTURES

The Hydrology calculations of the structures were not available with us for review. Also, there is no data pertaining to hydrological calculations (Discharge, Catchment, Scour Depth, etc.) in the as-built drawings of the Major Structures (Major and Minor Bridges) made available to us. However from our assessment of condition of structures during the site inventory, we are of the view that almost all structures are high level and the design of these structures must have been done by fulfilling the requirements of hydrology.

4.5 CONCLUSIONS ON REVIEW OF DRAWINGS

As per the Concession Agreement, the structures have been designed for loading as per IRC: 6-2000. In the present day however, IRC: 6-2017 is used for the designs. Special Vehicle (SV) loading has been included in the latest code. The Concessionaire needs to take this into account while allowing over-dimensional/overweight vehicles to pass through the Project Road.

Apart from the above, on the basis of the review of available 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.

CHAPTER 5.0: OPERATION & MAINTENANCE

5.1 OPERATIONS – REQUIREMENTS OF CONCESSION AGREEMENT

The Scope of Works for O&M stage has been mentioned in the Schedule-M 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 permitting smooth and uninterrupted flow of traffic during normal operating conditions, functioning of Toll system including charging and collecting the fees from road user, 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

As per the Concession Agreement, Periodic Maintenance for the carriageway with 25mm BC shall be carried out as required and at least once in ***six years*** from COD and in the last year of Concession Period. Road marking as specified and other roadside features shall also be restored to meet the relevant standards. This Periodic Maintenance shall also include profile corrective course of overlays with the periodic renewal of the wearing course of the road pavement and the wayside amenities.

The periodic renewal shall result in improvement of the riding quality, road roughness value to 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 2010 and the (proposed extended) Concession Period ends in December 2033, the Periodic Maintenance activity needs to be carried out in the years 2016and in 2033-34.The Concessionaire is however, required to carry out Preventive Maintenance as when required. The Concessionaire has carried out the first Major Maintenance in the year 2016-17. The Concessionaire has thereafter done Renewal works under Preventive/Major Maintenance, in the year 2019-20 and 2020-21 in a stretch of 81km (29% of total 281.6km of 2-lane length) and 62km (22% of total 281.6km 2-lane length) respectively. The Concessionaire has also done Renewal works under Preventive/Major Maintenance in the present year 2021-22 in a stretch

of 85km (29% of total 281.6km of 2-lane length)till Jan 2022, and has planned to complete Renewal works for full Project Road length by June 2022.

5.3 DETAILS OF LATEST BBD TESTS

The Benkelman Beam Deflection studies have been carried out by the Concessionaire in November 2021 (in the period of 10.11.2021to 26.11.2021). A summary of the same has been presented in **Table 5.1** below.

Table 5.1: Summary of latest BBD Tests conducted in November 2021

Sr. No.	D. Chainage		Side	Characteristic Deflection (mm)	Side	Characteristic Deflection (mm)
	From	To				
1	10	11	LHS	0.583	RHS	0.583
2	11	12	LHS	0.548	RHS	0.546
3	12	13	LHS	0.532	RHS	0.559
4	13	14	LHS	0.542	RHS	0.589
5	14	15	LHS	0.504	RHS	0.505
6	15	16	LHS	0.573	RHS	0.572
7	16	17	LHS	0.530	RHS	0.540
8	17	18	LHS	0.601	RHS	0.518
9	18	19	LHS	0.586	RHS	0.556
10	19	20	LHS	0.576	RHS	0.552
11	20	21	LHS	0.555	RHS	0.732
12	21	22	LHS	0.577	RHS	0.565
13	22	23	LHS	0.719	RHS	0.558
14	23	24	LHS	0.573	RHS	0.507
15	24	25	LHS	0.534	RHS	0.509
16	25	26	LHS	0.550	RHS	0.626
17	26	27	LHS	0.512	RHS	0.601
18	27	28	LHS	0.569	RHS	0.566
19	28	29	LHS	0.567	RHS	0.524
20	29	30	LHS	0.527	RHS	0.515
21	30	31	LHS	0.589	RHS	0.562
22	31	32	LHS	0.590	RHS	0.564
23	32	33	LHS	0.610	RHS	0.573
24	33	34	LHS	0.569	RHS	0.571
25	34	35	LHS	0.572	RHS	0.533
26	35	36	LHS	0.586	RHS	0.539
27	36	37	LHS	0.552	RHS	0.555
28	37	38	LHS	0.515	RHS	0.509
29	38	39	LHS	0.573	RHS	0.611
30	39	40	LHS	0.531	RHS	0.746
31	40	41	LHS	0.516	RHS	0.509

