

CHAPTER – 1 EXECUTIVE SUMMARY

1.0 PROJECT BACKGROUND

National Highways and Infrastructure Development Corporation (NHIDCL) is a fully owned company of the Ministry of Road Transport & Highways (MoRT&H), Government of India. The company promotes, surveys, establishes, design, build, operate, maintain and upgrade National Highways and Strategic Roads including interconnecting roads in parts of the country which share international boundaries with neighboring countries. The regional connectivity so enhanced would promote cross border trade and commerce and help safeguard India's international borders. This would lead to the formation of a more integrated and economically consolidated South and South East Asia. In addition, there would be overall economic benefits for the local population and help integrate the peripheral areas with the mainstream in a more robust manner.

The National Highways and Infrastructure Development Corporation Ltd. (NHIDCL) has been entrusted with the assignment of consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana.

NHIDCL will be the employer and executing agency for the consultancy services and the standards of output required from the appointed consultants are of international level both in terms of quality and adherence to the agreed time schedule. The consultancy firm will solely be responsible for submission of quality work in stipulated period.

After evaluation of Technical and Financial proposal National Highways & Infrastructure Development Corporation Limited (NHIDCL), MoRT&H, New Delhi has appointed C.E. Testing Company Pvt. Ltd. (CETEST) as consultant to prepare the Detailed Project Report for the below road stretches vide LOA No. NHIDCL/Bharatmala/DPR/Phase-I/Lot-1/Package 1A/2017/60 dated 13.03.2018.

The Project Road starts near Chirakuta and ends at Jalukbari interchange in Guwahati. The total length of the existing road stretch is 209.998km(As per Topographic survey).

The entire road comes under Dhubri, Bongaigaon, Goalpara, Kamrup Rural & Kamrup Metropolitan district of Assam. The project road Passes through village / localities namely Chirakuthi, Sonamukhi, Koliarkhal, Tilapara, MohishBathan, Salkocha, Hatipota, Dhirghat, Arayarjhar, KharidaGossaigaon, Chapar, Bahalpur, Nitya Bazar, KayetPipeara, Talguri, Salbari, Besimari, Boitamari, Borkhata (Nolbari), Khagarpur, Uttar Salmara, Tulungia (junction withNH-117), Deohati, Choutaki, Singimari, Nalipara, Kherkabari, Katashbari, Khoragaon, Garaimari, Chalantapara, KabaitaryTinali, Oudubi, Jogighopa, Kharbhuja, Makri, Dakurivitha, Hadalpara, Kalyanpur, Solmari, Gendra, Balijan, Budhipara, Agia, Ulupara, AgiaPaharkata, KalpaniChandmari, Bolbolla, Phaphanga, Godhar Bari, TukuraBormahara, Bhimajuli, Paikan, Krishnai, Jyoti Nagar, MolanDubri,

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Beki Paul, Salpara, Darapara, Dabli, Letheng, Lela, Mondal gram, Makhipara, Dudhnoi, Fafal, Puranibitha, Amjonga, Kachadal, Darangiri, Dosimapara, Rangjuli, Dhanubhanga, Deoshila, Gathiapara, Kothakuthi, Dhupdhara, Sakite, Hakite, Bandapara, Kukurmara, Rajapara, Dhupguri, Chukunai Para, Burgrui, Singra, BokoNagopara, ChakBaho, BokoJarapara, BokoDakhurpara, Boko, Barpara, Turukpur, Turukpara, AguckaBoko, lampara, Bripara, Bongaon market, Bamunigaon, Khabibe, Gobardhan, Kumi, Chhaygaon, Champak Nagar, Kharavanga, Kukurmara, Bartezipur, Surutezipur, Rampur, Bhagabatipara, Rajapokubi, Batarhat, Haligaon, Bijohnagar, Uparhali, Sarpara, Mirza, Barkuchi, Sontola, Bongara, Khuikuchi, Bullapara, VIP chok, Kahikuchi, Azara, Lankeswarandends at Jalukbari Interchange in Guwahati in the state of Assam.

The Package-1 of the project road starts near Chirakuta and ends Near Mowatari, before Chapar Bypass) (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain.

Package No	Design Chainage (km)			Survey Chainage(Km), Starting Chainage of Bilasipura KM 0.000			Package Start point	Package end point
	From	To	Length (km)	From	To	Length (km)		
Pkg-1	0.000	17.737	17.737	5.580	25.633	20.053	Near Chirakuta	Near Mowatari, before Chapar Bypass)

Status of Various Sections

Pkg	Name of Stretch	Length (km)	Project Status
	Spur to Connect NH17 to East West Corridor (NH27)		
HT	Hapachara to Tulungia road	14.660	Work in Progress
	Total Length	14.660	
	Tulungia – Guwahati Section		
5	Tulungia to Jogighopa (before Naranarayan Setu)	18.901	Work in Progress
6	Panchratna to Nichinta	12.300	Work in Progress
7	Nichinta to Paikan	11.900	Work in Progress
8	Paikan to Dhupdhara Sahar	43.750	Work in Progress
9	Dhupdhara Sahar to Milmila R.F	33.684	Work in Progress
10	Milmila R.F to Approach of Airport Junction VIP Chowk	27.316	Work in Progress
	Total Length	147.851	

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Pkg	Name of Stretch	Length (km)	Project Status
	Bilasipura - Tulungia Section		
1	Chirakuta to Mowatari, before Chapar Bypass)	17.737	Instant Package
2	Mowatari, before Chapar Bypass to Tulungia (Junction with NH 117)	26.820	SFC Completed
	Total Length	44.557	

1.1 OBJECTIVES

The main objective of the Consultancy Services is to establish Detailed Project Reports for rehabilitation and up-gradation of the existing two to four lane **Bilasipura – Chapar – Tulungia – Jogighopa – Gendera – Paikan – Dudhnoi - Guwahati Road (Length 225.000 km) to 4-Lane with paved shoulder of National Highway configuration.**

The viability of the project shall be established taking into account the requirements with regard to rehabilitation, upgrading and improvement based on highway design, pavement design, provision of service roads wherever necessary, type of intersections, rehabilitation and widening of existing and/or construction of new bridges and structures, road safety features, quantities of various items of works and cost estimates and economic analysis.

The Detailed Project Report would inter-alia include detailed highway design, design of pavement and overlay with options for flexible or rigid pavements, design of bridges and cross drainage structures and grade separated structures, design of service roads, quantities of various items, detailed drawings, detailed cost estimates, economic and financial viability analyses, environmental and social feasibility, social and environmental action plans as appropriate and documents required for tendering the project on commercial basis for international / local competitive bidding.

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1.2 PROJECT STAGES

- ✓ **STAGE 1:** Inception Report
- ✓ **STAGE 2:** Feasibility Report
- ✓ **STAGE 3:** LA & Clearances I Report
- ✓ **STAGE 4:** Detailed Project Report (DPR)
- ✓ **STAGE 5:** Technical Schedules
- ✓ **STAGE 6:** LA & Clearances II Report
- ✓ **STAGE 7:** Award Determination
- ✓ **STAGE 8:** Land Possession

1.3 STRUCTURE OF FINAL DETAILED PROJECT REPORT

Final Detailed Project Report consists of the following volume.

Volume – I: Main Report

- Chapter -1: Executive Summary
- Chapter -2: Overview of NHIDCL
- Chapter -3: Project Background
- Chapter -4: Engineering Surveys, Investigation and Analysis
- Chapter -5: Socio- Economic Profile
- Chapter -6: Indicative Design Standards
- Chapter -7: Traffic Surveys & Analysis
- Chapter -8: Social Analysis
- Chapter -9: Environmental Impact Assessment Report
- Chapter -10: Cost-Estimate
- Chapter -11: Economic and Financial Analysis
- Chapter -12: Road Safety Audit
- Chapter -13: Conclusions & Recommendations

Volume – IA: Appendix to Main Report

- Appendix-3.1: Road Inventory Survey
- Appendix-3.2: Pavement Condition Survey
- Appendix-3.3: Culvert Inventory Survey
- Appendix-3.4 : Bridge Inventory Survey
- Appendix-3.5 :List of TBM & GPS Point
- Appendix-3.6 :Trial Pit Data
- Appendix-3.7 : Soil Report
- Appendix-3.8 : Hydraulic Calculation of Bridges
- Appendix-3.9 : Geotechnical Investigation
- Appendix-7.1 :Origin-Destination survey and analysis
- Appendix-7.2 : Classified traffic volume count survey and analysis
- Appendix-7.3 :Axle load survey and analysis

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- Appendix-7.4 : Turning moment count survey and analysis
- Appendix-7.5 : Pedestrian count survey and analysis

Volume – II: Design Report

Volume – III: Material Report

Volume – IV: EIA &SIA

Volume – V: Technical Specification

Volume – VI: Rate analysis

Volume – VII: Cost-Estimate

Volume – VIII: Bill of Quantities

Volume – IX: Drawing Volume (Roads & Structure)

1.4 DEFICIENCIES AND ISSUES

The following major deficiencies have been identified and addressed in terms of traffic operation, safety, road conditions and maintenance. A few other issues which contribute to operational deficiencies and safety concerns and which prevent the optimum utilization of the highway capacity to a desirable level of service, e.g. driving discipline and compliance, traffic surveillance, corridor security and management, level of regular road maintenance, maintenance and its road worthiness etc. are beyond the scope of this study.

a)Operation

- ✓ No access control
- ✓ Conflicts between fast moving vehicles with slow moving vehicles
- ✓ Deficiency in the Geometry of existing road alignment

b)Safety

- ✓ Shoulder drop-off at places
- ✓ Inadequate traffic signs
- ✓ Sub Standard Curve on the project road

1.5 SALIENT FEATURES

This relates to the most suitable alignment for 4-laning of road sections and for optimum upgrading of existing road based on field data and detail study involving traffic, geo-technical, topographic, pavement and road condition and socio-economic aspects. Special attention has been given for augmentation of capacity for intended level of appropriate design applications have been considered for operational efficiency and road safety.




Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A (**Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikani-Dudhnoi-Guwahati Road** (Length **225.000 km**) in the State of Assam)

**Final Detailed Project Report
Executive Summary**

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Table 1.1: Salient Features of the Proposed Road(Package -1)

SI	Descriptions	Existing	Proposed
1	Start Point	Near Chirakuta (Ex.Ch.5.580 Km)	Near Chirakuta (Design Ch.0.000 Km)
2	End Point	Near Mowatari, before Chapar Bypass (Ex.Ch.25.633Km)	Near Mowatari, before Chapar Bypass(Design Ch.17.737Km)
3	Length	Existing Length = 20.053Km (As per topographic survey)	Proposed Length =17.737 Km (As per Design)
4	Terrain	Plain Terrain	Plain Terrain
5	Alignment	Two Lane	Up-gradation of whole alignment in 4-lane configuration
6	Design Speed	Avg. 30-40 Kmph	Ruling = 100 Kmph, Limiting = 80 Kmph
7	Cross-Sectional Parameters	Two Lane	TCS-1D: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN RURAL AREA(RECONSTRUCTION OVER EXISTING PAVEMENT) Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Earthen Shoulder = 2 x1.5m Kerb Shyness=2 x 0.5m Median = 1.5 m Roadway Width=22.5m

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SI	Descriptions	Existing	Proposed
			TCS-2: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Earthen Shoulder = 2 x1.5m Kerb Shyness=2 x 0.5m Median = 4.0 m Roadway Width=25.0m TCS-2A: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH WITH BOTH SIDE RETAINING WALL AND STONE PITCHING ALONG THE BERM Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Earthen Shoulder = 2 x1.5m Kerb Shyness=2 x 0.5m Median = 4.0 m Roadway Width=25.0m TCS-2C: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH WITH BOTH SIDE RETAINING WALL Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Earthen Shoulder = 2 x1.5m Kerb Shyness=2 x 0.5m

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SI	Descriptions	Existing	Proposed
			Median = 4.0 m Roadway Width=25.0m TCS-4F: 4 LANE CARRIAGEWAY WITH BOTH SIDE SERVICE ROAD IN BUILT-UP AREA (RECONSTRUCTION OVER EXISTING PAVEMENT) Carriageway = 2 x 7.0m Paved Shoulder = 2 x 2.5m Kerb Shyness=2 x 0.5m Railing = 2 x 0.25m Median = 1.5m Service Road = 2 x 5.5m Cover Drain = 2 x 1.0m Roadway Width=35.00m TCS-4F1: 4 LANE CARRIAGEWAY WITH BOTH SIDE SERVICE ROAD IN RURAL AREA (RECONSTRUCTION OVER EXISTING PAVEMENT) Carriageway = 2 x 7.0m Paved Shoulder = 2 x 2.5m Kerb Shyness=2 x 0.5m Railing = 2 x 0.25m Median = 1.5m Service Road = 2 x 5.5m Earthen Shoulder = 2 x 1.0m Roadway Width=35.00m TCS-4F2: 4 LANE CARRIAGEWAY WITH RIGHT SIDE SERVICE ROAD IN RURAL AREA (RECONSTRUCTION OVER EXISTING PAVEMENT) Carriageway = 2 x 7.0m

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SI	Descriptions	Existing	Proposed
			Paved Shoulder = 1 x 2.5m+1X1.5m Kerb Shyness=2 x 0.5m Railing = 1 x 0.25m Median = 1.5m Service Road = 1 x 5.5m Drain=1x1m Earthen Shoulder = 1 x 1.5m Roadway Width=28.75m TCS-5D: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN FOREST STRETCH WITH BOTH SIDE R.C.C RETAINING WALL Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Earthen Shoulder = 2 x1.5m Kerb Shyness = 2 x 0.5m Median =1.5m Roadway Width=22.5m TCS-5E: 4 LANE CARRIAGEWAY WITH RIGHT SIDE SERVICE ROAD IN FOREST STRETCH (RECONSTRUCTION OVER EXISTING PAVEMENT) Carriageway = 2 x 7.0m Paved Shoulder = 1 x 2.5m+1X1.5m Kerb Shyness=2 x 0.5m Railing = 1 x 0.25m Median = 1.5m Service Road = 1 x 5.5m

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SI	Descriptions	Existing	Proposed
			Drain=1x1m Earthen Shoulder = 1 x 1.5m Roadway Width=28.75m TCS-6B: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN VUP/SVUP APPROACHS WITH BOTH SIDE SERVICE ROAD Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Kerb Shyness=4 x 0.5m Crash Barrier=2x0.5m+2x0.25m Median = 1.5m Service Road = 2 x 5.5m Earthen Shoulder = 2 x 1.0m Roadway Width=35m TCS-6B1: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN FLYOVER APPROACHS WITH BOTH SIDE SERVICE ROAD WITH DRAIN Carriageway = 2 x 10.5m Crash Barrier=2x0.5m Median = 1.0m Crash Barrier=2x0.5m Service Road = 2 x 5.5m Drain = 2 x 1.0m Roadway Width=37m

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SI	Descriptions	Existing	Proposed
8	Traffic	Base year traffic (2019) ➤ Ch. 31.000 km near Bahalpur - Fast moving vehicle =6617nos. - Slow moving vehicle =889nos. - AADT in no = 7506 nos. - AADT in PCU = 8957PCU Total Commercial vehicle per day= 1767 nos.	➤ Ch. 31.000 km near Bahalpur Projected traffic, Year 2023 - Total Vehicle in no = 11546 nos. - Total Vehicle in PCU =10888 PCU Projected traffic, Year 2046 - Total Vehicle in no = 28024 nos. - Total Vehicle in PCU =33441 PCU
9	Traffic Growth Rate	-	5%
10	Pavement Design Life	-	20 Years for flexible pavement
11	Design MSA	-	Adopted MSA = 44 MSA
12	CBR Considered	-	5%

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SI	Descriptions	Existing	Proposed
13	Design Pavement Thickness	Pavement thickness varies from-300mm to 800 mm	<u>Main Carriageway</u> For Widening/RE Wall portion/ Reconstruction/New Construction BC -40 mm DBM -60 mm Aggregate Layer - 100 mm CT Base-100 mm CT Sub-Base- 200 mm Total -500 mm <u>Service Road</u> BC -40 mm Aggregate Layer - 100 mm CT Base-100 mm CT Sub-Base- 200 mm Total -440 mm
14	Major Bridge	Nil	Nil
15	Minor Bridges	8 Nos.	10 Nos. Reconstruction = 7 nos. Retained and Additional 2 Lane = 1 no. New Construction= 2 nos.

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SI	Descriptions	Existing	Proposed
16	Viaduct	Nil	Viaduct: 3 Nos. Ch. 5.040 km, RCC T Beam + PSC T Girder, span (1 x 35m + 11 x 40m + 1 x 20.8m + 2 x 30m) Ch. 5.660km, RCC T Beam + PSC T Girder + Simply Supported Voided Slab, span (1 x 20.8m + 1 x 30m + 6 x 40m + 2 x 35m + 1 x 15m) Ch. 5.929 km, PSC T Girder, span (2 x 40m)
17	Culverts	Culvert = 8 nos.	Reconstruction= 8 Nos. New Construction = 46 Nos. Total no. of RCC Box Culverts = 54 Nos.
18	Railway Crossings/ RUB/ROB	-	1 No. ROB (36m + 72m + 36m)
19	VUP	Nil	2Nos.
20	VOP	Nil	1No
21	FLYOVER	Nil	455m
22	SVUP	Nil	5Nos.