Sr. No.	D. Chainage		Side	Characteristic Deflection (mm)	Side	Characteristic Deflection (mm)
	From	To				
32	41	42	LHS	0.500	RHS	0.508
33	42	43	LHS	0.525	RHS	0.576
34	43	44	LHS	0.506	RHS	0.725
35	44	45	LHS	0.575	RHS	0.603
36	45	46	LHS	0.546	RHS	0.518
37	46	47	LHS	0.538	RHS	0.563
38	47	48	LHS	0.543	RHS	0.602
39	48	49	LHS	0.564	RHS	0.615
40	49	50	LHS	0.580	RHS	0.545
41	50	51	LHS	0.541	RHS	0.547
42	51	52	LHS	0.551	RHS	0.560
43	52	53	LHS	0.539	RHS	0.552
44	53	54	LHS	0.530	RHS	0.587
45	54	55	LHS	0.569	RHS	0.723
46	55	56	LHS	0.587	RHS	0.503
47	56	57	LHS	0.565	RHS	0.532
48	57	58	LHS	0.578	RHS	0.569
49	58	59	LHS	0.527	RHS	0.531
50	59	60	LHS	0.562	RHS	0.527
51	60	61	LHS	0.569	RHS	0.544
52	61	62	LHS	0.620	RHS	0.526
53	62	63	LHS	0.553	RHS	0.541
54	63	64	LHS	0.539	RHS	0.540
55	64	65	LHS	0.529	RHS	0.536
56	65	66	LHS	0.510	RHS	0.522
57	66	67	LHS	0.547	RHS	0.562
58	67	68	LHS	0.525	RHS	0.574
59	68	69	LHS	0.574	RHS	0.588
60	69	70	LHS	0.534	RHS	0.566
61	70	71	LHS	0.557	RHS	0.557
62	71	72	LHS	0.562	RHS	0.569
63	72	73	LHS	0.569	RHS	0.531
64	73	74	LHS	0.556	RHS	0.561
65	74	75	LHS	0.578	RHS	0.541
66	75	76	LHS	0.556	RHS	0.551
67	76	77	LHS	0.537	RHS	0.511
68	77	78	LHS	0.539	RHS	0.509
69	78	79	LHS	0.574	RHS	0.536
70	79	80	LHS	0.512	RHS	0.547
71	80	81	LHS	0.541	RHS	0.515

Sr. No.	D. Chainage		Side	Characteristic Deflection (mm)	Side	Characteristic Deflection (mm)
	From	To				
72	81	82	LHS	0.559	RHS	0.537
73	82	83	LHS	0.563	RHS	0.544
74	83	84	LHS	0.533	RHS	0.551
75	84	85	LHS	0.535	RHS	0.528
76	85	86	LHS	0.540	RHS	0.550
77	86	87	LHS	0.528	RHS	0.531
78	87	88	LHS	0.550	RHS	0.539
79	88	89	LHS	0.556	RHS	0.552
80	89	90	LHS	0.546	RHS	0.543
81	90	91	LHS	0.545	RHS	0.548
82	91	92	LHS	0.551	RHS	0.553
83	92	93	LHS	0.537	RHS	0.554
84	93	94	LHS	0.559	RHS	0.583
85	94	95	LHS	0.527	RHS	0.536
86	95	96	LHS	0.553	RHS	0.560
87	96	97	LHS	0.546	RHS	0.509
88	97	98	LHS	0.566	RHS	0.548
89	98	99	LHS	0.556	RHS	0.520
90	99	100	LHS	0.563	RHS	0.510
91	100	101	LHS	0.528	RHS	0.505
92	101	102	LHS	0.585	RHS	0.565
93	102	103	LHS	0.546	RHS	0.577
94	103	104	LHS	0.558	RHS	0.566
95	104	105	LHS	0.534	RHS	0.550
96	105	106	LHS	0.710	RHS	0.551
97	106	107	LHS	0.512	RHS	0.505
98	107	108	LHS	0.543	RHS	0.567
99	108	109	LHS	0.586	RHS	0.588
100	109	110	LHS	0.575	RHS	0.746
101	110	111	LHS	0.560	RHS	0.553
102	111	112	LHS	0.569	RHS	0.564
103	112	113	LHS	0.564	RHS	0.559
104	113	114	LHS	0.531	RHS	0.591
105	114	115	LHS	0.501	RHS	0.552
106	115	116	LHS	0.550	RHS	0.581
107	116	117	LHS	0.531	RHS	0.594
108	117	118	LHS	0.582	RHS	0.534
109	118	119	LHS	0.588	RHS	0.583
110	119	120	LHS	0.582	RHS	0.539
111	120	121	LHS	0.543	RHS	0.542

Sr. No.	D. Chainage		Side	Characteristic Deflection (mm)	Side	Characteristic Deflection (mm)
	From	To				
112	121	122	LHS	0.549	RHS	0.520
113	122	123	LHS	0.575	RHS	0.567
114	123	124	LHS	0.558	RHS	0.517
115	124	125	LHS	0.562	RHS	0.556
116	125	126	LHS	0.586	RHS	0.550
117	126	127	LHS	0.533	RHS	0.596
118	127	128	LHS	0.556	RHS	0.585
119	128	129	LHS	0.549	RHS	0.559
120	129	130	LHS	0.553	RHS	0.536
121	130	131	LHS	0.558	RHS	0.570
122	131	132	LHS	0.529	RHS	0.585
123	132	133	LHS	0.519	RHS	0.559
124	133	134	LHS	0.558	RHS	0.542
125	134	135	LHS	0.528	RHS	0.580
126	135	136	LHS	0.561	RHS	0.533
127	136	137	LHS	0.557	RHS	0.577
128	137	138	LHS	0.531	RHS	0.508
129	138	139	LHS	0.524	RHS	0.534
130	139	140	LHS	0.560	RHS	0.559
131	140	141	LHS	0.568	RHS	0.593
132	141	142	LHS	0.508	RHS	0.554
133	142	143	LHS	0.507	RHS	0.545
134	143	144	LHS	0.565	RHS	0.543
135	144	145	LHS	0.534	RHS	0.601
136	145	146	LHS	0.539	RHS	0.560
137	146	147	LHS	0.537	RHS	0.579
138	147	148	LHS	0.559	RHS	0.508
139	148	149	LHS	0.604	RHS	0.574
140	149	150	LHS	0.555	RHS	0.592
141	150	150.790	LHS	0.540	RHS	0.531
	Average Deflection (mm)			**0.554**		**0.558**

As per Schedule-M of the Concession Agreement, wherever the characteristic deflection exceeds 0.8mm, a bituminous overlay shall be provided appropriately designed according to IRC 81-1997. From the above Table, it can be seen that the deflection values are within the acceptable limit. Thus there is no requirement of any overlay as per the BBD test results.

5.4 LATEST ROUGHNESS MEASUREMENT STUDIES

Roughness Measurement by using 5th 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 fall below the prescribed acceptable Roughness Values given in Table M-2 of the Concession Agreement. The Acceptable values and Desirable values of Roughness are 3000mm/km and 2000mm/km (allowable tolerance is +/- 5%) respectively. Also, the surface roughness shall not exceed 1000mm in any 200m length during the service life of the pavement at any time.

The latest Roughness Measurement Report made available to us is for studies done in the month of November 2021 (10.11.2021 to 11.11.2021). The Calibrated Roughness values mm/km for both the carriageways have been represented in **Table 5.2** below.

Table 5.2: Latest Roughness Measurement Values

S.No	Chainage		Calculated UI/Km		S. No	Chainage		Calculated UI/Km	
	From	To	LHS	RHS		From	To	LHS	RHS
1	10	11	1864	1859	72	81	82	1874	1843
2	11	12	1854	1869	73	82	83	1823	1797
3	12	13	1895	1864	74	83	84	1859	1848
4	13	14	1874	1848	75	84	85	1879	1859
5	14	15	1838	1817	76	85	86	1879	1828
6	15	16	1879	1854	77	86	87	1817	1812
7	16	17	1854	1833	78	87	88	1885	1874
8	17	18	1838	1848	79	88	89	1817	1843
9	18	19	1854	1890	80	89	90	1843	1802
10	19	20	1864	1854	81	90	91	1848	1854
11	20	21	1838	1869	82	91	92	1838	1812
12	21	22	1890	1874	83	92	93	1823	1781
13	22	23	1843	1812	84	93	94	1869	1828
14	23	24	1879	1895	85	94	95	1838	1823
15	24	25	1890	1874	86	95	96	1885	1838
16	25	26	1833	1869	87	96	97	1843	1781
17	26	27	1833	1869	88	97	98	1828	1874
18	27	28	1869	1833	89	98	99	1848	1843
19	28	29	1869	1854	90	99	100	1854	1792
20	29	30	1848	1838	91	100	101	1885	1802
21	30	31	1854	1843	92	101	102	1833	1879
22	31	32	1854	1874	93	102	103	1848	1873
23	32	33	1817	1807	94	103	104	1895	1859
24	33	34	1848	1854	95	104	105	1859	1864
25	34	35	1859	1854	96	105	106	1854	1828
26	35	36	1817	1838	97	106	107	1843	1833
27	36	37	1874	1854	98	107	108	1854	1807
28	37	38	1864	1864	99	108	109	1812	1812
29	38	39	1879	1843	100	109	110	1817	1797

S.No	Chainage		Calculated UI/Km		S. No	Chainage		Calculated UI/Km	
	From	To	LHS	RHS		From	To	LHS	RHS
30	39	40	1843	1854	101	110	111	1864	1864
31	40	41	1864	1864	102	111	112	1812	1802
32	41	42	1843	1859	103	112	113	1895	1812
33	42	43	1885	1838	104	113	114	1833	1817
34	43	44	1859	1854	105	114	115	1833	1843
35	44	45	1859	1848	106	115	116	1848	1817
36	45	46	1854	1843	107	116	117	1833	1807
37	46	47	1854	1838	108	117	118	1859	1833
38	47	48	1874	1833	109	118	119	1838	1838
39	48	49	1874	1854	110	119	120	1828	1823
40	49	50	1817	1854	111	120	121	1848	1823
41	50	51	1890	1812	112	121	122	1843	1848
42	51	52	1833	1874	113	122	123	1864	1833
43	52	53	1843	1900	114	123	124	1859	1859
44	53	54	1869	1864	115	124	125	1843	1833
45	54	55	1869	1859	116	125	126	1874	1879
46	55	56	1869	1854	117	126	127	1838	1843
47	56	57	1823	1854	118	127	128	1848	1797
48	57	58	1833	1812	119	128	129	1864	1843
49	58	59	1859	1869	120	129	130	1838	1854
50	59	60	1869	1802	121	130	131	1833	1843
51	60	61	1854	1874	122	131	132	1879	1833
52	61	62	1905	1885	123	132	133	1854	1817
53	62	63	1859	1864	124	133	134	1869	1854
54	63	64	1874	1838	125	134	135	1854	1916
55	64	65	1854	1859	126	135	136	1838	1864
56	65	66	1843	1828	127	136	137	1859	1854
57	66	67	1828	1817	128	137	138	1859	1874
58	67	68	1848	1900	129	138	139	1838	1854
59	68	69	1869	1843	130	139	140	1838	1874
60	69	70	1864	1854	131	140	141	1838	1869
61	70	71	1859	1823	132	141	142	1817	1848
62	71	72	1838	1854	133	142	143	1885	1885
63	72	73	1869	1807	134	143	144	1854	1848
64	73	74	1854	1833	135	144	145	1838	1859
65	74	75	1869	1838	136	145	146	1812	1854
66	75	76	1864	1807	137	146	147	1833	1802
67	76	77	1848	1812	138	147	148	1843	1848
68	77	78	1838	1859	139	148	149	1838	1848
69	78	79	1854	1817	140	149	150	1848	1812

S.No	Chainage		Calculated UI/Km		S. No	Chainage		Calculated UI/Km	
	From	To	LHS	RHS		From	To	LHS	RHS
70	79	80	1838	1823	141	150	150.79	1824	1830
71	80	81	1843	1807		**Maximum Value**		**1905**	**1916**
72	81	82	1874	1843		**Average Value**		**1853**	**1843**

As seen from above, the maximum Roughness Values on LHS and RHS carriageway are seen to be 1905mm/km and 1916mm/km respectively which are within the Acceptable Range. The pavement surface on an average is seen to have a Roughness Value of 1853mm/km and 1843mm/km on LHS and RHS respectively which also are within the Acceptable Range. Thus as per the Roughness measurement studies also, no requirement of overlay is suggested.