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SI	Descriptions	Existing	Proposed															
23	FOOT OVER BRIDGE(FOB)	Nil	Foot over bridge has been proposed at 4 locations.															
			<table><tr><th>Sl.No</th><th>Design Ch.(km)</th><th>Location</th></tr><tr><td>1</td><td>8.088</td><td>Hatipota</td></tr><tr><td>2</td><td>12.826</td><td>Dhirghat</td></tr><tr><td>3</td><td>15.352</td><td>Areajhar</td></tr><tr><td>4</td><td>17.303</td><td>Mowatari</td></tr></table>	Sl.No	Design Ch.(km)	Location	1	8.088	Hatipota	2	12.826	Dhirghat	3	15.352	Areajhar	4	17.303	Mowatari
			Sl.No	Design Ch.(km)	Location													
			1	8.088	Hatipota													
			2	12.826	Dhirghat													
			3	15.352	Areajhar													
4	17.303	Mowatari																
24	RETAINING WALL	Nil	Length of Retaining Wall=12580 m															
25	TOE WALL	Nil	Length of Toe Wall=4296m															
26	BREAST WALL	Nil	430m															
27	LINED DRAINS	Drain length = 631m	Length of RCC Cover Drain =11869m Chute Drain = 1060m															
28	SERVICE ROAD	Nil	18457m															
29	RE WALL	Nil	1558m															
30	GROUND IMPROVEMENT BY SAND PILING	Nil	2150m															
31	STONE PITCHING	Nil	5306m															
32	MAJOR INTERSECTION	Nil	3 nos (All Major Intersection has been developed with grade separated structure (VUP, SVUP & Flyover) with service road.)															

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SI	Descriptions	Existing	Proposed				
33	MINOR INTERSECTION	39 Nos.	39 nos(All Minor Intersection has been developed with Service Road and Access to Main carriageway through Service Road)				
34	BUS BAY WITH PASSENGER SHELTER	Nil	➤ Bus-bay with passenger shelter = 1 Locations (Both Side)				
			SI no	Design Chainage (km)	Side	Location	Remarks
			1	14.268	Both	Near Aryarjhar	Bus Bay with Passenger Shelter
35	TRUCK LAY BAY	Nil	Nil				
36	TOLL PLAZA	Nil	1 No.				
37	ROW	Varying from 11m-50m	• Rural Area:35m /40m • Built-up Location:35m • Bypass Location :45m/50m • Forest Location: 35m/40m				
38	LAND DETAILS	Available land 28.56Ha	Land to be acquired 44.1687Ha				
39	FOREST STRETCH	The project road stretch Passes through Srigrām RF & Sarpamari RF • The affected length of forest stretch=2.169Km	The project road stretch Passes through Srigrām RF & Sarpamari RF • The affected length of forest stretch=2.169Km				

CHAPTER – 2

INTRODUCTION AND OVERVIEW OF NHIDCL

2.1 GENERAL

National Highways and Infrastructure Development Corporation (NHIDCL) is a fully owned company of the Ministry of Road Transport & Highways (MoRT&H), Government of India. The company promotes, surveys, establishes, design, build, operate, maintain and upgrade National Highways and Strategic Roads including interconnecting roads in parts of the country which share international boundaries with neighboring countries. The regional connectivity so enhanced would promote cross border trade and commerce and help safeguard India's international borders. This would lead to the formation of a more integrated and economically consolidated South and South East Asia. In addition, there would be overall economic benefits for the local population and help integrate the peripheral areas with the mainstream in a more robust manner.

The National Highways and Infrastructure Development Corporation Ltd. (NHIDCL) has been entrusted with the assignment of consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana.

NHIDCL will be the employer and executing agency for the consultancy services and the standards of output required from the appointed consultants are of international level both in terms of quality and adherence to the agreed time schedule. The consultancy firm will solely be responsible for submission of quality work in stipulated period.

After evaluation of Technical and Financial proposal National Highways & Infrastructure Development Corporation Limited (NHIDCL), MoRT&H, New Delhi has appointed C.E. Testing Company Pvt. Ltd. (CETEST) as consultant to prepare the Detailed Project Report for the below road stretches vide Letter of Acceptance No. NHIDCL/Bharatmala/DPR/Phase-I/Lot-1/Package-1A/2017/60, dated 13.03.2018.

The Project Road starts at near Chirakuta and ends at Jalukbari interchange in Guwahati. The total length of the existing road stretch is 209.998km (based on Topographic Survey).

The Package-1 of the project road starts near Chirakuta and ends Near Mowatari, before Chapar Bypass (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

2.2 PROJECT BACKGROUND

State Profile

Assam is located in the far North-East part of the country and situated within the longitude 90°E to 96°E and latitude 24°N to 28°N. The area of the state is 78,438 square kilometers as against the country's total area of 3,280,483 square kilometers. Thus, the state constitutes 2.39% of the total land area of the country. Population of Assam stood at 266.38 lakhs. Assam is situated at the North-Eastern Himalayan sub-region of India. The state is bounded by Bangladesh on the West and South and is very near to Burma (Myanmar) on the East and to Tibet, Bhutan and China on the North. Internally, the state has a common boundary with Nagaland, Tripura, Mizoram, Meghalaya, West Bengal and Arunachal Pradesh.

Sl.	Description	Assam 2011
1	Population size	31205576
2	Population size(Males)	15939443
3	Population size(Females)	15266133
4	Population size(Rural)	26807034
5	Population size(Urban)	4398542
6	Population density (Total, Persons per sqkm)	398
7	Sex ratio (Females per 1000males)	958
8	Population size, 0 - 6 yrs	4638130
9	Sex ratio, 0 - 6 yrs (Females per 1000 males)	962
10	Literacy rate, 7+ yrs (Persons, Per cent)	72.19
11	Literacy rate, 7+ yrs (Males, Per cent)	77.85
12	Literacy rate, 7+ yrs (Females, Per cent)	66.27

Project road

The Project Road starts at near Chirakuta and ends at Jalukbari interchange in Guwahati. The total length of the existing road stretch is 209.998 km (As per Topographic Survey).

The Package-1 starts near Chirakuta and ends Near Mowatari, before Chapar Bypass (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey). The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain.

Project Districts

The PKG-1 of the project road comes under Dhubri district of Assam.

Brief features of the Dhubri district is summarized below.

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Dhubri

Dhubri District, with population of about 19.5 lakh is Assam's the 2nd most populous district, located in the state Assam in India. Total geographical area of Dhubri district is 2176 km². Population density of the district is 896 persons per km².

An official Census 2011 detail of Dhubri, a district of Assam has been released by Directorate of Census Operations in Assam. Enumeration of key persons was also done by census officials in Dhubri District of Assam.

In 2011, Dhubri had population of 1,949,258 of which male and female were 997,848 and 951,410 respectively. In 2001 census, Dhubri had a population of 1,566,396 of which males were 804,999 and remaining 761,397 were females. Dhubri District population constituted 6.25 percent of total Maharashtra population. In 2001 census, this figure for Dhubri District was at 5.88 percent of Maharashtra population.

There was change of 24.44 percent in the population compared to population as per 2001. In the previous census of India 2001, Dhubri District recorded increase of 22.97 percent to its population compared to 1991.

Table 2.2.2 Socio-economic profile of Dhubri District

Description	2011	2001
Population	19.50 Lakhs	15.67 Lakhs
Actual Population	1,949,258	1,566,396
Male	997,848	951,410
Female	804,999	761,397
Population Growth	24.44%	22.97%
Area Sq. Km	2,176	1,664
Density/km ²	896	941
Proportion to Assam Population	6.25%	5.88%
Sex Ratio (Per 1000)	953	946
Child Sex Ratio (0-6 Age)	968	965
Average Literacy	58.34	48.17
Male Literacy	63.10	55.84
Female Literacy	53.33	40.02
Total Child Population (0-6 Age)	3,68,262	3,26,739
Male Literates	5,11,551	
Female Literates	4,10,790	41,78,984
Child Proportion (0-6 Age)	18.89%	20.86%

Source: <http://www.census2011.co.in>

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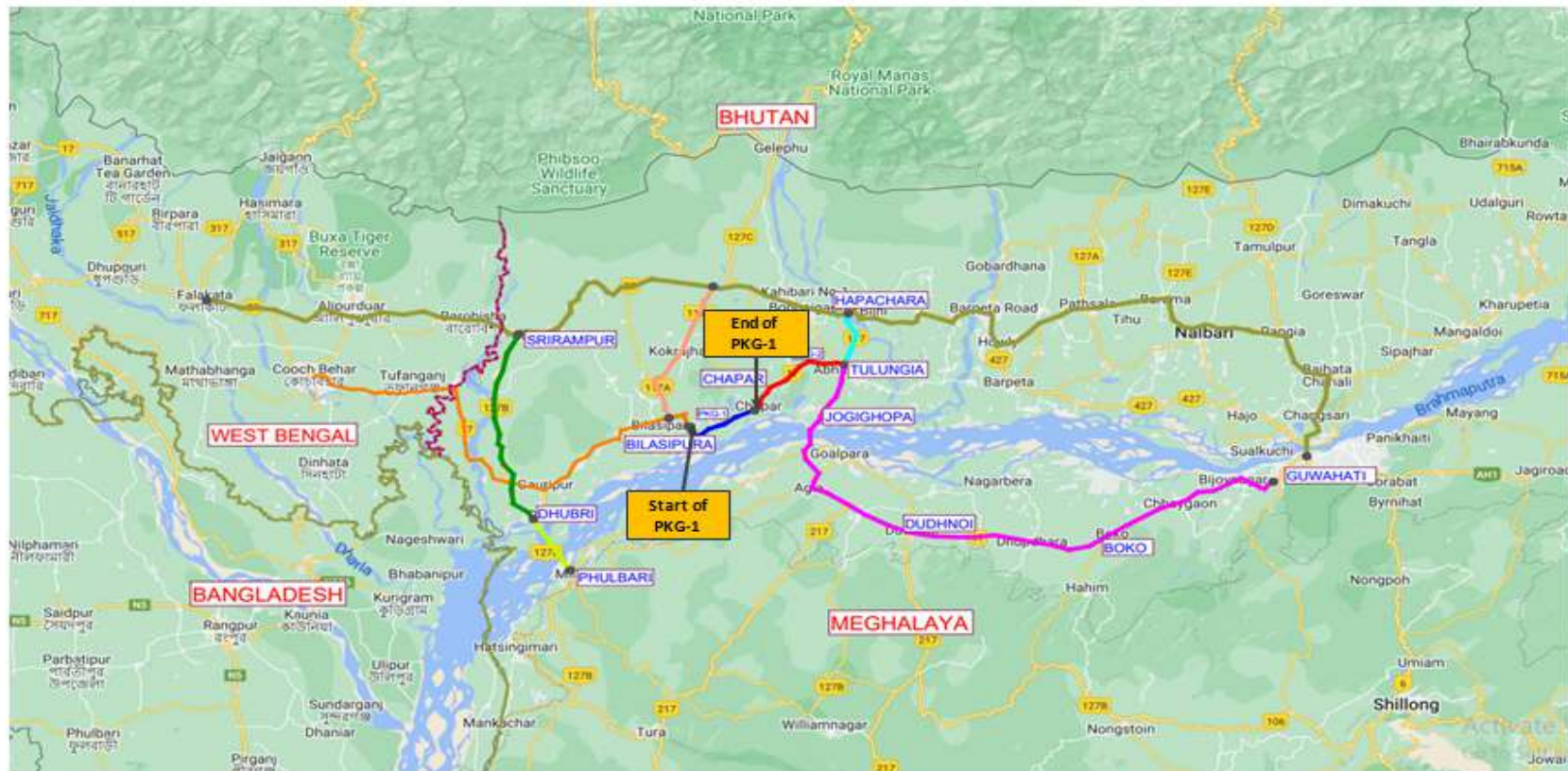


Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A (**Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam**)

**Final Detailed Project Report
Introduction and Overview of
NHIDCL**

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Figure 2.1- Key plan of project Road



2.3 OVER VIEW OF NHIDCL ORGANIZATION & ACTIVITIES

National Highways and Infrastructure Development Corporation is a fully owned company of the Ministry of Road Transport & Highways, Government of India. The company promotes surveys, establishes, designs, builds, operates, maintains and upgrades National Highways and Strategic Roads including interconnecting roads in parts of the country which share international boundaries with neighboring countries. The regional connectivity so enhanced would promote cross border trade and commerce and help safeguard India's international borders. This would lead to the formation of a more integrated and economically consolidated South and South East Asia. In addition, there would be overall economic benefits for the local population and help integrate the peripheral areas with the mainstream in a more robust manner. An approximate aggregate length of 10,000 kms has been identified to begin with for development through this company. The company envisages creating customized and specialized skills in terms of addressing issues like complexities of geographical terrains and addressing extensive coordination requirements with security agencies. The company would also endeavor to undertake infrastructure projects including but not restricted to urban infrastructure and urban or city transport and to act as an agency for development of all types of Infrastructure. The company envisages working towards cross sharing of technical know-how and enhancing opportunities for business development with other nations and their agencies including the multilateral organizations and institutions.

The company also proposes to improve road connectivity and efficiency of the international trade corridor, by expanding about 500 KMs of roads in the North Bengal and Northeastern region of India to enable efficient and safe transport regionally with other South Asia Sub-regional economic Cooperation (SASEC) member countries.

2.4 MISSION OF NHIDCL

To be a professional company which works in most efficient and transparent manner and designs, develops & delivers infrastructure projects in a time bound basis for maximizing benefits to all stakeholders.

2.5 VISION OF NHIDCL

To be an instrument for creation and management of infrastructure of the highest standard in the country with focus on the North East and Border areas and contribute significantly towards nation building.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

CHAPTER-3

PROJECT BACKGROUND

3.1 EXISTING SCENARIO

3.1.1 START AND END POINT OF THE PROJECT ROAD

The Project Road starts near Chirakuta and ends at Jalukbari interchange in Guwahati. The total length of the existing road stretch is 209.998km (As per topographic survey).The project road comes under Dhubri, Bongaigaon, Goalpara, Kamrup Rural & Kamrup Metropolitan districts of Assam.

The Package-1 of the project road starts near Chirakuta and ends Near Mowatari, before Chapar Bypass) (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey).

Latitude: 26°13'60" Longitude: 90°16'48" Elevation: 57.09±28 m Accuracy: 10.3 m Time: 05-10-2023 15:22 Note: start of PKG-01	
Originating point of PKG-1, near Chirakuta (Ch. 5.580 Km)	Terminating point of PKG-1, near Mowatari, before Chapar bypass(Ch.25.633km)

3.1.2 IMPORTANCE OF PROJECT ROAD

❖ **Connectivity to West Bengal:**

- ✓ To Alipurduwar Via NH 117 (Old NH 31C) and NH 27 (Old NH 31C)
- ✓ To Cooch Behar Via NH 17 (Old NH 31)

❖ **Connectivity to Meghalaya:**

- ✓ To Tura via NH 17 (Old NH 37) and NH 217 (Old NH 31C) from Paikan, Dudhnoi

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

- ✓ To Selsela, Zikzak via NH 17 (Old NH 37), SH 12 (Assam), SH2 (Meghalaya) from Agia
- ✓ To Rongjeng and Nongstoin NH 17 (Old NH 37), SH 10 (Assam), SH1 (Meghalaya) from Boko
- ✓ To Shillong via NH 17 (Old NH 37), SH3 (Meghalaya) from Airport Junction Meghalaya
- ❖ **Connectivity to Nagaland:**
 - ✓ To Dimapur via NH 27 (Old NH 37) and AH2 from Nagaon
- ❖ **Connectivity to Arunachal Pradesh:**
 - ✓ To Itanagar via NH 27 (Old NH 37), NH15, NH415 from Gohpur
- ❖ This economic corridor also provides connectivity to Upper Assam and Lower Assam (via NH27) with the neighboring states.
- ❖ It also connects important market/Town Bilasipura, Chapar, Tulungia, Jogighopa, Krishnai, Dudhnoi, Dhupdhara, Boko, Chayagaon, Bijohnagar, Mirza & Guwahati. The project road also connects the proposed MMLP at Jogighopa.
- ❖ The Social benefits arising due to the project will be triggered off due to improved accessibility to various services such as easy access to markets, health facilities, school, work place etc., which in turn increases the income of the locals, and ultimately raises their standard of living

Road network along the project road is represented in below Plate -3.1.2

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A (**Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam**)

**Final Detailed Project Report
Project Background**

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Plate -3.1.2: Location Map of the project Road



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

The Package-1 starts near Chirakuta and ends Near Mowatari, before Chapar Bypass (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain.

3.1.3 SETTLEMENT

Details of Package-1

During Survey work, it has been observed that there are 10 nos. of habitations along the project road section. Details of the habitations are given below Table No – 3.1.3a

Table – 3.1.3a: List of Habitations along the Project Corridor

Sl. No.	Chainage (Km)		Length (Km)	Name of Habitation
	From	To		
1	5.580	8.000	2.420	Chirakuthi
2	8.000	10.000	2.000	Sonamukhi
3	10.000	10.800	0.800	Koliarkhal
4	10.800	12.000	1.200	Tilapara
5	12.000	13.400	1.400	Mohish Bathan
6	13.400	15.600	2.200	Salkocha
7	15.600	20.000	4.400	Hatipota
8	20.000	23.000	3.000	Dhirghat
9	23.000	25.000	2.000	Arayarjhar
10	25.000	25.633	0.633	Kharida Gossaigaon

The locations of major settlement areas along the project corridor are mentioned in Table- 3.1.3 b

Table – 3.1.3b: List of major settlement areas

Sl. No.	Chainage (Km)		Length (Km)	Major settlement
	From	To		
1	15.600	20.000	1.340	Hatipota

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Plate – 3.1.3: Photograph of settlement area is shown below



3.1.4 LAND USE PATTERN

The land use pattern of the road stretch is mainly agricultural land and also some settlement areas are observed along the project road.

3.1.5 TERRAIN CLASSIFICATION

The project road passes through plain terrain.

3.1.6 RIGHT OF WAY (ROW)

Details of Package-1

The existing ROW along the project road varies from 11m to 50m. Chainagewise existing ROW details are shown in Table 3.1.6:

Table-3.1.6: List of Existing ROW

Survey Chainage(m)	EROW Width(m)
5.580	48
5.630	47
5.680	47
5.730	45
5.780	44

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Survey Chainage(m)	EROW Width(m)
5.830	44
5.880	43
5.930	45
5.980	49
6.030	49
6.080	44
6.130	42
6.180	45
6.230	48
6.280	51
6.330	49
6.380	49
6.430	47
6.480	47
6.530	53
6.580	53
6.630	51
6.680	51
6.730	51
6.780	54
6.830	57
6.880	53
6.933	50
6.985	52
7.035	12
Sonamukhi & Tilapara Bypass, From Survey Ch. 7.080km to Survey Ch. 14.480km	
14.480	18
14.510	24
14.560	21
14.610	18
14.660	16
14.710	19
14.760	21
14.810	17
14.860	21
14.910	22

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Survey Chainage(m)	EROW Width(m)
14.960	20
15.010	18
15.060	18
15.110	18
15.160	18
15.210	18
15.260	14
15.310	14
15.360	28
15.410	33
15.460	37
15.510	31
15.560	23
15.610	31
15.660	29
15.710	28
15.760	27
15.810	29
15.860	30
15.910	25
15.960	28
16.010	28
16.060	27
16.110	27
16.160	32
16.210	38
16.260	29
16.310	29
16.360	27
16.410	26
16.460	22
16.510	26
16.560	31
16.610	33
16.660	32
16.710	32

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Survey Chainage(m)	EROW Width(m)
16.760	33
16.810	31
16.860	31
16.910	19
16.960	19
17.010	15
Realignment Location, From Survey Ch. 17.068km to Survey Ch. 18.550km	
18.550	14
18.600	13
18.650	15
18.700	15
18.750	16
18.800	14
18.850	16
18.900	15
18.950	13
19.000	12
19.050	12
19.100	12
19.150	12
19.200	12
19.250	12
19.300	12
19.350	12
19.400	27
19.450	17
19.500	12
19.550	12
19.600	12
19.650	36
19.700	41
19.750	41
19.800	47
19.850	54
19.900	53
19.950	51

[Signature]



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Survey Chainage(m)	EROW Width(m)
20.000	33
20.050	40
20.100	36
20.150	34
20.200	35
20.250	34
20.300	28
20.350	36
20.400	36
20.450	41
20.500	39
20.550	40
20.600	37
20.650	44
20.700	39
20.750	34
20.800	30
20.850	33
20.900	34
20.950	41
21.000	39
21.050	40
21.100	46
21.150	30
21.200	34
21.250	34
21.300	39
21.350	40
21.400	35
21.450	31
21.500	31
21.550	33
21.600	31
21.650	22
21.700	20
21.750	27

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Survey Chainage(m)	EROW Width(m)
21.800	32
21.850	34
21.910	37
21.950	30
22.000	27
22.050	27
22.100	28
22.150	31
22.200	30
22.250	30
22.300	29
22.350	30
22.400	30
22.450	30
22.500	30
22.550	29
22.600	29
22.650	30
22.700	29
22.750	27
22.800	29
22.850	28
22.900	29
22.950	31
23.000	31
23.050	31
23.100	30
23.150	31
23.200	31
23.250	32
23.300	32
23.350	20
23.400	12
23.450	11
23.500	12
23.550	13

I. M. M. M.



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Survey Chainage(m)	EROW Width(m)
23.600	15
23.650	16
23.700	15
23.750	28
23.800	28
23.850	29
23.900	29
23.950	29
24.000	29
24.050	29
24.100	30
24.150	32
24.200	30
24.250	30
24.300	29
24.350	29
24.400	28
24.450	29
24.500	28
24.550	28
24.600	35
24.650	32
24.700	33
24.750	33
24.800	32
24.850	32
24.900	30
24.950	29
25.000	28
25.050	30
25.100	31
25.150	29
25.200	29
25.250	29
25.300	30
25.350	31

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Survey Chainage(m)	EROW Width(m)
25.400	31
25.450	30
25.500	26
25.550	28

3.1.7 EXISTING PAVEMENT AND CARRIAGEWAY

The existing road is two lane with earthen shoulder on both side. The carriageway width of the existing road is 7m. Width of shoulder varies from 1.0 – 1.5 meter on each side of the project road. Total formation width varies from 9 – 10 meter.

The existing pavement condition along the road is basically fair to poor. Various types of pavement distresses encountered in poor pavement stretch are Cracking, Potholes, Raveling, Edge drop, Rutting and Patching.

Details are given in **Appendix 3.1 and 3.2.**

Table-3.1.7: Summary of existing pavement and carriageway

SL. NO	Package	Chainage (Km)		Length (Km)	Width of Carriageway (m)	Type of Pavement
		From	To			
1	1	5.580	25.633	20.053	7.0	Bituminous

Plate – 3.1.7: Pavement Distresses observed along the project stretch



S. Mukherjee



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)



3.1.8 EXISTING INTERSECTIONS

Details of Package-1

There are 39 nos. (2nos. 4-legged & 37 nos. 3-legged) minor intersections have been found along the project road. The details of minor intersections are given below in Table-3.1.8.

Table-3.1.8: Details of Minor Intersections

Sl. No.	Location	Type	
	Survey Ch. (Km)	Type of Intersection	Lead Towards
1	5.580	3-legged	Towards Bilasipara
2	6.041	3-legged	Towards KMP
3	6.180	3-legged	Towards Bulkapara



**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Sl. No.	Location	Type	
	Survey Ch. (Km)	Type of Intersection	Lead Towards
4	6.370	3-legged	Towards Village Road
5	6.680	3-legged	Towards Bharat Brick Industry
6	6.787	3-legged	Towards Village Road
7	14.540	3-legged	Towards Village Road
8	14.818	3-legged	Towards Sonapur
9	15.170	3-legged	Towards Konokali
10	15.550	3-legged	Towards Chand Bundigain
11	15.960	3-legged	Towards Hate Pota Mosto Pat
12	16.068	3-legged	Towards New Hati Pota
13	16.564	3-legged	Towards Morok
14	16.924	3-legged	Towards Islam Aria Bazzar
15	20.120	3-legged	Towards Marojartila
16	20.386	3-legged	Towards Fuljhurpara
17	20.785	3-legged	Towards Joy Guru Brick Industry
18	20.970	3-legged	Towards Village Road
19	21.030	3-legged	Towards Village Road
20	21.380	3-legged	Towards Momota Brick Field
21	21.532	3-legged	Towards Village Road
22	21.705	3-legged	Towards T G Brick Field
23	21.815	3-legged	Towards Chakchaka
24	22.300	3-legged	Towards Arer Jhar 1no Word
25	22.725	3-legged	Towards Arer JharPokirpara
26	22.960	3-legged	Towards Arer JharPutimari
27	23.075	3-legged	Towards Kodomtola
28	23.157	3-legged	Towards Village Road
29	23.300	3-legged	Towards Village Road
30	23.447	3-legged	Towards Village Road
31	23.528	3-legged	Towards Village Road
32	24.292	3-legged	Towards Mowatary
33	24.813	3-legged	Towards Kharidagosiyyow
34	24.873	4-legged	Towards Kharidagosiyyow(LHS),Towards Kharidagosiyyow(RHS)
35	24.900	3-legged	Towards Kharidagosiyyow
36	25.026	4-legged	Towards Kharidagosiyyow(LHS),Towards



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Location	Type	
	Survey Ch. (Km)	Type of Intersection	Lead Towards
			Kharidagosiyyow(RHS)
37	25.100	3-legged	Towards Kharidagosiyyow
38	25.268	3-legged	Towards Village Road
39	25.340	3-legged	Towards Kharidagosiyyow

3.1.9 EXISTING BRIDGES

Details of Package-1

8nos. of minor bridges have been observed along the project stretch. Details of existing minor bridges are given below in Table 3.1.9. Details are given in **Appendix 3.4**.

Table-3.1.9: Details of Existing Minor Bridges

Sl No	Survey Chainage (km)	Name of river/ stream	Type of bridge	Span arrangement (exp. joint to exp. joint)	Clear roadway width between kerbs	Total outer width of bridge (m)
1	6.244	Nallah	RCC Slab	1 x 6m	7.5	12.5
2	15.347	Sukhi river	RCC Slab	3 x 7.95m	7.5	8.0
3	15.994	Nallah	RCC Slab	1 x 6m	7.5	11.2
4	16.797	Nallah	RCC Slab	1 x 6m	7.5	11.5
5	19.347	Nallah	RCC Slab	1x9.3m+1x8.9 m	7.5	8.0
6	20.331	Dhirbil River	PSC Girder	1 x 40.7m	7.5	8.0
7	23.738	Nallah	RCC Slab	1 x 6.0m	7.5	12.8
8	25.452	Nallah	RCC Slab	5 x 7.5m	7.5	8.0

[Signature]



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Plate 3.1.9: Photographs of Some Existing Minor Bridges



3.1.10 EXISTING CULVERTS

Details of Package-1

8 nos. existing culverts have been observed along the project stretch out of which 4 nos. are Slab culverts and remaining 4 no are pipe culvert. Details of existing culverts are given below in Table-3.1.10.

Table – 3.1.10: Details of Existing Culverts

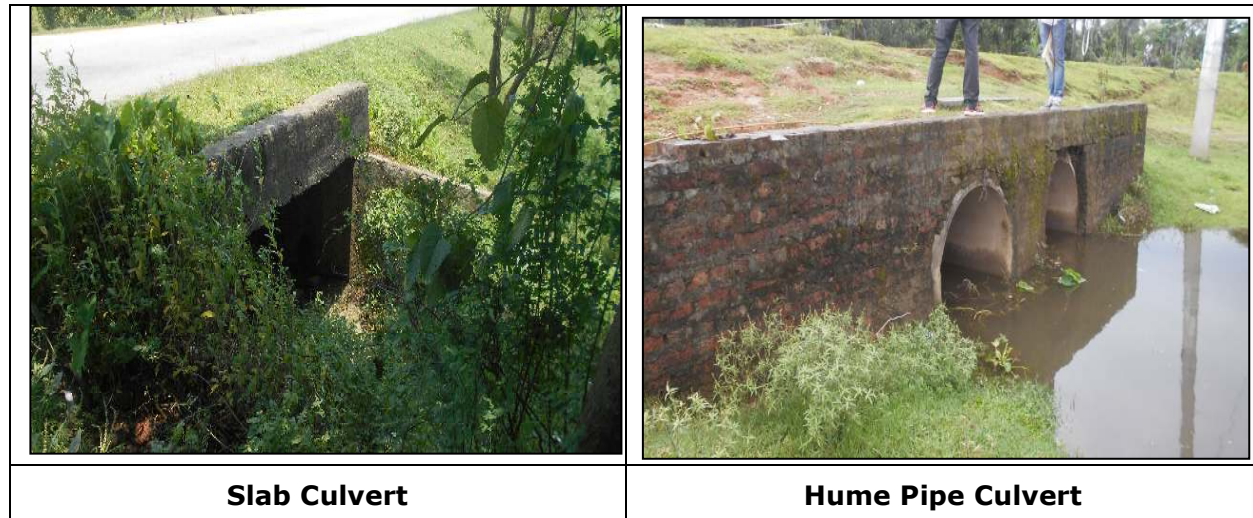
Sl. No	Survey Chainage (km)	Type of Structures (Pipe/Slab/Box/Arch)	Thickness of Slab (m)	Span Arrangement (no x length) (m)	Carriageway width (m)	Width of culvert (m)
1	7.028	Slab	0.2	1X5.77m	7.5	12.60
2	19.519	Slab	0.3	1X0.9m	7.5	10.5
3	19.642	Hume Pipe	0.3	2 X1.2m	7.5	17.7
4	21.893	Slab	0.3	1 X 3.0m	7.5	11.2
5	23.222	Slab	-	1 X 1.0m	7.5	11
6	24.306	Hume Pipe	0.3	1 X 1.2m	7.5	19.7
7	24.556	Hume Pipe	0.3	1 X 1.2m	7.5	20
8	24.924	Hume Pipe	0.3	1 X 1.2m	7.5	19

J. Mulya



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Plate 3.1.10: Photographs of Some Existing Culverts



3.1.11 ROADWAY DRAINAGE

Lined drains are present in the few stretches in the project road.
Total length of existing lined Drain=631m

3.1.12 EXISTING RAILWAY CROSSING

No railway level crossing has been observed for Package -1

3.1.13 EXISTING ROB

No ROB's has been observed for Package -1

3.1.14 EXISTING RUB

No RUB have been observed along the project stretch.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

3.1.15 EXISTING FLYOVER

No Flyover has been observed for Package -1

3.1.16 FOREST STRETCH

The project stretch passes through Srigrum RF & Sarpamari RF. Details are given below.

As per Existng Survey Ch(km)		As per Design Ch(km)		Side	Effective Length(km)	Length (km)	Remaks	Remaks
From	To	From	To					
-	-	9.950	10.168	Both	0.436	0.218	Srigrum RF	-
-	-	10.168	10.678	Left	0.51	0.51	Sarpamari RF	
-	-	10.168	10.703	Right	0.535	0.535	Sarpamari RF	
18.561	19.249	10.678	11.366	Left	0.688	0.688	Srigrum RF	

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

3.1.17 PHOTOGRAPH

Photograph of field work have been shown in Plate 3.1.17

Plate-3.1.17: Photographs of Field Work



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)



Turning Movement Count Survey



Pedestrian Count Survey



Trial Pit

3.2 DEVELOPMENT PROPOSAL

3.2.1 PROPOSED CROSS SECTION DETAILS

Details of Package-1

The existing 2-lane road has been developed in 4-lane configuration. Appropriate design applications have been considered for operational efficiency and road safety. Different types of typical cross-section have been proposed. Details of TCS has been given in Table-3.2.1

Table-3.2.1: Details of Proposed Cross-Section

3.2.2 PROPOSED TYPICAL CROSS-SECTION

Sl. No.	Description	Length (m)
TCS 1D	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN RURAL AREA(RECONSTRUCTION OVER EXISTING PAVEMENT)	2227
TCS 2	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH	900
TCS 2A	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH WITH BOTH SIDE RETAINING WALL AND STONE PITCHING ALONG WITH BERM	2353
TCS 2C	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH WITH BOTH SIDE RETAINING WALL	609
TCS 4F	TYPICAL CROSS SECTION OF 4 LANE CARRIAGEWAY WITH BOTH SIDE SERVICE ROAD IN BUILT-UP AREA (RECONSTRUCTION OVER EXISTING PAVEMENT WITH FULL GRANULAR LAYER SCARIFICATION WITH NEW SUBGRADE)	2873
TCS 4F1	TYPICAL CROSS SECTION OF 4 LANE CARRIAGEWAY WITH BOTH SIDE SERVICE ROAD IN RURAL AREA (RECONSTRUCTION OVER EXISTING PAVEMENT)	969

Sl. No.	Description	Length (m)
TCS 4F2	TYPICAL CROSS SECTION OF 4 LANE CARRIAGEWAY WITH RIGHT SIDE SERVICE ROAD IN RURAL AREA(RECONSTRUCTION OVER EXISTING PAVEMENT)	180
TCS 5D	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN FOREST STRETCH WITH BOTH SIDE R.C.C RETAINING WALL	738
TCS 5E	TYPICAL CROSS SECTION OF 4 LANE CARRIAGEWAY WITH RIGHT SIDE SERVICE ROAD IN FOREST STRETCH (RECONSTRUCTION OVER EXISTING PAVEMENT WITH FULL GRANULAR LAYER SCARIFICATION WITH NEW SUBGRADE)	678
TCS 6B	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN VUP/SVUP APPROACHES WITH BOTH SIDE SERVICE ROAD	1215
TCS 6B1	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN FLYOVER APPROACHES WITH BOTH SIDE SERVICE ROAD WITH DRAIN	343
	ROB+VIADUCT+VUP	1220
	TAPPERED PORTION	2700
	FLYOVER	455
	TOLL PLAZA	277
	Total Length=	17737

Proposed TCS details is given below in Table 3.2.2

Table-3.2.2: Details of Proposed TCS

Sl No	Chainage(m)		Length (m)	TCS Type
	From	To		
1	0	373	373	TCS 4F1
2	373	598	225	Tapered

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A **(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)**

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**Final Detailed Project Report
Project Background**

Sl No	Chainage(m)		Length (m)	TCS Type
	From	To		
3	598	875	277	Toll Plaza
4	875	1200	325	TCS 4F1
5	1200	1540	340	TCS 6B
6	1540	2460	920	TCS 2A
7	2460	2500	40	TCS 2C
8	2500	3330	830	TCS 2A
9	3330	3400	70	TCS 2C
10	3400	3520	120	TCS 2A
11	3520	4170	650	TCS 2
12	4170	4240	70	TCS 2A
13	4240	4490	250	TCS 2
14	4490	4748	258	TCS 2C
15	4748	5968	1220	ROB+VIADUCT+VUP
16	5968	6109	141	TCS 2A
17	6109	6350	241	TCS 2C
18	6350	7225	875	TCS 6B
19	7225	7450	225	Tapered(TCS 6B-TCS 1D)
20	7450	7985	535	TCS 1D
21	7985	8210	225	Tapered(TCS 1D-TCS 4F)
22	8210	8880	670	TCS 4F
23	8880	9223	343	TCS 6B1
24	9223	9500	277	Flyover
25	9500	9678	178	Flyover1
26	9678	9950	272	TCS 2A
27	9950	10688	738	TCS 5D

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A **(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)**

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**Final Detailed Project Report
Project Background**

Sl No	Chainage(m)		Length (m)	TCS Type
	From	To		
28	10688	11366	678	TCS 5E
29	11366	11900	534	TCS 1D
30	11900	12125	225	Tapered(TCS 1D-TCS 4F)
31	12125	12175	50	TCS 4F
32	12175	12400	225	Tapered(TCS 4F-TCS 1D)
33	12400	12498	98	TCS 1D
34	12498	12723	225	Tapered(TCS 1D-TCS 4F)
35	12723	13454	731	TCS 4F
36	13454	13725	271	TCS 4F1
37	13725	13950	225	Tapered(TCS 4F1-TCS 1D)
38	13950	14408	458	TCS 1D
39	14408	14633	225	Tapered (TCS 1D-TCS 4F)
40	14633	15170	537	TCS 4F
41	15170	15395	225	Tapered (TCS 4F-TCS 1F)
42	15395	15575	180	TCS 4F2
43	15575	15800	225	Tapered (TCS 4F2-TCS 1D)
44	15800	16115	315	TCS 1D
45	16115	16340	225	Tapered (TCS 1D-TCS 4F)
46	16340	17225	885	TCS 4F
47	17225	17450	225	Tapered (TCS 4F-TCS 1D)
48	17450	17737	287	TCS 1D
Total Length			17737	

3.2.3 GEOMETRIC DESIGN

Details of Package-1

All the horizontal curves have been designed with the recommended design speed and appropriate super elevation has been provided for attaining riding safety and comfort in confirmation to IRC standards.