5.5 ASSESSMENT OF TRAFFIC GROWTH RATES

The data pertaining to vehicle passing from start of tolling (2010-11) upto end of December 2021was furnished to us by the Concessionaire for all the three Toll Plazas. These vehicle passing figures were compiled by us to assess the historical average Growth Rate of different vehicle categories. The traffic passing data of the three plazas was averaged for the assessment of the Growth Rate.

5.5.1 COMPARISON OF ACTUAL TRAFFIC VERSUS TRAFFIC CONSIDERED FOR DESIGN

The pavement has been designed for 20 years Design Life for a Design Traffic of 90MSA. Since the data for actual traffic movement on the road since COD is available with the Concessionaire and the same has been provided to us, we have carried out an analysis for working out the Design Life consumed till date. For this analysis, normally expected VDF values have been considered. The results are brought out in the **Table 5.3** below.

Table 5.3: MSA Calculation for Pavement

Year	C.P. Year	LCV / Minibus	Bus	Trucks	MAVs	Total Veh.	No. of Standard Axles	Design Standard Axles	Cumu. no. of Std. Axles passed	Cumu. MSA passed
VDF		1.50	1.00	4.50	4.50					
2010-11 (Start of Traffic)	2.5	770	292	941	1153	3156	3967550	1487831	1487831	1.49
2011-12	3.5	745	296	945	1223	3209	4076868	1528825	3016657	3.02
2012-13	4.5	675	298	858	1109	2940	3709130	1390924	4407580	4.41
2013-14	5.5	728	302	868	1119	3017	3772458	1414672	5822252	5.82
2014-15	6.5	738	340	817	1005	2900	3520790	1320296	7142548	7.14
2015-16	7.5	939	452	913	1243	3547	4220313	1582617	8725165	8.73
2016-17	8.5	1022	486	885	1209	3602	4176330	1566124	10291289	10.29

Year	C.P. Year	LCV / Minibus	Bus	Trucks	MAVs	Total Veh.	No. of Standard Axles	Design Standard Axles	Cumu. no. of Std. Axles passed	Cumu. MSA passed
VDF		1.50	1.00	4.50	4.50					
2017-18	9.5	1086	503	934	1313	3836	4468878	1675829	11967118	11.97
2018-19	10.5	1209	535	924	1374	4042	4631668	1736875	13703993	13.70
2019-20	11.5	1312	567	854	1204	3937	4305540	1614578	15318571	15.32
2020-21	12.5	1702	395	938	1487	4522	5059083	1897156	17215727	17.22
2021-22	13.5	1813	427	947	1502	4688	5171017	1939131	19154858	19.15

For estimation of MSA from year 2021-22 and upto the end of Concession Period (2033-34), we have analysed the cumulative likely MSA in two scenarios by applying a uniform 3% & 5% traffic growth rate on all the vehicle categories from the year 2022-23 till end of Concession Period (2033-34). This analysis has been summarized in **Table 5.4** below.

Table 5.4: Summary of MSA scenarios

Scenarios	Traffic from COD to 2021-22		Traffic from 2022-23upto end of C.P (2033-34)	
	Adopted Growth Rate	Cumulative likely MSA	Adopted Growth Rate	Cumulative likely MSA
Scenario 1	Actual traffic	17.22	3% uniform	46.56
Scenario 2	Actual traffic	17.22	5% uniform	52.50

From the above Table, following inferences can be drawn.

a) It is seen that the cumulative MSA of traffic passing since the COD (2010-11) upto the year 2021-22 is only about 17MSA as against the Design Traffic of 90MSA. Even though almost 50% of the Concession Period has been completed, so far only about 19% of the Design MSA has been consumed.
b) Even if a standard 5% traffic growth rate is applied uniformly for all vehicles from 2022-23 to end of Concession Period, it is seen that the cumulative traffic at the end of Concession Period is 46MSA only.
c) Considering the data of the actual traffic captured from COD till now, the Residual Life of the Pavement is still about 73MSA and so it can be said that there is no requirement of any structural overlay during the balance Concession Period.

5.6 PRESENT STATUS OF O&M

5.6.1 CONCESSIONAIRE OBLIGATION STATUS

As per the information shared by the Concessionaire, there are adequate numbers of Technical and Non-Technical personnel presently mobilized at site.

a) The Technical manpower include Project Manager, Senior and Mid-management level Managers, Civil Engineers, Executives for Maintenance, Toll Operation, IT, Accounts, HR & Administration.
b) The User Services presently mobilized at site include
   i) Three fully furnished Ambulances and necessary staff including drivers, compounder and helpers.
   ii) Recovery Vans are available on call.
   iii) Fire fighting vehicle is available on call.
   iv) Heavy duty tow-away vehicle / crane is available on call.
c) The Route Patrol Vehicles (2 nos. Mahindra Scorpio &3 nos. Hero HF Deluxe motorbikes) are also mobilized and are functional.
d) Tolling System is functional at the Toll Plazas
e) Insurances are in place.

Fig 5.1: Ambulance at Toll Plazas

5.6.2 CONTRACT FOR ROUTE OPERATION & ROUTINE MAINTENANCE

The Concessionaire has executed a contract with ***M/s Feedback Highways OMT Pvt Ltd*** for the Toll Collection (including Security and Housekeeping), Route Operations & Incident Management and Routine Maintenance. The Scope of Work under this contract is mentioned in brief below.

a) Toll operations including security
   i) Providing manpower for tolling, housekeeping (accounts executive, HR & admin)
   ii) Managing all incidents on Toll Plaza, VIP lanes
   iii) Providing and deploying entire tolling security
b) Route Operations & Incident Management
   i) Managing all incidents on the Highway and ensuring smooth traffic flow
   ii) Prevention of all unauthorized works, entries/accesses
   iii) Removal of all new encroachments
   iv) Registering of all incidents, filing FIRs if any thefts/burglary on Project Road
c) Routine Maintenance
   i) Maintenance of all fixed assets and project assets (Incidence Management Vehicles, JCB Machine, Bucket lift crane/sky life vehicle, Water tanker, DG Sets, ACs)

ii) Leasing of vehicles for maintenance (Tractor trolley, Water tanker, Maintenance vehicle, Motor bikes, Mechanical broomer) including diesel & petrol.
iii) Horticulture of median &avenue plantation – weeding and manure including provision of water for horticulture and housekeeping supplies from existing bore-well.

5.6.3 CONTRACT FOR REPAIR WORK OF STRUCTURES

The Concessionaire had appointed ***M/s Sunrise Engineering*** for conducting specialized repair work of 21 major structures (each side) of the Project Road. This contract was on BOQ basis the item-wise quantities of which have been got assessed by the Concessionaire in the year 2018. The works specified therein were to be completed in a time period of 3 months with a DLP of 12 months from date of completion of work. These works broadly included repair of expansion joints, cleaning of bearings, repairs on concrete surfaces using epoxy mortar grouting at pre-identified locations including making any necessary temporary diversions (without any bituminous treatment) and all other incidental works.
During our field studies, we observed that the works have been completed by the agency.

5.6.4 PRESENT WORK OF PERIODIC MAINTENANCE

The Concessionaire is presently doing the overlay work. As informed by the Concessionaire, in the F.Y 19-20, overlay work in different stretches aggregating to a length of 25.080km and 50.170km on LHS and RHS respectively, was jointly identified with MPRDC and the work was duly completed. Similarly in the F.Y 20-21, the overlay work in different stretches aggregating to a length of 41.612km and 20.396km on LHS and RHS respectively had been completed. The Concessionaire has also done Renewal works under Preventive/Major Maintenance in the present year 2021-22 in a stretch of 85km (29% of total 281.6km of 2-lane length) till Jan 2022. The Concessionaire intends to complete the present cycle of Renewal works on full length of the Project Road by June 2022.

5.7 HIGHWAY ENCROACHMENT DETAILS

There is encroachment seen in the Service Roads at Amlaha and Kotri built-up stretches. These encroachments are in the form of parked vehicles, cattle tied with the pedestrian guard rail on the Service Road. Some permanent encroachments like road-side dhabas, Petrol Pumps, etc are also seen but with the support and intervention of Local Administration, some of these have been removed by the Concessionaire. The latest list of locations of encroachments reported removed by the Concessionaire in the MPR of Dec-21 is presented in the **Table 5.5** below.

Table 5.5: List of encroachments removed

Encroachment removal Details as on Dec-2021				
S.No.	**Side**	**Km**	**Encroachment**	**Type**
1	Median	44+450	Unauthorized Median Opening	Removed with JCB

Encroachment removal Details as on Dec-2021				
S.No.	**Side**	**Km**	**Encroachment**	**Type**
2	Median	45+900	Unauthorized Median Opening	Removed with JCB
3	Median	46+500	Unauthorized Median Opening	Removed with JCB
4	Median	47+400	Unauthorized Median Opening	Removed with JCB
5	Median	52+150	Unauthorized Median Opening	Removed with JCB
6	Median	52+700	Unauthorized Median Opening	Removed with JCB
7	Median	10+100	Political Advt. Flex	Removed
8	LHS	17+750	Advt. posters	Removed
9	LHS	15+800	Property Seller Flex	Removed
10	RHS	132+800	Wire fencing by farmer	Removed
11	LHS	97+200	OFC cable laying at shoulder	Removed
12	RHS	139+200	Shiv Shakti boat club board	Removed
13	RHS	17+400	Property Seller Flex	Removed
14	RHS	16+250	Property Seller Flex	Removed
15	Median	118+900	Advt. board	Removed
16	RHS	110+650	Forest Deptt fencing work	Removed
17	LHS	87+000	Unauthorized tea shop	Removed
18	LHS	87+900	Restaurant Advt. Board	Removed
19	LHS	87+200	Dhaba board	Removed
20	LHS	98+800	Restaurant Advt. Board	Removed
21	Median	116+800	Dhaba flags in median	Removed
22	Median	118+400	Rudra palace board in Median	Removed
23	LHS	57+900	Shoppers material on SR road	Removed
24	Median	44+050	Farmhouse board in median	Removed
25	RHS	25+400	Temp. Fruit Seller	Removed
26	LHS	25+300	Temp. Fruit Seller	Removed
27	RHS	120+650	HDD work at road shoulder	Stopped
28	LHS	25+300	Temp. Fruit Seller	Removed
29	RHS	133+800	Temp. shop on shoulder	Removed
30	Median	115+200	Temple work in Median	Stopped
31	LHS	55+450	Verma Tea stall Advt. board	Removed
32	RHS	41+950	Tea shop on shoulder	Removed
33	LHS	118+600	HDD work at road shoulder	Stopped
34	RHS	117+400	HDD work at road shoulder	Stopped

From the above table, it is seen that majority of the encroachments are in the form of earthen access to the roadside eateries. It is informed by the Concessionaire that the Concessionaire has issued notices and also taken up with the local administration for the removal of such encroachments. Such exercises are carried out by the Concessionaire from time to time.