Details of Alignment Report are given below in **Table-3.2.3**

Table-3.2.3: Horizontal and Vertical Alignment Report

HIP/ CUR VE NO.	ELEMENT	START			END			LENGTH (m)	CHORD LENGT H (m)	RAD IUS (m)	HAND OF ARC	SUPERELE VATION (%)	DESIGN SPEED	EXTRA WIDENING
		CHAINAG E (m)	EASTING	NORTHING	CHAINAG E (m)	EASTING	NORTHING							
	Transition	145.557	228338.675	2904222.863	200.557	228377.267	2904183.692		55					
	Straight	200.557	228377.267	2904183.692	506.582	228596.977	2903970.669	306.025						
2	Arc	506.582	228596.977	2903970.669	560.150	228635.236	2903933.175		53.569	5000	Right	Normal Camber	100	--NA--
	Straight	560.150	228635.236	2903933.175	1682.900	229432.895	2903143.044	1122.749						
	Transition	1682.900	229432.895	2903143.044	1722.900	229461.468	2903115.053		40					
3	Arc	1722.900	229461.468	2903115.053	2002.931	229684.345	2902946.565		280.031	1200	Left	3.7	100	--NA--
	Transition	2002.931	229684.345	2902946.565	2042.931	229719.067	2902926.707		40					
	Straight	2042.931	229719.067	2902926.707	2328.263	229967.535	2902786.427	285.333						
	Transition	2328.263	229967.535	2902786.427	2368.263	230002.475	2902766.956		40					
4	Arc	2368.263	230002.475	2902766.956	3710.053	231273.020	2902845.552		1341.78 9	1200	Left	3.7	100	--NA--
	Transition	3710.053	231273.020	2902845.552	3750.053	231305.294	2902869.181		40					
	Straight	3750.053	231305.294	2902869.181	3782.677	231331.510	2902888.599	32.624						
	Transition	3782.677	231331.510	2902888.599	3877.677	231409.570	2902942.677		95					
5	Arc	3877.677	231409.570	2902942.677	4014.337	231534.738	2902996.465		136.661	500	Right	5.0	100	--NA--
	Transition	4014.337	231534.738	2902996.465	4109.337	231627.694	2903015.876		95					
	Straight	4109.337	231627.694	2903015.876	4232.603	231749.094	2903037.241	123.265						

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A **(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)**

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**Final Detailed Project Report
Project Background**

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		CHAINAG E (m)	EASTING	NORTHING	CHAINAG E (m)	EASTING	NORTHING							
6	Arc	4232.603	231749.094	2903037.241	4855.972	232369.064	2903033.223		623.369	1725	Right	Normal Camber	80	--NA--
	Straight	4855.972	232369.064	2903033.223	5975.607	233469.144	2902824.884	1119.635						
	Transition	5975.607	233469.144	2902824.884	6045.607	233538.287	2902814.163		70					
7	Arc	6045.607	233538.287	2902814.163	6234.495	233721.787	2902848.061		188.888	350	Left	7.0	80	--NA--
	Transition	6234.495	233721.787	2902848.061	6304.495	233782.535	2902882.777		70					
	Straight	6304.495	233782.535	2902882.777	6730.829	234145.434	2903106.529	426.333						
	Transition	6730.829	234145.434	2903106.529	6845.829	234246.009	2903162.076		115					
8	Arc	6845.829	234246.009	2903162.076	6894.355	234291.597	2903178.619		48.527	400	Right	5.0	100	--NA--
	Transition	6894.355	234291.597	2903178.619	7009.355	234404.389	2903200.499		115					
	Straight	7009.355	234404.389	2903200.499	7238.040	234630.716	2903233.247	228.684						
	Transition	7238.040	234630.716	2903233.247	7353.040	234743.508	2903255.127		115					
9	Arc	7353.040	234743.508	2903255.127	7369.662	234759.346	2903260.169		16.622	400	Left	5.0	100	--NA--
	Transition	7369.662	234759.346	2903260.169	7484.662	234864.026	2903307.526		115					
	Straight	7484.662	234864.026	2903307.526	7934.691	235264.696	2903512.441	450.029						
	Transition	7934.691	235264.696	2903512.441	7994.691	235317.766	2903540.425		60					
10	Arc	7994.691	235317.766	2903540.425	8067.734	235379.788	2903578.957		73.043	800	Left	5.0	100	--NA--
	Transition	8067.734	235379.788	2903578.957	8127.734	235428.388	2903614.137		60					
	Straight	8127.734	235428.388	2903614.137	8181.797	235471.783	2903646.382	54.064						
11	Arc	8181.797	235471.783	2903646.382	8223.615	235505.085	2903671.673		41.818	2000	Left	Normal Camber	100	--NA--
	Straight	8223.615	235505.085	2903671.673	8276.613	235546.955	2903704.165	52.998						
12	Arc	8276.613	235546.955	2903704.165	8318.431	235580.257	2903729.456		41.818	2000	Right	Normal Camber	100	--NA--
	Straight	8318.431	235580.257	2903729.456	8412.891	235656.076	2903785.796	94.460						
	Transition	8412.891	235656.076	2903785.796	8527.891	235751.473	2903849.828		115					
13	Arc	8527.891	235751.473	2903849.828	8569.643	235789.176	2903867.721		41.752	400	Right	5.0	100	--NA--
	Transition	8569.643	235789.176	2903867.721	8684.643	235899.104	2903901.134		115					



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**Final Detailed Project Report
Project Background**

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		CHAINAG E (m)	EASTING	NORTHING	CHAINAG E (m)	EASTING	NORTHING							
	Straight	8684.643	235899.104	2903901.134	9010.198	236214.765	2903980.786	325.555						
14	Arc	9010.198	236214.765	2903980.786	9033.965	236237.775	2903986.738		23.767	2000	Left	Normal Camber	100	--NA--
	Straight	9033.965	236237.775	2903986.738	9129.454	236330.077	2904011.200	95.489						
15	Arc	9129.454	236330.077	2904011.200	9175.807	236375.017	2904022.553		46.353	2000	Right	Normal Camber	100	--NA--
	Straight	9175.807	236375.017	2904022.553	9272.107	236468.651	2904045.059	96.300						
	Transition	9272.107	236468.651	2904045.059	9387.107	236578.949	2904077.229		115					
16	Arc	9387.107	236578.949	2904077.229	9508.585	236683.269	2904138.558		121.478	400	Left	5.0	100	--NA--
	Transition	9508.585	236683.269	2904138.558	9623.585	236765.016	2904219.293		115					
	Straight	9623.585	236765.016	2904219.293	9641.235	236776.965	2904232.283	17.650						
	Transition	9641.235	236776.965	2904232.283	9716.235	236829.961	2904285.280		75					
17	Arc	9716.235	236829.961	2904285.280	9794.593	236895.680	2904327.542		78.358	300	Right	7.0	80	0.6
	Transition	9794.593	236895.680	2904327.542	9869.593	236965.889	2904353.771		75					
	Straight	9869.593	236965.889	2904353.771	10110.128	237194.523	2904428.495	240.535						
	Transition	10110.128	237194.523	2904428.495	10145.128	237227.748	2904439.497		35					
18	Arc	10145.128	237227.748	2904439.497	10579.968	237613.590	2904636.705		434.84	1500	Left	3.0	100	--NA--
	Transition	10579.968	237613.590	2904636.705	10614.968	237641.969	2904657.190		35					
	Straight	10614.968	237641.969	2904657.190	10638.051	237660.634	2904670.773	23.083						
19	Arc	10638.051	237660.634	2904670.773	10758.494	237760.092	2904738.670		120.442	2000	Right	Normal Camber	100	--NA--
	Straight	10758.494	237760.092	2904738.670	10844.465	237832.523	2904784.982	85.971						
	Transition	10844.465	237832.523	2904784.982	10924.465	237898.935	2904829.556		80					
20	Arc	10924.465	237898.935	2904829.556	10951.612	237920.410	2904846.160		27.147	600	Left	5.0	100	--NA--
	Transition	10951.612	237920.410	2904846.160	11031.612	237980.265	2904899.215		80					
	Straight	11031.612	237980.265	2904899.215	11079.003	238015.022	2904931.430	47.391						
	Transition	11079.003	238015.022	2904931.430	11154.003	238072.064	2904980.045		75					
21	Arc	11154.003	238072.064	2904980.045	11176.313	238090.656	2904992.367		22.31	300	Right	7.0	80	0.6



Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A (Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)

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**Final Detailed Project Report
Project Background**

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		CHAINAG E (m)	EASTING	NORTHING	CHAINAG E (m)	EASTING	NORTHING							
	Transition	11176.313	238090.656	2904992.367	11251.313	238157.654	2905025.959		75					
	Straight	11251.313	238157.654	2905025.959	11534.433	238415.809	2905142.206	283.120						
	Transition	11534.433	238415.809	2905142.206	11649.433	238518.193	2905194.343		115					
22	Arc	11649.433	238518.193	2905194.343	11681.020	238544.143	2905212.339		31.588	400	Left	5.0	100	--NA--
	Transition	11681.020	238544.143	2905212.339	11796.020	238628.860	2905289.952		115					
	Straight	11796.020	238628.860	2905289.952	11823.764	238648.396	2905309.652	27.744						
	Transition	11823.764	238648.396	2905309.652	11938.764	238733.113	2905387.264		115					
23	Arc	11938.764	238733.113	2905387.264	11950.938	238742.945	2905394.442		12.174	400	Right	5.0	100	--NA--
	Transition	11950.938	238742.945	2905394.442	12065.938	238842.678	2905451.485		115					
	Straight	12065.938	238842.678	2905451.485	12437.055	239173.279	2905620.100	371.117						
	Transition	12437.055	239173.279	2905620.100	12482.055	239213.051	2905641.143		45					
24	Arc	12482.055	239213.051	2905641.143	12498.989	239227.630	2905649.755		16.934	500	Left	5.0	80	--NA--
	Transition	12498.989	239227.630	2905649.755	12543.989	239265.255	2905674.433		45					
	Straight	12543.989	239265.255	2905674.433	12612.803	239322.224	2905713.033	68.814						
25	Arc	12612.803	239322.224	2905713.033	12702.166	239398.002	2905760.359		89.363	1200	Right	Normal Camber	80	--NA--
	Straight	12702.166	239398.002	2905760.359	12966.841	239627.556	2905892.108	264.675						
26	Arc	12966.841	239627.556	2905892.108	13097.061	239742.526	2905953.208		130.22	2000	Right	Normal Camber	100	--NA--
	Straight	13097.061	239742.526	2905953.208	13247.135	239877.271	2906019.284	150.074						
	Transition	13247.135	239877.271	2906019.284	13322.135	239943.130	2906055.057		75					
27	Arc	13322.135	239943.130	2906055.057	13401.794	240003.172	2906107.051		79.659	300	Left	7.0	80	0.6
	Transition	13401.794	240003.172	2906107.051	13476.794	240047.991	2906167.122		75					
	Straight	13476.794	240047.991	2906167.122	13506.122	240064.535	2906191.338	29.328						
	Transition	13506.122	240064.535	2906191.338	13576.122	240104.975	2906248.465		70					
28	Arc	13576.122	240104.975	2906248.465	13975.470	240421.854	2906482.532		399.348	700	Right	5.0	100	--NA--
	Transition	13975.470	240421.854	2906482.532	14045.470	240488.346	2906504.392		70					
	Straight	14045.470	240488.346	2906504.392	14978.595	241379.530	2906781.002	933.125						



Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A **(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)**

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

**Final Detailed Project Report
Project Background**

HIP/ CUR VE NO.	ELEMENT	START			END			LENGTH (m)	CHORD LENGT H (m)	RAD IUS (m)	HAND OF ARC	SUPERELE VATION (%)	DESIGN SPEED	EXTRA WIDENING
		CHAINAG E (m)	EASTING	NORTHING	CHAINAG E (m)	EASTING	NORTHING							
29	Arc	14978.595	241379.530	2906781.002	15126.707	241520.314	2906826.997		148.112	5000	Left	Normal Camber	100	--NA--
	Straight	15126.707	241520.314	2906826.997	15689.522	242052.654	2907009.682	562.815						
30	Arc	15689.522	242052.654	2907009.682	15753.541	242113.038	2907030.945		64.019	4000	Left	Normal Camber	100	--NA--
	Straight	15753.541	242113.038	2907030.945	16061.677	242402.851	2907135.615	308.135						
31	Arc	16061.677	242402.851	2907135.615	16180.573	242515.813	2907172.656		118.897	2000	Right	Normal Camber	100	--NA--
	Straight	16180.573	242515.813	2907172.656	16817.990	243127.132	2907353.177	637.416						
32	Arc	16817.990	243127.132	2907353.177	16952.430	243256.565	2907389.513		134.441	5000	Right	Normal Camber	100	--NA--
	Straight	16952.430	243256.565	2907389.513	17325.859	243617.419	2907485.604	373.428						
33	Arc	17325.859	243617.419	2907485.604	17371.481	243661.367	2907497.845		45.622	2000	Left	Normal Camber	100	--NA--
	Straight	17371.481	243661.367	2907497.845	17647.809	243926.699	2907575.022	276.328						
34	Arc	17647.809	243926.699	2907575.022	17686.398	243963.646	2907586.157		38.589	2000	Left	Normal Camber	100	--NA--
	Straight	17686.398	243963.646	2907586.157	17730.246	244005.505	2907599.213	43.848						
35	Arc	17730.246	244005.505	2907599.213	17771.165	244044.690	2907610.997		40.919	2000	Right	Normal Camber	100	--NA--
	Straight	17771.165	244044.690	2907610.997	18061.544	244323.607	2907691.774	290.379						

J. Mulya



Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A **(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)**

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**Final Detailed Project Report
Project Background**

VERTICAL CURVE REPORT												
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	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT	
3	76.243	35.429	Hog	60	-0.029	46.243	35.353	106.243	35.389	0.253	-0.133	155.440
4	190.956	35.276	Sag	65	0.053	158.456	35.319	223.456	35.446	-0.133	0.523	99.085
5	313.091	35.915	Hog	150	-0.203	238.091	35.523	388.091	35.495	0.523	-0.560	138.504
6	432.585	35.246	Sag	86	0.097	389.585	35.487	475.585	35.395	-0.560	0.346	94.923
7	553.516	35.665	Hog	130	-0.150	488.516	35.440	618.516	35.289	0.346	-0.577	140.845
8	662.711	35.034	Sag	70	0.059	627.711	35.236	697.711	35.068	-0.577	0.095	104.167
9	812.369	35.177	Hog	60	-0.015	782.369	35.148	842.369	35.144	0.095	-0.111	291.262
10	1121.004	34.836	Sag	200	0.478	1021.004	34.946	1221.004	36.636	-0.111	1.800	104.657
11	1528.147	42.164	Hog	460	-1.955	1298.147	38.024	1758.147	38.484	1.800	-1.600	135.294
12	1874.225	36.627	Sag	180	0.427	1784.225	38.067	1964.225	36.897	-1.600	0.300	94.737
13	2731.103	39.197	Hog	80	-0.041	2691.103	39.077	2771.103	39.153	0.300	-0.112	194.175
14	3229.604	38.638	Hog	100	-0.023	3179.604	38.694	3279.604	38.488	-0.112	-0.300	531.915
15	3714.335	37.184	Sag	100	0.013	3664.335	37.334	3764.335	37.084	-0.300	-0.200	1000.000
16	4103.684	36.405	Sag	60	0.015	4073.684	36.465	4133.684	36.405	-0.200	0.000	300.000



Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A **(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)**

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**Final Detailed Project Report
Project Background**

VERTICAL CURVE REPORT												
CURVE NO.	IP		TYPE OF CURVE	CURVE LENGTH	M VALUE	START		END		GRADIENT		K' VALUE
	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT	
17	4283.147	36.405	Sag	80	0.050	4243.147	36.405	4323.147	36.605	0.000	0.500	160.000
18	4663.206	38.305	Sag	200	0.500	4563.206	37.805	4763.206	40.805	0.500	2.500	100.000
19	5051.000	48.000	Hog	340	-1.062	4881.000	43.750	5221.000	48.000	2.500	0.000	136.000
20	5666.000	48.000	Hog	270	-0.675	5531.000	48.000	5801.000	45.300	0.000	-2.000	135.000
21	6136.000	38.600	Sag	200	0.500	6036.000	40.600	6236.000	38.600	-2.000	0.000	100.000
22	6399.789	38.600	Sag	115	0.173	6342.289	38.600	6457.289	39.290	0.000	1.200	95.833
23	6750.614	42.810	Hog	380	-1.330	6560.614	40.530	6940.614	39.770	1.200	-1.600	135.714
24	7093.194	37.329	Sag	130	0.211	7028.194	38.369	7158.194	37.134	-1.600	-0.300	100.000
25	7419.397	36.350	Sag	60	0.023	7389.397	36.440	7449.397	36.350	-0.300	0.000	200.000
26	7873.000	36.350	Hog	80	-0.030	7833.000	36.350	7913.000	36.230	0.000	-0.300	266.667
27	8156.334	35.500	Sag	80	0.030	8116.334	35.620	8196.334	35.500	-0.300	0.000	266.667
28	8509.000	35.500	Hog	80	-0.013	8469.000	35.500	8549.000	35.449	0.000	-0.126	634.921
29	8880.774	35.030	Sag	250	0.821	8755.774	35.188	9005.774	38.155	-0.126	2.500	95.202