5.8 IDENTIFIED BLACK SPOTS

MPRDC vide their Letter No. 19230 dated 02.08.2019, had communicated to the Concessionaire regarding 29 number of black spots of the years 2016, 2017 & 2018 for the Project Road. MPRDC had sought the pre-improvement and post-improvement photographs for the 29 locations from the Concessionaire. As per the list attached in the Annexure of the said letter, long term improvement measures were required only at one location and the required short term rectification measures (in the form of erection of sign boards and road markings) were completed on 19 locations by the Concessionaire. The updated status in respect of these black spots is to be provided by the Concessionaire.

In the Safety Audit Report dated September 2019 of ***M/s G.K Consulting Engineers, Hyderabad***, appointed by the Concessionaire to carry out Safety Audit during O&M stage, 14 accident black spots on the Project Road have been identified on the basis of accident data from May 2016 to Dec 2018. These identified black spots have been presented in **Table 5.6** below.

Table 5.6: Identified Black Spots

Accident Black spot Data from May 2016 to December 2018			
Sr. No.	**Chainage**	**Location Details**	**No. of Accidents**
1	133.200	Starting of Curve	20
2	128.800	Bridge on Curve	9
3	140.200	Culvert in Curve Location	8
4	132.400	Straight Road	7
5	137.000	Straight Road	7
6	137.100	Straight Road	7
7	138.800	Straight Road	7
8	137.000	Straight Road	6
9	132.200	Straight Road	5
10	134.000	500m from Toll Plaza	5
11	135.400	300m away from Junction	5
12	137.500	On Curve	5
13	137.800	End of Curve	5
14	28.400	Straight Road	5

It was seen that there were 14 locations identified as accident-prone. From these 14 locations, 11 locations were seen to be between Ch 130+000 to Ch 140+000. Most of these stretches are straight road sections. The Safety Audit Report had suggested rectification remedial measures for these black spots in the form of providing traffic calming measures, providing warning signs, roadway indicators, hazard markers, crash barriers, etc.

Upon review of the MPRs of Oct-21, Nov-21 & Dec-21 of the Concessionaire, it was seen that 31% of the reported accidents took place in the same stretch of Ch 130+000 to Ch 140+000.

Over-speeding was the main reason of accidents. Due to over-speeding, the vehicles were seen skidding and having rear-ended collisions.

It is noted that the recommendations made by the Safety Consultant for the rectification measures has been partially completed by the Concessionaire and the balance work is in progress except the work which requires COS approval from MPRDC.

5.9 CONCLUSIONS ON STATUS OF O&M

i) From the results of BBD Studies as well as Roughness Measurement studies, it is seen that the performance of the pavement is within acceptable limits. Though the pavement shows signs of distresses like Ravelling and cracking in some small areas, Patchwork is seen at a number of locations. It is expected however, that the Concessionaire shall rectify such damaged areas during the overlay work which is being done presently.

ii) It is seen than MBCB/guardrail, cat eyes, etc are damaged at some places. Repair works of such items need to be taken up urgently since these are essential from Road Safety considerations.

iii) For the structures, regular inspections and timely maintenance activity need to be enhanced.

iv) The Routine Maintenance especially the clearing of ROW and Waterway, etc. needs to be improved.

v) The operation of the Toll Plazas, Route Patrol Vehicles and Ambulance is found to be acceptable.

CHAPTER 6.0: COSTS

6.1 OPERATION & MAINTENANCE COSTS AND FUTURE STRATEGY

6.1.1 BROAD STRATEGY

As per Concession Agreement and also mentioned in the O&M Manual approved for the Project, one overlay or renewal with BC is to be carried out at least one in six years and in the last year of Concession Period. Along with functional overlay some rectification of the wearing coat of the structures may be required.

Under Preventive Maintenance, the Concessionaire is already rectifying the existing damages/defects seen during the condition survey. The first Major Maintenance has been carried out in the year 2016-17. Another renewal is being carried out, some portion of which has been completed in the present year 2021-22. As per the Concessionaire, this present cycle of Renewal works is planned to be completed by June 2022.

The Concessionaire has also got done the repair and maintenance works of all the major structures and the culverts.

6.2 ASSESSMENT OF O&M COSTS

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 MPPWD 2017 SOR have been adopted. A summary of the O&M Cost for the year 2022-23 is furnished in the **Table 6.1** below. The break-up of these costs are presented in sub-paras later.

Table 6.1: Base O&M and Periodic Maintenance Cost at FY 2023 level which is used for future years with escalation

S.No	Details	Amount(Rs in Cr.)
1	Periodic Maintenance Costs (for entire length)	76.63
2	Routine Maintenance & Operations Costs	
i)	Operational Expense	14.46
ii)	Routine Maintenance Expense	3.41

Renewal works are being carried out, some portion of which has been completed in the present year 2021-22. As per the Concessionaire, this present cycle of Renewal works is planned to be completed by June 2022.

The future requirements in terms of renewals are envisaged by us as under

2026-27: Renewal to be carried out in 140km 2-lane length.
2027-28: Renewal to be carried out in 140km 2-lane length.
2032-33: Renewal to be carried out in 190km 2-lane length.
2033-34: Renewal to be carried out in 90km 2-lane length.

For the projection of O&M Costs, the strategy presented above is used and the rates of MPPWD SOR 2017 have been escalated by 3.63% per annum. (WPI Growth Rate from 2010 to 2020 is 3.63% on an average). 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

S.No	Year	Periodic Maintenance Costs (in Cr.)	Routine Operations and Maintenance Cost (in Cr.)
1	2022-23		17.87
2	2023-24		17.87
3	2024-25		17.87
4	2025-26		17.87
5	2026-27	35.41	17.53
6	2027-28	37.88	17.53
7	2028-29		17.87
8	2029-30		17.87
9	2030-31		17.87
10	2031-32		17.87
11	2032-33	48.06	17.53
12	2033-34	22.97	11.68
		144.31	**225.08**

6.2.1 PERIODIC MAINTENANCE COSTS

Cost for Periodical Renewal has been worked out as per MPPWD 2017 SOR rates and an escalation of 3.63% has been applied over these rates to arrive for rates for the base year (2022-23). The costs worked out are inclusive of GST. The costs have been summarized in the **Table 6.3A** to **6.3C** below.