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A **(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)**

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**Final Detailed Project Report
Project Background**

VERTICAL CURVE REPORT												
CURVE NO.	IP		TYPE OF CURVE	CURVE LENGTH	M VALUE	START		END		GRADIENT		K' VALUE
	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT	
30	9475.000	49.885	Hog	540	-2.700	9205.000	43.135	9745.000	45.835	2.500	-1.500	135.000
31	9950.000	42.761	Sag	250	0.815	9825.000	44.635	10075.000	44.147	-1.500	1.109	95.822
32	10220.851	45.765	Hog	220	-0.432	10110.851	44.545	10330.851	45.256	1.109	-0.463	139.949
33	10471.994	44.603	Sag	160	0.334	10391.994	44.973	10551.994	45.567	-0.463	1.206	95.866
34	10670.305	46.993	Hog	200	-0.366	10570.305	45.788	10770.305	46.737	1.206	-0.257	136.705
35	10919.223	46.355	Sag	80	0.040	10879.223	46.457	10959.223	46.411	-0.257	0.141	201.005
36	11209.506	46.763	Hog	330	-0.990	11044.506	46.531	11374.506	43.033	0.141	-2.261	137.386
37	11665.569	36.454	Sag	240	0.692	11545.569	39.166	11785.569	36.507	-2.261	0.045	104.076
38	12110.185	36.652	Sag	100	0.114	12060.185	36.630	12160.185	37.132	0.045	0.960	109.290
39	12343.000	38.886	Hog	140	-0.168	12273.000	38.214	12413.000	38.886	0.960	0.000	145.833
40	12560.000	38.886	Hog	140	-0.175	12490.000	38.886	12630.000	38.186	0.000	-1.000	140.000
41	12864.269	35.843	Sag	120	0.160	12804.269	36.443	12924.269	35.885	-1.000	0.070	112.150
42	13256.439	36.116	Hog	60	-0.022	13226.439	36.095	13286.439	36.047	0.070	-0.230	200.000
43	13362.022	35.874	Sag	60	0.039	13332.022	35.943	13392.022	35.961	-0.230	0.291	115.163



Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A **(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)**

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**Final Detailed Project Report
Project Background**

VERTICAL CURVE REPORT												
CURVE NO.	IP		TYPE OF CURVE	CURVE LENGTH	M VALUE	START		END		GRADIENT		K' VALUE
	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT	
44	13473.423	36.198	Hog	100	-0.054	13423.423	36.052	13523.423	36.126	0.291	-0.143	230.415
45	13731.561	35.827	Sag	60	0.023	13701.561	35.870	13761.561	35.878	-0.143	0.168	192.926
46	13832.783	35.997	Hog	80	-0.054	13792.783	35.930	13872.783	35.847	0.168	-0.374	147.601
47	13907.240	35.718	Sag	60	0.044	13877.240	35.831	13937.240	35.782	-0.374	0.211	102.564
48	14055.090	36.031	Hog	80	-0.049	14015.090	35.946	14095.090	35.920	0.211	-0.277	163.934
49	14135.884	35.807	Sag	60	0.036	14105.884	35.890	14165.884	35.866	-0.277	0.197	126.582
50	14300.661	36.131	Hog	100	-0.056	14250.661	36.033	14350.661	36.006	0.197	-0.249	224.215
51	14414.894	35.846	Sag	80	0.045	14374.894	35.946	14454.894	35.926	-0.249	0.200	178.174
52	14574.038	36.164	Hog	88.107	-0.060	14529.985	36.076	14618.091	36.013	0.200	-0.344	161.961
53	14669.038	35.837	Sag	60	0.025	14639.038	35.941	14699.038	35.833	-0.344	-0.015	182.371
54	14858.769	35.809	Sag	60	0.026	14828.769	35.814	14888.769	35.909	-0.015	0.334	171.920
55	15144.249	36.762	Hog	100	-0.079	15094.249	36.595	15194.249	36.615	0.334	-0.295	158.983
56	15332.789	36.206	Sag	80	0.084	15292.789	36.324	15372.789	36.423	-0.295	0.541	95.694



Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A **(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)**

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**Final Detailed Project Report
Project Background**

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	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT	
57	15428.189	36.722	Hog	60	-0.025	15398.189	36.560	15458.189	36.784	0.541	0.206	179.104
58	15625.460	37.129	Hog	80	-0.030	15585.460	37.046	15665.460	37.091	0.206	-0.096	264.901
59	15760.000	37.000	Sag	60	0.007	15730.000	37.029	15790.000	37.000	-0.096	0.000	625.000
60	16052.425	37.000	Sag	60	0.015	16022.425	37.000	16082.425	37.060	0.000	0.200	300.000
61	16385.009	37.665	Hog	200	-0.097	16285.009	37.465	16485.009	37.478	0.200	-0.187	516.796
62	16658.401	37.154	Sag	100	0.039	16608.401	37.247	16708.401	37.215	-0.187	0.123	322.581
63	16824.028	37.358	Hog	100	-0.034	16774.028	37.296	16874.028	37.282	0.123	-0.152	363.636
64	17229.762	36.742	Sag	80	0.015	17189.762	36.803	17269.762	36.742	-0.152	0.000	526.316
65	17637.000	36.742	Hog	80	-0.034	17597.000	36.742	17677.000	36.606	0.000	-0.341	234.604

3.2.4 PAVEMENT THICKNESS

Innovative pavement considering CT base and CT sub-base has been proposed for widening/Reconstruction/RE Wall/Bypass portion has been proposed.

Flexible pavement shall be designed as per IRC: 37-2018(Fourth Revision). Design traffic is minimum 44 MSA and design CBR is 5%. Following pavement thickness has been adopted for the project road Package-1.

Main Carriageway
<u>For Widening / Reconstruction/RE Wall/Bypass</u>
BC -40 mm
DBM -60 mm
Aggregate Layer- 100 mm
CT Base-100 mm
CT Sub-Base- 200 mm
Total -500 mm
Service Road
BC -40 mm
Aggregate Layer- 100 mm
CT Base-100 mm
CT Sub-Base- 200 mm
Total -440 mm

3.2.5 PROPOSED BRIDGES

Details of Package-1

10 nos. minor bridge (Reconstruction= 7 nos, Retain & additional 2 lane bridge=1 no, & New Construction=2nos) has been proposed. The details of improvement proposal of minor bridge is given below in Table-3.2.5

Table-3.2.5: Improvement proposal of Minor bridges

Sl. No.	Design Chainage(km)	Existing Bridge Details				Proposed Bridge Details			
		Type of Structures (Bridge)	Span Arrangement (No. x Span) m	CW (m)	Total Width (m)	Type	Span Arrangement (No. x Span in m)	Total Width (m)	Type of Structure
1	0.664	RCC Slab	1 x 6m	11.7	12.5	Reconstruction Minor Bridge	1 x 6m x 6m	30.2	RCC Box
2	1.900	-				New construction Minor Bridge	2 x 24m	28	RCC Integral Voided Slab
3	4.203	-				New construction Minor Bridge	1 x 40m	28	PSC T Girder
4	7.801	RCC Slab	3 x 7.95m	7.3	8.0	Reconstruction Minor Bridge	1 x 24m	28	RCC Integral Voided Slab
5	8.446	RCC Slab	1 x 6m	10.2	11.2	Reconstruction Minor Bridge with Service road bridges	1 x 6m x 3m	45.1	RCC Box
6	9.250	RCC Slab	1 x 6m	10.7	11.5	Reconstruction minor bridge (Both side service road bridge)	1 x 8m x 4m	21.6	RCC Box (vertical gradient)
7	11.467	RCC Slab	1x9.3m+1x8.9m	7.3	8.0	Reconstruction Minor Bridge	1 x 24m	28	RCC Integral Voided Slab(with

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A **(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)**

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

**Final Detailed Project Report
Project Background**

Sl. No.	Design Chainage(km)	Existing Bridge Details				Proposed Bridge Details			
		Type of Structures (Bridge)	Span Arrangement (No. x Span) m	CW (m)	Total Width (m)	Type	Span Arrangement (No. x Span in m)	Total Width (m)	Type of Structure
									longitudinal gradient)
8	12.439	PSC Girder	1 x 40.7m	7.4	8.0	Additional Two lane Minor Bridge	1 x 42m	12.5	PSC T Girder,
9	15.843	RCC Slab	1 x 6.0m	12.1	12.8	Reconstruction Minor Bridge	1 x 6m x 3m	28	RCC Box
10	17.557	RCC Slab	5 x 7.5m	7.4	8.0	Reconstruction Minor Bridge	5 x 8m x 6m	28	RCC Box

J. Mulya



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

3.2.6 PROPOSED CULVERTS

Details of Package-1

54 nos. of RCC box culverts has been proposed in the project section. Out of which 8 nos. of culvert are to be reconstructed. 46 nos. additional new culvert has been proposed. Details is given below in Table-3.2.6(a) & (b).

Table-3.2.6 (a):Details of Proposed Reconstruction Culvert

Sl No.	Survey Chainage (Km)	Design Chainage(KM)	Remarks for Proposal	Size Span X Height (M X M)
1	7.028	1.447	Cast-in-situ	1 X 4.0 X 5.0_EC
2	19.519	11.637	RCC segmental box	1 X 2.0m X 2.0m
3	19.642	11.755	Cast-in-situ	1 X 3.0m X 4.0m
4	21.893	13.998	Cast-in-situ	1 X 3.0m X 4.0m
5	23.222	15.326	RCC segmental box	1 X 2.0m X 3.0m
6	24.306	16.411	Cast-in-situ	1 X 3.0m X 4.0m
7	7.028	16.661	RCC segmental box	1 X 2.0m X 3.0m
8	19.519	17.029	RCC segmental box	1 X 2.0m X 3.0m

Table-3.2.6 (b) : Details of Proposed New Culvert

Sl. No.	Design Chainage(KM)	Remarks for Proposal	Size Span X Height (M X M)
1	0.233	Cast-in-situ	1 X 4.0 m X 5.0 m
2	0.424	Cast-in-situ	1 X 4.0 m X 5.0 m
3	0.923	Cast-in-situ	1 X 4.0 m X 5.0 m
4	1.192	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
5	1.688	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
6	2.065	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
7	2.300	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
8	2.468	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
9	2.725	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
10	2.855	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
11	3.125	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
12	3.221	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
13	3.310	Cast-in-situ	1 X 4.0 m X 5.0 m _EC

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Design Chainage(KM)	Remarks for Proposal	Size Span X Height (M X M)
14	3.405	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
15	4.356	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
16	4.505	Cast-in-situ	1 X 4.0 m X 5.0 m
17	4.562	Cast-in-situ	1 X 4.0 m X 5.0 m
18	4.667	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
19	6.265	Cast-in-situ	1 X 4.0 m X 5.0 m
20	6.527	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
21	6.682	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
22	6.769	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
23	6.889	Cast-in-situ	1 X 4.0 m X 5.0 m
24	7.107	RCC segmental box	1 X 2.0 m X 2.0 m
25	7.374	RCC segmental box	1 X 2.0 m X 2.0 m
26	7.652	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
27	7.932	RCC segmental box	1 X 2.0 m X 2.0 m
28	8.098	RCC segmental box	1 X 2.0 m X 3.0 m
29	8.709	RCC segmental box	1 X 2.0 m X 2.0 m
30	9.031	RCC segmental box	1 X 2.0 m X 3.0 m
31	9.649	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
32	9.879	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
33	10.399	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
34	10.519	Cast-in-situ	1 X 4.0 m X 5.0 m
35	12.219	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
36	12.731	Cast-in-situ	1 X 4.0 m X 5.0 m
37	13.048	Cast-in-situ	1 X 4.0 m X 5.0 m
38	13.358	Cast-in-situ	1 X 4.0 m X 5.0 m _EC
39	13.780	RCC segmental box	1 X 2.0 m X 2.0 m
40	14.234	RCC segmental box	1 X 2.0 m X 2.0 m
41	14.825	Cast-in-situ	1 X 3.0 m X 4.0 m
42	15.585	RCC segmental box	1 X 2.0 m X 3.0 m
43	16.043	RCC segmental box	1 X 2.0 m X 2.0 m
44	16.277	Cast-in-situ	1 X 3.0 m X 4.0 m
45	17.309	RCC segmental box	1 X 2.0 m X 2.0 m
46	17.692	RCC segmental box	1 X 2.0 m X 2.0 m

3.2.7 PROPOSED ROB

1 no. ROB has been proposed in the project road stretch. Details is given below

[Signature]

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Design Ch(km)	Length of ROB (m)	Width of the ROB
1	5.371	1 x 36m + (1 x 72m) + 1 x 36m	Bowstring Girder + Composite Girder: Carriageway Width= 2x9.5m Overall width =29.2m

3.2.8 PROPOSED VIADUCT/FLYOVER/VUP/SVUP/VOP

Details of Flyover are given below in Table 3.2.8.a

Table-3.2.8.a: Details of Flyover

SI No.	Design Chainage (km)	Improvement Proposal		Total Width (m)
		Type of Structure	Span Arrangement (No. x Span in m)	
1	Km 9.223 to Km 9.678	PSC Box Girder	13x35m	23

2 Nos Vehicular Underpass(VUP), 5 nos Small Vehicular Underpasses(SVUP) & 1 no Vehicular Overpass(VOP) are proposed at the following locations mentioned below.

Table-3.2.8.b: Location of Vehicular/Small Vehicular Underpass (VUP/SVUP)

Sl. No.	Design Chainage (km)	Type of Structure	Span Arrangement (No. x Span)m
1	0.346	SVUP	1 x 8.0mx5.0m, RCC Box
2	1.000	SVUP	1 x 8.0mx5.0m, RCC Box
3	1.528	SVUP	1 x 8.0mx5.0m, RCC Box
4	4.754	SVUP	1 x 15m, Simply Supported Voided Slab
5	5.869	VUP	1 x 40m, PSC T Girder
6	6.332	SVUP	1 x 8.0m x 5.0m, RCC Box,
7	6.725	VUP	1 x 24m, RCC Integral Voided Slab

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Table-3.2.8.c: Location of Vehicular Overpass (VOP)

Sl No.	Design Chainage (km)	Type of Structure	Span Arrangement (No.xSpan)m
1	3.608	VOP	2 x 21m, RCC T Girder,

Details of Viaduct are given below in Table 3.2.8.d

Table-3.2.8.d: Details of Viaduct

Sl. No.	Design Chainage (km)	Improvement Proposal		Total Width (m)
		Type of Structure	Span Arrangement (No. x Span in m)	
1	5.040	RCC T Beam + PSC T Girder, Viaduct	1 x 35m + 11 x 40m + 1 x 20.8m + 2 x 30m	24
2	5.660	RCC T Beam + PSC T Girder + Simply Supported Voids Slab, Viaduct	1 x 20.8m + 1 x 30m + 6 x 40m + 2 x 35m + 1 x 15m	24
3	5.929	PSC T Girder, Viaduct	2 x 40m	24

3.2.9 JUNCTION IMPROVEMENT

Details of Package-1

Junctions have been classified into "Major" and "Minor" junctions according to functional importance and prospects. 3 nos. of major junction (3 no. 3-legged) and 39 nos. of minor junctions (2 nos. 4-legged & 37 nos. 3-legged) have been developed. Detail of major & minor junctions are given below in Table 3.2.9a & 3.2.9b:

Table-3.2.9a: Details of proposed major junctions

Sl. No.	Design Chainage (KM)	Type of Intersection	Lead Towards	Improvement Proposal
1	Ch.1.600km	3-Legged	Junction is provided at the start point of Sonamukhi & Tilapara Bypass	Improvement with grade separated structure with service road
2	Ch.6.730km	3-Legged	Junction is provided at the end point of Sonamukhi & Tilapara Bypass	Improvement with grade separated structure with service road

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Design Chainage (KM)	Type of Intersection	Lead Towards	Improvement Proposal
3	Ch.9.550km	3-Legged	Junction is provided at the start point of Hatipota Realignment	Improvement with grade separated structure with service road

Table-3.2.9b: Details of proposed minor junctions

Sl. No.	Design Chainage (KM)	Type of Intersection	Lead Towards	Remarks
1	0.000	3-legged	Towards Bilasipara	Improvement with service road and merging lane
2	0.462	3-legged	Towards KMP	
3	0.598	3-legged	Towards Bulkapara	
4	0.783	3-legged	Towards Village Road	
5	1.093	3-legged	Towards Bharat Brick Industry	
6	1.203	3-legged	Towards Village Road	
7	7.000	3-legged	Towards Village Road	
8	7.278	3-legged	Towards Sonapur	
9	7.998	3-legged	Towards Chand Bundigain	
10	8.413	3-legged	Towards Hate Pota Mosto Pat	
11	8.518	3-legged	Towards New Hati Pota	
12	9.016	3-legged	Towards Morok	
13	9.376	3-legged	Towards Islam Aria Bazaar	
14	10.668	3-legged	End point of Hatipota Realignment	
15	12.228	3-legged	Towards Marojartila	
16	12.498	3-legged	Towards Fuljhurpara	
17	12.894	3-legged	Towards Joy Guru Brick Industry	
18	13.078	3-legged	Towards Village Road	
19	13.138	3-legged	Towards Village Road	
20	13.483	3-legged	Towards Momota Brick Field	
21	13.638	3-legged	Towards Village Road	
22	13.818	3-legged	Towards T G Brick Field	
23	13.923	3-legged	Towards Chakchaka	
24	14.408	3-legged	Towards Arer Jhar 1no Word	
25	14.831	3-legged	Towards Arer JharPokirpara	
26	15.068	3-legged	Towards Arer JharPutimari	
27	15.182	3-legged	Towards Kodomtola	
28	15.265	3-legged	Towards Village Road	



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Design Chainage (KM)	Type of Intersection	Lead Towards	Remarks
29	15.406	3-legged	Towards Village Road	
30	15.558	3-legged	Towards Village Road	
31	15.635	3-legged	Towards Village Road	
32	16.398	3-legged	Towards Mowatary	
33	16.918	3-legged	Towards Kharidagosiyygow	
34	16.978	4-legged	Towards Kharidagosiyygow(LHS), Towards Kharidagosiyygow(RHS)	
35	17.008	3-legged	Towards Kharidagosiyygow	
36	17.134	4-legged	Towards Kharidagosiyygow(LHS), Towards Kharidagosiyygow(RHS)	
37	17.208	3-legged	Towards Kharidagosiyygow	
38	17.374	3-legged	Towards Village Road	
39	17.446	3-legged	Towards Kharidagosiyygow	

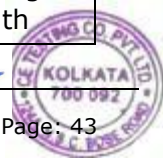
3.2.10 SERVICE ROADS AND DRAINS

Details of Package-1

Service road and RCC cover drain cum footpath has been proposed at Built-up locations. Details are given below in Table 3.2.10(a) & (b)

Table-3.2.10(a): Details of Service Road

Sl. No.	Location of service road(from km to km)	Right hand side(RHS)/Left hand side(LHS)/or Both sides	Length (km)of service road	Reference to TCS	Remarks
1	Km 0.000 to km 0.373	Both sides	$2 \times 0.373 = 0.746$	TCS 4F1	2x5.5m
2	Km 0.373 to km 0.598	Both sides	$2 \times 0.225 = 0.450$	Tapered	Varying Width
3	Km 0.800 to km 1.540	Both sides	$2 \times 0.740 = 1.480$	-	2x5.5m
4	Km 6.350 to km 7.225	Both sides	$2 \times 0.875 = 1.750$	TCS 6B	2x5.5m
5	Km 7.225 to km 7.450	Both sides	$2 \times 0.225 = 0.450$	Tapered	Varying Width



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Location of service road(from km to km)	Right hand side(RHS)/Left hand side(LHS)/or Both sides	Length (km)of service road	Reference to TCS	Remarks
6	Km 7.985 to km 8.210	Both sides	$2 \times 0.225 = 0.450$	Tapered	Varying Width
7	Km 8.210 to km 8.880	Both sides	$2 \times 0.670 = 1.340$	TCS 4F	2x5.5m
8	Km 8.880 to km 9.223	Both sides	$2 \times 0.343 = 0.686$	TCS 6B1	2x5.5m
9	Km 9.223 to km 9.500	Both sides	$2 \times 0.277 = 0.554$	-	2x5.5m
10	Km 9.500 to km 9.678	Both sides	$2 \times 0.178 = 0.356$	-	2x5.5m
11	Km 9.678 to km 9.950	Both sides	$2 \times 0.272 = 0.544$	-	2x5.5m
12	Km 10.668 to km 11.366	Right sides	$1 \times 0.698 = 0.698$	-	1x5.5m
13	Km 11.900 to km 12.125	Both sides	$2 \times 0.225 = 0.450$	Tapered	Varying Width
14	Km 12.125 to km 12.175	Both sides	$2 \times 0.050 = 0.100$	TCS 4F	2x5.5m
15	Km 12.175 to km 12.400	Both sides	$2 \times 0.225 = 0.450$	Tapered	Varying Width
16	Km 12.498 to km 12.723	Both sides	$2 \times 0.225 = 0.450$	Tapered	Varying Width
17	Km 12.723 to km 13.454	Both sides	$2 \times 0.731 = 1.462$	TCS 4F	2x5.5m
18	Km 13.454 to km 13.725	Both sides	$2 \times 0.271 = 0.542$	TCS 4F1	2x5.5m
19	Km 13.725 to km 13.950	Both sides	$2 \times 0.225 = 0.450$	Tapered	Varying Width
20	Km 14.408 to km 14.633	Both sides	$2 \times 0.225 = 0.450$	Tapered	Varying Width
21	Km 14.633 to km 15.170	Both sides	$2 \times 0.537 = 1.074$	TCS 4F	2x5.5m
22	Km 15.170 to km 15.395	Both sides	$2 \times 0.225 = 0.450$	Tapered	Varying Width

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Location of service road(from km to km)	Right hand side(RHS)/Left hand side(LHS)/or Both sides	Length (km)of service road	Reference to TCS	Remarks
23	Km 15.395 to km 15.575	One side	1X0.180=0.180	TCS 4F2	2x5.5m
24	Km 15.575 to km 15.800	One side	1X0.225=0.225	Tapered	Varying Width
25	Km 16.115 to km 16.340	Both sides	2X0.225=0.450	Tapered	Varying Width
26	Km 16.340 to km 17.225	Both sides	2X0.885=1.770	TCS 4F	2x5.5m
27	Km 17.225 to km 17.450	Both sides	2X0.225=0.450	Tapered	Varying Width

Table-3.2.10(b): Details of Cover Drain

Chainage (m)		Side	Length (m)	Remarks
From	To			
7985	8210	Both	2X225=450	Tapered Portion
8210	8880	Both	2X670=1340	TCS-4F
8880	9223	Both	2X343=686	TCS-6B1
9223	9500	Both	2X277=554	-
10668	11366	One	1X698=698	TCS-5E
11900	12125	Both	2X225=450	Tapered Portion
12125	12175	Both	2X50=100	TCS-4F
12175	12400	Both	2X225=450	Tapered Portion
12498	12723	Both	2X225=450	Tapered Portion
12723	13454	Both	2X731=1462	TCS-4F
14408	14633	Both	2X225=450	Tapered Portion
14633	15170	Both	2X537=1074	TCS-4F
15170	15395	Both	2X225=450	Tapered Portion
15395	15575	One	1X180=360	TCS-4F2
15575	15800	One	1X225=225	Tapered Portion
16115	16340	Both	2X225=450	Tapered Portion
16340	17225	Both	2X885=1770	TCS-4F
17225	17450	Both	2X225=450	Tapered Portion
Total Length of 1.0m Width Covered Drain =			11869	

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

3.2.11 ROAD MARKINGS/SIGNAGE/ROAD FURNITURE

Details of Package-1

Traffic signage, Thermoplastic road markings, road studs, delineators, Rumble Strip, Thrie-Metal Beam crash barriers & Overhead gantry etc. has been proposed at required locations to ensure adequate safety of the road users. Details are given below in Table-3.2.11.

Table-3.2.11: Details of various road signs and marking

SI No	Traffic Signages, Road Marking and other appurtenances	unit	Quantity
1	Right Hand Side Curve(900 mm Triangular)	Nos.	58
2	Left Hand Side Curve(900 mm Triangular)	Nos.	52
3	School (900 mm Triangular)	Nos.	36
4	Side road left(900 mm Triangular)	Nos.	80
5	Side road right(900 mm Triangular)	Nos.	76
6	Bus Stop(800 mm x 600 mm rectangular)	Nos.	2
7	Direction Sign<.0.9 sqm	Nos.	10
8	Stop Sign(900 mm Octagonal)	Nos.	156
9	Horn prohibited(600mm Circular)	Nos.	36
10	Hazard Marker (one way) (900mm x300 mm rectangular)	Nos.	264
11	Object Marker (one way) (900mm x300 mm rectangular)	Nos.	2
12	Rumble strip	Nos.	160
13	Road Stud	Nos.	2696
14	Built-up area(900 mm Triangular)	Nos.	20
15	Delineator	Nos.	600
16	Lane marking, edge marking	Sqm	14300
17	Cats Eye	Nos.	21202
18	Hexagonal woven mesh fencing	Rm	8436
19	Solar Bilnker	Nos	4

Overhead traffic signs: Details is given below

Sl. No.	Location (Km)	Size
1	0.150	Minimum Clear Span of 22.5m.(Ref TCS-1D)and minimum clear height from road top level shall be 6.0m

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

3.2.12 BUS BAY & PASSENGER SHELTER

Details of Bus-bay with passenger shelter is given below in Table-3.2.12

Table-3.2.12: List of Passenger shelter and Bus-Bay with Passenger Shelter

Sl. No.	Project Facility	Design Chainage (km)	Side	Location
1	Bus Bay with Passenger shelter	14.268	Both side	Near Aryarjhar

3.2.13 TOLL PLAZA

Details of Toll Plaza is given below in Table-3.2.13

Sl. No.	Design Chainage (km)	Name of the Place	Remarks
1	0.736	Chirakuta	8 Lane Toll Plaza

3.2.14 FOOT OVER BRIDGE (FOB)

Foot over bridge has been proposed at 4 locations. The details is given below.

Sl.No	Design Ch.(km)	Location	Remarks
1	8.088	Hatipota	Foot Over Bridge (FOB) shall have minimum clear width of 3.0m with provision of 4 sided stairs. Minimum clear height from road top level shall be 6.0m and minimum clear span shall be as per proposed road TCS at FOB locations. Foot Over Bridge (FOB) shall be aesthetically pleasant and shall reflect cultural heritage of Assam.
2	12.826	Dhirghat	
3	15.352	Areajhar	
4	17.303	Mowatari	

3.2.15 PROTECTION WORK

Details of Protection works are given below in Table 3.2.15.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Table-3.2.15: Details of Protection Work

(A) Toe wall

Main Carriageway:

Design Ch		Side	Length (km)
From(km)	To(km)		
0.000	0.598	Both	1.196
0.800	1.540	Both	1.480
10.685	11.365	Left	0.680
11.585	11.865	Both	0.560
15.435	15.815	Left	0.380
Total length=			4.296

(B) Retaining Wall

Location		Side	Length (km)
From(km)	To(km)		
Main Carriageway			
0.200	1.200	Both	2.000
1.540	1.650	Both	0.220
1.610	1.650	Both	0.080
1.650	2.460	Both	1.620
2.460	2.510	Both	0.100
2.510	2.550	Both	0.080
2.550	2.900	Both	0.700
2.900	2.980	Both	0.160
2.980	3.100	Both	0.240
3.100	3.330	Both	0.460
3.330	3.400	Both	0.140
3.400	3.520	Both	0.240
3.710	3.850	One	0.140
4.180	4.240	Both	0.120
4.500	4.740	Both	0.480
5.965	6.106	Both	0.282
6.106	6.350	Both	0.488
9.678	9.950	Both	0.544
9.950	10.688	Both	1.476
11.365	11.585	Both	0.440
11.865	12.225	Both	0.720
12.225	12.700	Both	0.950

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Location		Side	Length (km)
From(km)	To(km)		
Service Road			
9.500	9.950	Both	0.900
Total length=			12.580

(C) Breast wall

Location		Side	Length (km)
From(km)	To(km)		
3.570	3.630	Both	0.120
3.710	3.850	Left	0.140
11.665	11.835	Left	0.170
Total length=			0.430

(D) Stone Pitching

Location		side	Length(km)
From(km)	To(km)		
Main Carriageway			
1.540	1.650	Both	0.220
1.650	2.460	Both	1.620
2.500	3.330	Both	1.660
3.400	3.520	Both	0.240
4.050	4.350	Both	0.600
4.170	4.240	Both	0.140
5.968	6.109	Both	0.282
9.678	9.950	Both	0.544
Total length=			5.306

(E) Ground Improvement by Sand Piling

Chainage(km)		Length(km)
from	to	
1.600	3.500	1.900
6.415	6.665	0.250
Total Length=		2.150

(F) Chute Drain

Chute drain has been proposed of 1060m length

CHAPTER - 4

ENGINEERING SURVEYS, INVESTIGATION AND ANALYSIS

4.1 Introduction

Different types of field studies, engineering surveys and investigations are required to gather data and information for preparation of the report for the project road stretches. The aim of the investigations is to develop an adequate supportive database for selecting and preparing the most appropriate and economic proposal to meet the functional and structural efficiency of the road as well as safety requirements.

The following are the necessary engineering survey and investigations need to be carried out at site to assess the existing characteristics of the road:

- (a) Reconnaissance Survey
- (b) Road Inventory
- (c) Pavement Condition Survey
- (d) Inventory and Condition Survey of Existing Structures
- (e) Topographical Survey
- (f) Traffic Survey
- (g) Sub-grade Investigation
- (h) Quarry Material Survey
- (i) Sub-Soil Exploration

4.2 Engineering Surveys and Investigations

4.2.1 Reconnaissance Survey

The consultants made an in-depth study of the available maps of the project area and other relevant information collected. A detailed reconnaissance survey was conducted for the PKG-1 (Existing length=20.053km, as per Topographic survey, Ex.Ch.5.580km to Ex.Ch.25.633km), near Chirakuta to near Mowatari, before Chapar Bypass section of the project Road and detail features such as land use, habitation, water routes, river, intersecting roads, utilities such as electrical lines (HT/LT/HT), etc has been noted. This enabled the Consultants to visualize the possible problems to be encountered during the finalization of the design work. The detailed ground reconnaissance of project influence area was utilized for planning and programming the detailed surveys and investigations.

4.2.2 Road Inventory

Detailed inventory of the project road stretches have been prepared through visual inspection with sample measurements to assess the existing status. Features like existing kilometerage, terrain, land use, width of pavement and shoulders, height of embankment, geometric deficiencies, important road junctions, railway level crossings, utilities, other

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

roadside features etc. were recorded. The inventory is essentially included to physical information on the road and its environment for enabling preliminary assessment of the project. The existing road is consists two lane with earthen shoulder configuration. Brief summary of the Carriageway & shoulder details are in table 4.1. Details are given in **Appendix- 3.1** to Main Report

Table 4.1: Brief summary of Carriageway and Shoulder Details

Chainage(km)		Carriageway Width (m)	Shoulder width (m)
From	To		
5.600	5.800	7.0	LHS=1.5 RHS=1.5
5.800	6.000	7.0	LHS=1.5 RHS=1.5
6.000	6.200	7.0	LHS=1.5 RHS=1.5
6.200	6.400	7.0	LHS=1.5 RHS=1.5
6.400	6.600	7.0	LHS=1.5 RHS=1.5
6.600	6.800	7.0	LHS=1.5 RHS=1.5
6.800	7.000	7.0	LHS=1.5 RHS=1.5
7.000	7.200	7.0	LHS=1.5 RHS=1.5
7.200	7.400	7.0	LHS=1.5 RHS=1.5
7.400	7.600	7.0	LHS=1.5 RHS=1.5
7.600	7.800	7.0	LHS=1.5 RHS=1.5
7.800	8.000	7.0	LHS=1.5 RHS=1.5
8.000	8.200	7.0	LHS=1.5 RHS=1.5
8.200	8.400	7.0	LHS=1.5 RHS=1.5
8.400	8.600	7.0	LHS=1.5 RHS=1.5
8.600	8.800	7.0	LHS=1.5 RHS=1.5

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Chainage(km)		Carriageway Width (m)	Shoulder width (m)
From	To		
8.800	9.000	7.0	LHS=1.5 RHS=1.5
9.000	9.200	7.0	LHS=1.5 RHS=1.5
9.200	9.400	7.0	LHS=1.5 RHS=1.5
9.400	9.600	7.0	LHS=1.5 RHS=1.5
9.600	9.800	7.0	LHS=1.5 RHS=1.5
9.800	10.000	7.0	LHS=1.5 RHS=1.5
10.000	10.200	7.0	LHS=1.5 RHS=1.5
10.200	10.400	7.0	LHS=1.5 RHS=1.5
10.400	10.600	7.0	LHS=1.5 RHS=1.5
10.600	10.800	7.0	LHS=1.5 RHS=1.5
10.800	11.000	7.0	LHS=1.5 RHS=1.5
11.000	11.200	7.0	LHS=1.5 RHS=1.5
11.200	11.400	7.0	LHS=1.0 RHS=1.5
11.400	11.600	7.0	LHS=1.0 RHS=1.0
11.600	11.800	7.0	LHS=1.0 RHS=1.0
11.800	12.000	7.0	LHS=1.0 RHS=1.0
12.000	12.200	7.0	LHS=1.0 RHS=1.0
12.200	12.400	7.0	LHS=1.0 RHS=1.0
12.400	12.600	7.0	LHS=1.0 RHS=1.0
12.600	12.800	7.0	LHS=1.0

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Chainage(km)		Carriageway Width (m)	Shoulder width (m)
From	To		
			RHS=1.0
12.800	13.000	7.0	LHS=1.0 RHS=1.0
13.000	13.200	7.0	LHS=1.0 RHS=1.0
13.200	13.400	7.0	LHS=1.0 RHS=1.0
13.400	13.600	7.0	LHS=1.0 RHS=1.0
13.600	13.800	7.0	LHS=1.0 RHS=1.0
13.800	14.000	7.0	LHS=1.0 RHS=1.0
14.000	14.200	7.0	LHS=1.0 RHS=1.0
14.200	14.400	7.0	LHS=1.0 RHS=1.0
14.400	14.600	7.0	LHS=1.0 RHS=1.0
14.600	14.800	7.0	LHS=1.0 RHS=1.0
14.800	15.000	7.0	LHS=1.0 RHS=1.0
15.000	15.200	7.0	LHS=1.0 RHS=1.0
15.200	15.400	7.0	LHS=1.0 RHS=1.0
15.400	15.600	7.0	LHS=1.0 RHS=1.0
15.600	15.800	7.0	LHS=1.0 RHS=1.0
15.800	16.000	7.0	LHS=1.0 RHS=1.0
16.000	16.200	7.0	LHS=1.0 RHS=1.0
16.200	16.400	7.0	LHS=1.0 RHS=1.0
16.400	16.600	7.0	LHS=1.0 RHS=1.0