Table 6.3A: Costs of Periodic Renewal

Main Carriageway Paved area – Rigid	35,000	Sqm
Main Carriageway Paved area - Flexible	19,94,942	Sqm
Service/ Slip Road - Flexible	46,940	Sqm
Structure Deck Carriageway Area	20,580	Sqm
Major/ Minor Junctions Area - Flexible	80,619	Sqm

Table 6.3B: Costs of Periodic Renewal

S. No.	Items	Unit	Quantity for overlay in 2026-27	Quantity for overlay in 2027-28	Quantity for overlay in 2032-33	Quantity for overlay in 2033-34
			140 km 2 lane	**140 km 2 lane**	**190 km 2 lane**	**90 km 2 lane**
1	Functional overlay with **25 mm** BC for MCW Junction + Busbay + truck laybye	Cum	25945	25945	35210	16679
2	Functional overlay with 25 mm BC for Service Road + Junctions	Cum	587	587	796	377
3	Tack Coat on BT Layer	Sqm	1061251	1061251	1440269	682232
4	Cats EYE (Studs)	Nos	3750	3750	5089	2411
5	Replacement of W.C on structures 53mm	Sqm	10290	10290	13965	6615
6	Lane Marking	Sqm	9333	9333	12667	6000
7	Median & other Crash Barrier (RE Wall) Painting	Rm	969	969	1315	623
8	New Jersey Crash Barrier painting	Rm	2145	2145	2911	1379
9	Replacement of missing / damaged sign boards	no.	216	216	293	139
10	Construction of rumble strip on side roads	no.	53	53	72	34
11	I-Kerb Painting	Rm	53200	53200	72200	34200

S. No.	Items	Unit	Quantity for overlay in 2026-27	Quantity for overlay in 2027-28	Quantity for overlay in 2032-33	Quantity for overlay in 2033-34
12	Expansion joint (50mm vide strip seal joints)	Rm	405	405	550	260
13	Making good the earthen shoulders	Cum	55787	55787	75711	35863
14	Raising of Kerb	Rm				
15	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015) 100%	Sqm		35000		35,000
16	Replacement of PQC Slab (1%) every 5thYear	Cum		105		105
17	Joint sealant replacement every 5th Year (5 %)	m		1278		1,278
18	Up-gradation of TMS	Lane		24		

Table 6.3C: Costs of Periodic Renewal

S. No.	Items	Unit	Qty for complete length renewal	Rates as per MPPWD SOR 2017	Amount for entire length	Amount for overlay in 2026-27	Amount for overlay in 2027-28	Amount for overlay in 2032-33	Amount for overlay in 2033-34
						140 km 2 lane	**140 km 2 lane**	**190 km 2 lane**	**90 km 2 lane**
1	Functional overlay with **25mm** BC for MCW Junction + Busbay + truck laybye	Cum	51889	7655	39,72,10,494	198605247	198605247	269535692	127674802
2	Functional overlay with 25 mm BC for Service Road + Junctions	Cum	1174	7655	89,83,143	4491571	4491571	6095704	2887439
3	Tack Coat on BT Layer	Sqm	2122501	12	2,54,70,012	12735006	12735006	17283223	8186790
4	Cats EYE (Studs)	Nos	7500	545	40,87,500	2043750	2043750	2773661	1313839
5	Replacement of W.C on structures 53mm	Sqm	20580	849	1,74,72,513	8736257	8736257	11856348	5616165

S. No.	Items	Unit	Qty for complete length renewal	Rates as per MPPWD SOR 2017	Amount for entire length	Amount for overlay in 2026-27	Amount for overlay in 2027-28	Amount for overlay in 2032-33	Amount for overlay in 2033-34
6	Lane Marking	Sqm	18667	516	96,32,000	4816000	4816000	6536000	3096000
7	Median & other Crash Barrier (RE Wall) Painting	Rm	1938	58	1,12,425	56212	56212	76288	36137
8	New Jersey Crash Barrier painting	Rm	4290	96	4,11,840	205920	205920	279463	132377
9	Replacement of missing / damaged sign boards	no.	432	4200	18,14,400	907200	907200	1231200	583200
10	Construction of rumble strip on side roads	no.	106	6842	7,25,231	362615	362615	492121	233110
11	I - Kerb Painting	Rm	106400	17	17,61,984	880992	880992	1195632	566352
12	Expansion joint (50mm vide strip seal joints)	Rm	810	10431	84,49,110	4224555	4224555	5733325	2715785
13	Making good the earthen shoulders	Cum	1,11,574	150	1,67,36,160	8368080	8368080	11356680	5379480
14	Raising of Kerb	Rm	1,14,180	211	2,40,91,980				
15	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015) 100%	Sqm	35,000	25	8,75,000		875000		875000
16	Replacement of PQC Slab (1%) every 5th Year	Cum	105.000	5,153	5,41,065		541065		541065
17	Joint sealant replacement every 5th Year (5%)	m	1,277.778	27	34,500		34500		34500
18	Up-gradation of TMS	Lane			19200000		19200000		
Total (in Cr.) at 2022-23 rates including up-gradation of TMS					**68.32**	31.62	33.72	42.91	20.51
Total (in Cr.) including GST charges					**76.63**	35.41	37.88	48.06	22.97