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Chainage(km)		Carriageway Width (m)	Shoulder width (m)
From	To		
16.600	16.800	7.0	LHS=1.0 RHS=1.0
16.800	17.000	7.0	LHS=1.0 RHS=1.0
17.000	17.200	7.0	LHS=1.0 RHS=1.0
17.200	17.400	7.0	LHS=1.0 RHS=1.0
17.400	17.600	7.0	LHS=1.0 RHS=1.0
17.600	17.800	7.0	LHS=1.0 RHS=1.0
17.800	18.000	7.0	LHS=1.0 RHS=1.0
18.000	18.200	7.0	LHS=1.0 RHS=1.0
18.200	18.400	7.0	LHS=1.0 RHS=1.0
18.400	18.600	7.0	LHS=1.0 RHS=1.0
18.600	18.800	7.0	LHS=1.0 RHS=1.0
18.800	19.000	7.0	LHS=1.0 RHS=1.0
19.000	19.200	7.0	LHS=1.5 RHS=1.0
19.200	19.400	7.0	LHS=1.5 RHS=1.0
19.400	19.600	7.0	LHS=1.5 RHS=1.0
19.600	19.800	7.0	LHS=1.5 RHS=1.0
19.800	20.000	7.0	LHS=1.5 RHS=1.0
20.000	20.200	7.0	LHS=1.0 RHS=1.0
20.200	20.400	7.0	LHS=1.0 RHS=1.0
20.400	20.600	7.0	LHS=1.0

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Chainage(km)		Carriageway Width (m)	Shoulder width (m)
From	To		
			RHS=1.0
20.600	20.800	7.0	LHS=1.0 RHS=1.0
20.800	21.000	7.0	LHS=1.0 RHS=1.0
21.000	21.200	7.0	LHS=1.0 RHS=1.0
21.200	21.400	7.0	LHS=1.0 RHS=1.0
21.400	21.600	7.0	LHS=1.0 RHS=1.0
21.600	21.800	7.0	LHS=1.0 RHS=1.0
21.800	22.000	7.0	LHS=1.0 RHS=1.0
22.000	22.200	7.0	LHS=1.0 RHS=1.0
22.200	22.400	7.0	LHS=1.0 RHS=1.0
22.400	22.600	7.0	LHS=1.0 RHS=1.0
22.600	22.800	7.0	LHS=1.0 RHS=1.0
22.800	23.000	7.0	LHS=1.0 RHS=1.0
23.000	23.200	7.0	LHS=1.0 RHS=1.0
23.200	23.400	7.0	LHS=1.0 RHS=1.0
23.400	23.600	7.0	LHS=1.0 RHS=1.0
23.600	23.800	7.0	LHS=1.0 RHS=1.0
23.800	24.000	7.0	LHS=1.0 RHS=1.0
24.000	24.200	7.0	LHS=1.0 RHS=1.0
24.200	24.400	7.0	LHS=1.0 RHS=1.0

J. Mulya



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Chainage(km)		Carriageway Width (m)	Shoulder width (m)
From	To		
24.400	24.600	7.0	LHS=1.0 RHS=1.0
24.600	24.800	7.0	LHS=1.0 RHS=1.0
24.800	25.000	7.0	LHS=1.0 RHS=1.0
25.000	25.200	7.0	LHS=1.0 RHS=1.0
25.200	25.400	7.0	LHS=1.0 RHS=1.0
25.400	25.633	7.0	LHS=1.0 RHS=1.0

4.2.3 Pavement Condition Survey

Pavement condition survey has been carried out as per the standard format. The existing pavement surface is of bituminous type and surface condition along the road varies from fair to poor. Some portion of the stretches, various types of pavement distresses encountered in poor pavement stretch are Cracking, Potholes, Raveling, Edge drop, Rutting and Patching. Details are given in **Appendix- 3.2** to Main Report

Detailed field study including pavement condition, shoulder condition, embankment condition, drainage condition etc. were noted by visual means supplemented by sample measurements. The following measurements were involved:

- Cracking (as a percentage of paved carriageway area)
- Raveling (as a percentage of paved carriageway area)
- Pothole (as a percentage of paved carriageway area)
- Rut depth, mm
- Patching, (as a percentage of paved carriageway area)

4.2.4 Inventory and Condition Survey of Existing Structures

Inventory and condition survey of the existing bridges and culverts were carried out to identify their number, type, condition and hydrological aspects. Mainly visual inspection and dimensional measurements were carried out during this survey. Data were collected in the standard format. The exercise enabled to collect the visible as-built information to the extent possible and condition to assess the individual requirements of the existing structures enroute, like widening, repair and reconstruction. The Brief summary of existing structures are in table 4.3. Details are given in **Appendix- 3.3 & 3.4** to Main Report

Table 4.3: Brief summary of Structure Details of Package-1

Bridges		
Type	Existing	Proposed
Major Bridge	Nil	Nil
Minor Bridge	8 Nos.	10 Nos. - Reconstruction = 7 nos. - Retained and Additional 2 Lane = 1 no. - New Construction= 2 nos.
Culverts		
Type	Existing	Proposed
Pipe Culvert	4	Total no. of RCC Box Culverts = 54 Nos. Reconstruction= 8 Nos. New Construction = 46 Nos.
Slab Culverts	4	

4.2.5 Topographic Survey

The specific objective of the topographical survey is to delineate accurately the complete existing natural and man-made features, so as to study and develop the existing road, creating an accurate Digital Terrain Model, which is also a fundamental requirement to design the highway through latest software. The detailed topographical survey for the existing road stretches were completed with fixing BM pillars according to the procedure outlined in the TOR. Summary of BM, TBM and GPS pillar list for PKG-1 are in table 4.4.

Table 4.4: Summary of Pillars Details

❖ BM Pillar List

PILLAR NO	EASTING(M)	NORTHING(M)	RL(M)
RP2-3	228328.915	2904257.933	35.272
RP2-4	228496.927	2904054.523	35.375
RP2-5	228686.777	2903882.744	35.078
RP2-6	229106.517	2903470.149	34.209
RP2-7	229296.416	2903253.492	34.824
RP2-8	229492.826	2902600.811	35.096
RP2-9	229563.37	2902243.971	35.092
RP2-10	229586.301	2902033.36	35.060

PILLAR NO	EASTING(M)	NORTHING(M)	RL(M)
RP2-12	229767.003	2901486.956	35.534
RP2-13	230000.878	2901332.99	35.304
RP3-1	230778.131	2901151.23	35.337
RP3-2	231344.532	2901217.087	35.170
RP3-3	231522.379	2901218.907	35.650
RP3-4	231731.911	2901283.061	34.918
RP3-5	231918.198	2901400.375	35.121
RP3-6	232066.259	2901823.618	34.455
RP3-7	232225.734	2902023.844	34.845
RP3-8	232455.278	2902133.384	34.190
RP3-9	232885.408	2902367.185	34.424
RP3-10	233065.81	2902494.239	33.793
RP3-11	233250.26	2902698.778	34.435
RP3-12	233598.99	2903020.654	34.534
RP4-1	234697.268	2903242.314	34.853
RP4-2	235021.576	2903375.807	35.078
RP4-3	235512.295	2903661.912	35.431
RP4-4	235741.751	2903850.552	35.200
RP4-5	236259.715	2903977.463	34.697
RP4-6	236556.137	2904071.788	37.530
RP4-7	236643.878	2904120.719	39.284
RP4-8	236920.691	2904042.601	42.637
RP4-10	237193.979	2904549.015	46.134
RP4-9	237211.372	2904219.306	43.985
RP4-11	237369.354	2904708.13	45.812
RP4-12	237831.059	2904771.859	46.022
RP4-13	238098.211	2904997.45	47.003
RP5-1	238875.919	2905487.889	35.736
RP5-2	239089.16	2905568.382	37.894
RP5-3	239509.438	2905814.226	35.597
RP5-4	239705.756	2905935.225	35.456
RP5-5	239974.134	2906057.287	35.547
RP5-6	240269.625	2906403.127	35.702
RP5-7	240480.424	2906502.663	35.523
RP5-8	240726.469	2906580.141	35.641
RP5-9	241200.598	2906715.586	35.596
RP5-10	241468.75	2906810.634	36.508

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

PILLAR NO	EASTING(M)	NORTHING(M)	RL(M)
RP5-11	241691.211	2906887.98	35.770
RP5-12	242132.522	2907047.937	36.709
RP5-13	242350.516	2907126.082	36.445
RP5-14	242576.778	2907181.601	37.023
RP6/1	243392.0624	2907432.876	36.426
RP6/2	243616.3829	2907482.558	35.942
RP6/3	244082.6018	2907620.876	35.811

❖ TBM Pillar List

TBM NO	EASTING(M)	NORTHING(M)	RL(M)
TBM2-1	228708.533	2903860.585	34.978
TBM2-2	229488.422	2902721.435	34.756
TBM2-3	229648.494	2901913.551	36.134
TBM3-1	231319.909	2901204.404	35.287
TBM3-2	232081.135	2901868.859	35.168
TBM3-3	232642.563	2902224.843	35.848
TBM3-4	233778.644	2903100.697	34.697
TBM4-2	235687.468	2903794.137	35.175
TBM4-3	236215.272	2903982.322	35.036
TBM4-4	236451.574	2904030.968	34.787
TBM4-5	238350.953	2905102.87	36.450
TBM5-1	239154.369	2905607.865	39.253
TBM5-2	240415.956	2906468.234	36.067
TBM6/1	243817.317	2907545.15	36.762

❖ GPS Pillar List

GPS NO	EASTING(M)	NORTHING(M)	RL(M)
GPS2B	228241.896	2904484.692	34.600
GPS2C	228862.138	2903692.576	34.956
GPS2D	229490.366	2902879.23	35.073
GPS2F	230203.409	2901161.713	35.192
GPS2G	230438.31	2901103.9	35.594
GPS2H	231131.752	2901179.577	35.571
GPS2I	232009.049	2901608.917	34.965
GPS2J	232666.755	2902258.318	34.741
GPS2K	233369.083	2902905.354	34.263

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

GPS NO	EASTING(M)	NORTHING(M)	RL(M)
GPS3	234244.728	2903174.134	34.491
GPS3A	234456.296	2903219.428	34.549
GPS3B	235254.467	2903490.688	34.414
GPS3C	235962.154	2903920.818	34.441
GPS3D	237077.329	2904060.103	44.478
GPS3E	237628.376	2904664.766	46.426
GPS4	238566.792	2905200.357	36.374
GPS4A	238689.042	2905375.399	36.621
GPS4B	239304.441	2905707.343	36.432
GPS4C	240109.115	2906258.955	35.683
GPS4D	240955.101	2906651.633	35.678
GPS4E	241901.575	2906983.115	36.661
GPS5	242839.825	2907269.518	37.069
GPS5A	243123.189	2907340.674	36.882
GPS5B	243864.628	2907567.87	36.580

The survey has been done involving the following sequential steps:

1. Establishing Bench Marks
2. Traversing and Leveling
3. Cross-section Surveying/Detailing

Following features were recorded during detailing, in general:

- ✓ Carriageway crown, carriageway edges and two intermediate carriageway points
- ✓ Roadway edges (shoulder break-points)
- ✓ Embankment toe-line
- ✓ Borrow pit / pond / ditch / toe drain profile, where present
- ✓ All break-points of natural ground
- ✓ Positions of individual entities such as trees, utility lines and poles, wells and tube wells, other pillars like ROW etc.
- ✓ Property lines and structures (with description)
- ✓ Salient points on bridges and culverts (e.g. abutment, headwall, inverts level, etc.)

The data for each survey point were recorded in terms of Northing, Easting, and Elevation. To ensure standardization of works of different survey teams and to facilitate further CAD works, a rational coding system was developed and used.

The survey data collected in the field was downloaded in text file format and converted to graphic files using suitable software.

4.2.6 Traffic Survey

Following traffic surveys were conducted at site to estimate the present and future traffic of the project road.

- Classified traffic volume count survey
- Axle Loading Characteristics Survey
- Intersection Volume Count Survey
- Origin - Destination Survey
- Pedestrian count Survey

- Speed & Delay Survey

The details of the Traffic Survey Locations and Analysis are provided in Chapter -7 of the Main Report.

4.2.7 Sub-grade Investigation

Trial pits of size 1m x 1m were dug at the pavement shoulder interface at 0.5 km interval, extending through the pavement layers down to the sub-grade level to assess the following:

- a) Visual classification of soil
- b) Field density
- c) Field moisture content
- d) Atterberg Limits
- e) Existing pavement composition
- f) Available CBR

After the completion of field tests and collection of samples, the pits were backfilled with the excavated materials and compacted suitably so as not to discomfort the smooth movement of traffic of the existing road.

Analysis of Results

The factual results and the corresponding interpretations will be instrumental to assess the actual scenario of the existing road construction and will form a basis for the design of pavement structure. Summary of laboratory test result is given in table 4.4

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
 Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Table 4.4a : Summary of Laboratory Test Result(Trial-pit soil)

SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 m m	4.7 5 mm	2.0 0 mm	42 5 □	75 □	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
13	6.000	TP-13	100	100	100	100	95	60	44	28	16	MI	0.00	1.895	13.80	1.630	5.500	1.996	8.35	2.047	9.93	7.12
14	6.500	TP-14	100	100	100	100	97	51	30	26	4	ML	0.00	2.015	13.80	1.725	9.324	2.020	13.57	2.200	16.22	12.63
15	7.000	TP-15	100	100	100	100	98	44	32	21	11	SC	0.00	2.020	13.10	1.739	14.548	2.030	22.38	2.190	26.63	20.48
16	7.500	TP-16	100	100	100	100	99	45	32	22	10	SC	0.00	1.985	13.10	1.737	15.425	1.992	21.82	2.168	27.51	20.15
17	8.000	TP-17	100	100	100	100	99	54	34	23	11	CL	0.00	2.100	14.10	1.785	11.281	2.105	15.50	2.297	18.42	14.60
18	8.500	TP-18	100	100	100	100	97	34	28	20	8	SC	0.00	2.025	11.15	1.721	19.446	2.027	26.71	2.215	31.75	25.22
19	9.000	TP-19	100	100	98	93	63	44	30	20	10	SC	4.76	2.015	13.05	1.735	12.793	2.020	19.68	2.184	23.42	18.10
20	9.500	TP-20	100	100	97	90	57	39	31	18	13	SC	4.76	2.003	12.05	1.721	12.127	2.010	17.32	2.217	21.36	16.12
21	10.000	TP-21	100	100	100	100	95	33	29	19	10	SC	0.00	1.822	9.20	1.565	23.148	1.744	33.07	2.017	40.77	33.72
22	10.500	TP-22	100	100	100	100	98	16	Non-Plastic			SM	0.00	2.150	9.57	1.849	30.791	2.156	44.37	2.322	54.17	41.25
23	11.000	TP-23	100	100	100	100	99	13	Non-Plastic			SM	0.00	2.155	9.15	1.950	31.418	2.160	47.53	2.336	57.28	42.18
24	11.500	TP-24	100	100	100	100	99	13	Non-Plastic			SM	0.00	2.140	10.20	1.937	32.099	2.145	46.25	2.324	56.47	41.55

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A
(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)

Final Detailed Project Report
 Engineering survey, investigation and analysis

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
 Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSI- FICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 m m	4.7 5 mm	2.0 0 mm	42 5 □	75 □	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
25	12.000	TP-25	100	100	94	88	81	73	38	26	12	MI	2.04	1.855	14.50	1.595	6.048	1.860	9.18	2.003	10.92	8.46
26	12.500	TP-26	100	100	100	100	100	86	37	26	12	MI	1.96	1.810	15.30	1.557	5.174	1.816	7.84	1.937	9.33	7.22
27	13.000	TP-27	100	100	100	100	95	86	38	27	11	MI	2.08	1.830	14.60	1.556	6.460	1.836	8.87	2.002	10.55	8.35
28	13.500	TP-28	100	100	100	100	100	89	40	30	10	MI	1.96	1.810	15.40	1.549	5.274	1.815	7.68	1.977	9.17	7.14
29	14.000	TP-29	100	100	100	100	92	88	42	25	17	CI	4.35	1.736	14.30	1.519	4.899	1.742	6.93	1.896	8.74	6.40
30	14.500	TP-30	100	100	100	100	100	92	39	25	14	CI	2.13	1.755	15.50	1.495	5.440	1.761	7.94	1.901	9.49	7.39
31	15.000	TP-31	100	100	100	100	100	94	43	23	20	CI	2.00	1.755	13.38	1.507	2.434	1.697	3.48	1.942	4.29	3.49
32	15.500	TP-32	100	100	100	100	100	95	39	28	12	MI	0.00	1.766	15.60	1.519	5.578	1.770	8.04	1.907	9.81	7.48
33	16.000	TP-33	Trial pit excavation was not possible due to work in progress.																			
34	16.500	TP-34	Trial pit excavation was not possible due to work in progress.																			
35	17.000	TP-35	Trial pit excavation was not possible due to congested area.																			
36	17.500	TP-36	100	100	96	86	52	35	43	23	21	SC	13.04	2.022	11.40	1.759	13.206	2.028	19.98	2.182	24.55	18.30
37	18.000	TP-37	100	100	97	95	87	78	41	26	15	MI	4.35	1.785	13.50	1.542	5.715	1.790	8.38	1.997	10.05	7.75
38	18.500	TP-38	100	100	100	100	80	62	42	28	14	MI	5.50	1.835	12.05	1.576	6.876	1.840	11.31	1.982	13.57	10.30

S. Mulya



Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A
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Final Detailed Project Report
 Engineering survey, investigation and analysis