6.2.2 ROUTINE OPERATION & MAINTENANCE COSTS

These costs comprise 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: Yearly Routine maintenance and Cleaning Costs

S. No	Activity	Highway Component	Unit	Total Qty	Weightage Assigned	Projected Qty for 12 Months	Rates	Total amount (Rs.)
1	Replacement of Sign Boards (Routine)		Sqm	1872	5%	94	6641	6,21,598
2	Replacement of Cat Eyes		Nos	7500	5%	375	545	2,04,375
3	Repair of MBCB/Guard Rail		Rm	8619	3%	259	3406	8,80,689
4A	Pot Hole Filling (Flexi Pvmt) - MCW		Sqm	1994942	0.05%	997	124	1,23,686
4B	Pot Hole Filling (Flexi Pvmt) - Service Rd		Sqm	46940	0.10%	47	124	5,821
4C	Rigid Pavement Repair		Km			0.70	12000	8,400
4D	Flexi Pavement Repair		Km			140.00	15000	21,00,000
5	Painting on Fixtures	Sign Boards	Nos	1872		1,872	20	37,440
		5th Km	Nos	56	5%	3	238	666
		Km	Nos	226	5%	11	80	904
		HM Stone	Nos	1126	5%	56	21	1,182
		Conc. CB	Rm	1938	5%	97	58	5,621
		NJB	Rm	4290	5%	215	96	20,592
		Railing	Rm	7780	5%	389	32.42	12,611
		Road Mark.	Sqm	52951	20%	10590.25	516	54,64,571
		Kerb stone	Rm	106400	5%	5,320	16.56	88,099
6A	Replacement of Km Stone		Nos	226	1%	2	1681	3,799
6B	Replacement of Hm Stone		Nos	1126	2%	23	495	11,147
6C	Replacement of 5th Km Stone		Nos	56	0%	-	2791	-

S. No	Activity	Highway Component	Unit	Total Qty	Weightage Assigned	Projected Qty for 12 Months	Rates	Total amount (Rs.)
7	Replacement of Dead Plant	Median	Nos	31968	10%	3,197	570	18,22,176
8	Repair to the Conc. Structure		LS/No /Mth		20%	23	50000	27,60,000
9	Repair of Earthen shoulder		Cum	111574	10%	5,579	150	8,36,808
	Total (in Cr.) at 2017 MPPWD SOR rates							**1.50**
	Total (in Cr.) at 2022-23 rates considering 3.63% escalation							**1.859**
	Total per km cost (in Rs.)							**1,32,047**

Table 6.4B: Yearly Routine Maintenance and Cleaning Costs

S. No.	Description	Unit	Quantity	Rates	Total amount
1	**Routine and Preventive Maintenance**				
i	Repairs of distresses on flexible pavement on approaches and slip road, service road flushing by fine aggregates during monsoon, re-surfacing hungry areas by MSS	Km	140.79	132047 *	18590843
ii	Repair of joint seals, concrete spall and edge breaking, Sealing of minor cracks with epoxy in concrete pavement				
iii	Removal and readjustment of footpath tiles to remove rut and ravel, replacement of damaged 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, cement plaster 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 & pruning of shrubs & trees, watering, applying manure &pesticide				
2	**Cleaning of road and other assets, removal of vegetation, cleaning of drains, etc.**				
i	Cleaning of Main Carriageway	Km	140.79	64720	9111960
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				

S. No.	Description	Unit	Quantity	Rates	Total amount
viii	Transverse Drain Maintenance				
ix	Maintenance of the Toll Plaza				
x	Median plantation maintenance				
3	**Potable Drinking Water Maintenance**	LS			
	Total (in Rs.)				27702803
	Add 10 % for unforeseen and contingencies				2770280
	Grand Total (in Rs.)				30473083
	Amount (in Cr.) at 2022-23 Rates				**3.05**
	Total (in Cr.) including GST charges				**3.41**

* For the year of Major Maintenance, the Routine Maintenance Cost considered is reduced from Rs. 132047/km to Rs. 112359/km.

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

S. No	Description	Per Month	Yearly at 2022-23 rates
1	Staff salaries and Other expenses (Feedback Highways OMT expenses as per Contract) + Security expenses	41,59,529	6,18,43,882
2	SPV Staff	24,00,000	2,88,00,000
3	Consumables (like diesel for DG operations, HSD for vehicles, stationary, printers, cartridge, etc)	4,00,000	48,00,000
4	Electricity charges	1,20,000	14,40,000
5	AMC charges for TMS	6,00,000	72,00,000
6	Incidence Management expenses (Ambulance, Crane and Patrolling vehicle) – Only vehicle & fuel	4,22,370	50,68,440
7	Professional Consultancy charges		80,00,000
8	House-keeping and other misc. charges	2,00,000	24,00,000
9	Administration charges		50,00,000
10	Insurance charges		2,00,00,000
		Total (in Rs.)	**14,45,52,322**
		Total (in Cr.)	**14.46**

Note: As per the Clause 6.10.3 of the Concession Agreement, the Concessionaire is required to pay a Monitoring Fees to MPRDC @ 1% of annual toll collected for the first ten years from Commencement Date and thereafter 2% from start of 11th year to end of 15th year and 3% from the 16th year till the end of Concession Period.

6.3 CONCLUSIONS ON O&M REQUIREMENTS

The O&M Costs and the OpEx Projections for the Project Road has been worked out taking into consideration the requirements stipulated in the Concession Agreement. The present condition of the road, structure and other assets and the overall maintenance strategy of the Concessionaire, the costs cover all the requirements and there does not appear to be any likelihood of any unforeseen expenditure during the Concession Period.

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