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
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SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSI- FICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 m m	4.7 5 mm	2.0 0 mm	42 5 □	75 □	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
39	19.000	TP-39	100	100	96	92	66	49	45	27	18	SC	4.35	1.952	13.95	1.770	9.673	1.960	13.80	2.247	17.50	12.35
40	19.500	TP-40	100	100	86	80	47	22	39	20	19	SC	2.50	2.092	9.74	1.778	18.145	2.098	27.08	2.259	32.20	25.16
41	20.000	TP-41	100	100	100	100	93	87	58	26	32	CH	8.33	1.979	12.15	1.686	3.761	1.925	5.49	2.143	6.56	5.45
42	20.500	TP-42	100	100	93	83	46	19	Non-Plastic			SM	4.76	2.115	10.14	1.904	32.032	2.121	47.45	2.375	57.04	42.53
43	21.000	TP-43	100	100	100	100	100	90	32	23	10	CL	0.00	1.830	15.50	1.574	5.322	1.835	7.76	1.976	9.50	7.20
44	21.500	TP-44	100	100	100	100	96	74	35	29	6	MI	0.00	1.895	14.45	1.742	7.888	1.896	11.60	2.060	13.91	10.21
45	22.000	TP-45	100	100	100	100	96	78	33	23	10	CL	2.04	1.878	15.25	1.617	6.070	1.884	8.82	2.036	10.68	8.18
46	22.500	TP-46	100	100	100	100	96	80	33	22	11	CL	2.04	1.885	14.55	1.691	6.151	1.890	9.36	2.043	11.28	8.37
47	23.000	TP-47	100	100	100	100	87	69	28	19	9	CL	4.76	1.780	13.10	1.537	6.861	1.786	9.99	1.931	11.93	9.24
48	23.500	TP-48	100	100	100	100	89	68	28	19	9	CL	2.33	1.787	13.30	1.630	8.432	1.792	11.58	1.985	13.77	10.44
49	24.000	TP-49	100	100	100	100	97	69	35	28	7	ML	0.00	1.826	14.40	1.570	8.739	1.832	13.22	1.954	15.93	12.18
50	24.500	TP-50	100	100	100	100	97	60	34	29	5	ML	0.00	1.815	14.10	1.550	9.798	1.820	14.37	1.931	17.25	13.36
51	25.000	TP-51	100	100	100	100	96	71	34	27	7	ML	0.00	1.742	15.60	1.481	6.726	1.691	9.24	1.906	10.98	9.22
52	25.500	TP-52	100	100	100	100	99	81	36	29	8	MI	0.00	1.805	15.05	1.634	6.743	1.810	9.25	1.960	11.41	8.41

S. Mulya



Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A (Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Final Detailed Project Report
Engineering survey, investigation and analysis

SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 m m	4.7 5 mm	2.0 0 mm	42 5 □	75 □	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
13	6.000	TP-13	100	100	100	100	95	60	44	28	16	MI	0.00	1.895	13.80	1.630	5.500	1.996	8.35	2.047	9.93	7.12

Table 4.4b : Summary of Laboratory Test Result(Borrow-pit soil)

SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75 mm	2.00 mm	425 m	75 m	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
3	6.150	BP-02 (Sample 1)	100	100	100	100	99	93	41	23	18	CI	4.00	1.765	17.20	1.518	3.156	1.704	4.79	1.906	5.70	4.83
4	6.100	BP-02 (Sample 2)	100	100	100	100	95	84	41	22	19	CI	4.08	1.832	14.79	1.640	2.690	1.779	3.94	2.015	4.74	3.93
5	13.650	BP-03 (Sample 1)	100	100	100	100	100	96	44	29	15	MI	4.65	1.774	15.59	1.527	2.333	1.725	3.59	1.923	4.27	3.56

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A (Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Final Detailed Project Report
Engineering survey, investigation and analysis

SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75 mm	2.00 mm	425 m	75 m	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
6	13.650	BP-03 (Sample 2)	100	100	100	100	99	93	48	35	13	MI	4.00	1.806	16.25	1.560	1.980	1.790	2.90	2.021	3.48	2.75
7	13.650	BP-03 (Sample 3)	100	100	100	100	100	97	48	33	15	MI	4.17	1.821	16.50	1.551	1.404	1.763	2.05	1.972	2.45	2.06
8	22.600	BP-04 (Sample 1)	100	100	100	100	99	92	44	25	20	CI	3.85	1.767	18.25	1.537	3.454	1.725	5.23	1.907	6.42	5.12
9	22.650	BP-04 (Sample 2)	100	100	100	100	99	92	45	23	22	CI	3.70	1.701	17.50	1.463	1.820	1.660	2.76	1.820	3.28	2.71

Composition of Existing Pavement

Brief summary of existing crust details has been given below in table 4.5.

Table 4.5: Summary of existing crust details

Trial Pit No.	Chainage (km)	Side	Bituminous Layer(mm)	Granular Layer(mm)	Bituminous Layer (mm)	Granular Layer(mm)	Total Thickness(mm)
TP-13	6	RHS	60	240	-	-	300
TP-14	6.5	LHS	50	270	-	-	320
TP-15	7	RHS	40	460	-	-	500
TP-16	7.5	LHS	40	480	-	-	520

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Trial Pit No.	Chainage (km)	Side	Bituminous Layer(mm)	Granular Layer(mm)	Bituminous Layer (mm)	Granular Layer(mm)	Total Thickness(mm)
TP-17	8	RHS	100	500	-	-	600
TP-18	8.5	LHS	100	450	-	-	550
TP-19	9	RHS	100	460	-	-	560
TP-20	9.5	LHS	80	540	-	-	620
TP-21	10	RHS	60	460	-	-	520
TP-22	10.5	LHS	70	480	-	-	550
TP-23	11	RHS	90	270	-	-	360
TP-24	11.5	LHS	100	300	-	-	400
TP-25	12	RHS	110	280	30	240	660
TP-26	12.5	LHS	120	280	30	270	700
TP-27	13	RHS	110	190	30	130	460
TP-28	13.5	LHS	100	220	20	130	470
TP-29	14	RHS	30	260	30	180	500
TP-30	14.5	LHS	40	250	30	230	550
TP-31	15	RHS	100	190	30	350	670
TP-32	15.5	LHS	80	220	20	280	600
TP-33	16	RHS	Trial Pit is not possible due to work in progress				-
TP-34	16.5	LHS					-
TP-35	17	RHS					-
TP-36	17.5	LHS	100	570	-	-	670
TP-37	18	RHS	40	610	-	-	650
TP-38	18.5	LHS	50	630	-	-	680
TP-39	19	RHS	40	610	-	-	650
TP-40	19.5	LHS	40	670	-	-	710
TP-41	20	RHS	30	670	-	-	700

J. Mulya



Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A
(Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)

Final Detailed Project Report
Engineering survey, investigation and analysis

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
 Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Trial Pit No.	Chainage (km)	Side	Bituminous Layer(mm)	Granular Layer(mm)	Bituminous Layer (mm)	Granular Layer(mm)	Total Thickness(mm)
TP-42	20.5	LHS	40	710	-	-	750
TP-43	21	RHS	180	420	40	160	800
TP-44	21.5	LHS	170	430	40	150	790
TP-45	22	RHS	100	300	50	250	700
TP-46	22.5	LHS	100	310	50	190	650
TP-47	23	RHS	160	170	30	190	550
TP-48	23.5	LHS	200	150	30	220	600
TP-49	24	RHS	150	130	100	250	630
TP-50	24.5	LHS	160	490	-	-	650
TP-51	25	RHS	180	100	30	210	520
TP-52	25.5	LHS	200	80	40	280	600

S. Mukherjee



4.2.8 Quarry Material

The material investigation for road construction material required to be carried out to identify the potential sources of construction materials and to assess their general availability, engineering properties and quantities. This is one of the most important factors for stable, economic and successful implementation of the road program within the stipulated time. The material investigation is quite representative, but more exhaustive search may surely be explored by the contractors at the time of construction. For improvement work as well as for new construction the list of materials includes the following:

- Granular materials for sub-base works
- Crushed stone aggregates for base , bituminous surfacing and cement concrete works
- Sand for bituminous and cement concrete works, sub-base, filter materials and filling materials etc.
- Borrow earth/moorum materials for embankment, sub-grade and filling

Objective

The following are the basic objective to make material investigation:

- Source locations indicating places, kilometerage, availability and the status whether in operation or new source.
- Access to source, indicating the direction and nature of the access road i.e. left/ right of project road, approximate lead distance from the gravity center and type of access road.
- Ownership of land/ quarries, either government or private.
- Test results, indicating the quality of materials with respect to their suitability in construction.
- Probable use indicating the likely use of materials at various stages of construction work i.e. fill material, sub-grade, sub-base, base, bituminous surfacing and cross drainage structures.

The potential sources of construction materials were selected from consideration of the availability and suitability of the materials, easy access to the source and minimum hauling distance from the source in order to make the construction economical and feasible as far as possible.

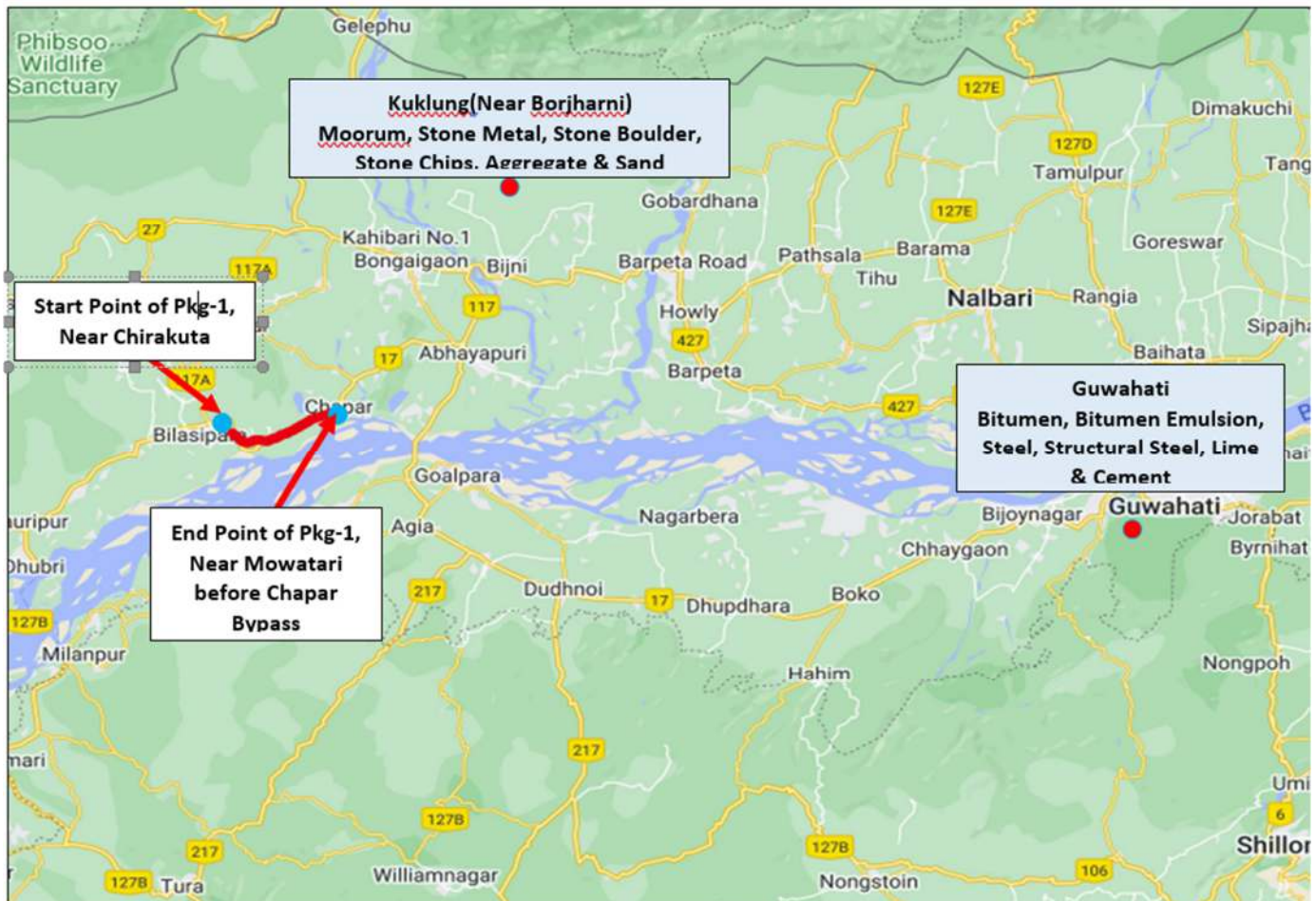
**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
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Details of material source for Package-1

Sl. No.	Name of Material	Place
1	Fine Sand	Kuklung(Near Borjharni)
2	Stone Metal	Kuklung(Near Borjharni)
3	Stone Boulder	Kuklung(Near Borjharni)
4	Stone Chips, Aggregate	Kuklung(Near Borjharni)
5	Coarse Sand	Kuklung(Near Borjharni)
6	Cement	Guwahati
7	Steel	Guwahati
8	Tar, Bitumen	Guwahati
9	Bitumen Emulsion	Guwahati
10	Structural Steel	Guwahati
11	Lime	Guwahati
12	Brick	Local

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Source Diagram for Material



4.2.9 Sub-soil Exploration

Subsoil exploration is completed. Geotechnical investigation Report is given in Appendix-3.9 to Main Report.

4.2.10 Photographs

Photographs of field activities are given below:

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

	
Road Inventory	Pavement Condition Survey
	
Culvert Inventory	Bridge Inventory
	
Topographic Survey	Trial Pit

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)



TMC Survey



CTVC Survey



Axle Load survey



OD Survey



Pedestrian Survey



BBD Survey



Geotechnical Investigation

CHAPTER – 5 SOCIO-ECONOMIC PROFILE

5.0 INTRODUCTION & BACKGROUND

The State

The state of Assam is situated in the northeastern side of the country and Located south of the eastern Himalayas. Assam is surrounded by seven states Arunachal Pradesh, Assam, Manipur, Mizoram, Tripura, Meghalaya and Sikkim on its domestic borders, Geographically Assam and these states are connected to the rest of India via a 22 kilometers strip of land in West Bengal called the Siliguri Corridor or "Chicken's Neck". Assam shares international border with Bhutan and Bangladesh. The state lies between 28°0' and 24°8' latitude, North of Equator and between the longitudinal lines 89°43' E and 96°1' E. Different types of tribes are present in the state, each of whom has their distinct customs, attires, languages and dialect. As the Brahmaputra flows in Assam the climate here is cold and there is rainfall most of the month. Geomorphic studies conclude that the Brahmaputra, the life-line of Assam is an antecedent river, older than the Himalayas. The river with steep gorges and rapids in Arunachal Pradesh entering Assam, becomes a braided river (at times 10 mi/16 km wide) and with tributaries, creates a flood plain (Brahmaputra Valley: 50–60 mi/80–100 km wide, 600 mi/1000 km long). With the partition of India in 1947, Assam became a constituent state of India. The capital of the state is Dispur.

The Economy

Assam has a literacy rate of 73.18 percent (According to 2011 census). Majority of the population in the state speaks Assam is, which is the official language of the state. The state offers technical and medical education. Agriculture and forestry contribute majority of Assam's Gross Domestic Product. Most of state's population, about 69 per cent of the total, depends on cultivation. Rice is the main food crop in Assam's agriculture as it is the main diet of state population. Other food crops cultivated in agriculture include jute, sugarcane, fruits, tea, pulses, coconut, potatoes, cotton, and areca nuts. Tea is the most important cash crops in Assam and the state is well known world-wide for its tea. The other cash crop is jute, oilseeds, sugarcane, cotton, tobacco. The State of Assam is traditionally known for its rich Handloom and Handicraft products. Other industries like Tea Industries, Paper Industry, Caustic Soda and Chlorine Plant, India Carbon Ltd. Also present in the state. The state is rich in mineral resources such as coal, petroleum and natural gas, limestone

The Environment

Assam has a sub-tropical monsoon climate. From the climatic point of view the year in Assam can broadly be divided in two, the cold season and the rainy season. However, there are two other short seasons namely spring and autumn representing the transition between cold and rainy seasons and that between rainy and cold season's respectively. Annual rainfall averages around 1,500. The south-west monsoon rains starts from the

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Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

third week of June and they continue up to the middle of September. The daytime temperature in summer, the rainy season, rises to around 35°C and in winter cools to 25°C with a nighttime minimum of around 10°C. In most of the plain districts of Assam the air is highly humid throughout the year.

Indigenous People

Different types of Tribes are present in Assam and they speak in different type of language. Assamese or Asamiya is an Eastern Indo-Aryan language used mainly in the state of Assam, where it is an official language. It is also spoken in parts of Arunachal Pradesh and other northeast Indian states.

5.1 SOCIAL ASSESSMENT

Objective

The objective of Social Assessment report is to present a socio-economic profile of the subproject area with particular reference to indigenous people, communicable diseases especially HIV/AIDS, human trafficking, poverty level, local economy like agriculture, industry, health and educational status in accordance with guidelines and recommendations of Government of India and especially National Highways & Infrastructure Development Corporation Limited (NHIDCL).

Project Road

The Project Road starts near Chirakuta and ends at Jalukbari interchange in Guwahati. The total length of the existing road stretch is 209.998km (based on Topographic Survey).

The Package-1 of the project road starts near Chirakuta and ends near Mowatari, before Chapar Bypass) (Ex.Ch.5.580km to Ex.Ch.25.633km). The existing length of Package-1 is 20.053km (As per Topographic Survey). The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain

Project Description

The Project Road starts at near Chirakuta and passes through village / localities namely Chirakuthi, Sonamukhi, Koliarkhal, Tilapara, MohishBathan, Salkocha, Hatipota, Dhirghat, Arayarjhar, KharidaGossaigaon, Chapar, Bahalpur, Nitya Bazar, Kayethpara, Talguri, Salbari, Besimari, Boitamari, Borkhata (Nolbari), Khagarpur, Uttar Salmara, Tulungia(junction with NH-117), Deohati, Choutaki, Singimari, Nalipara, Kherkabari, Katashbari, Khoragaon, Garaimari, Chalantapara, KabaitaryTinali, Oudubi, Jogighopa, Kharbhuja, Makri, Dakurivitha, Hadalpara, Kalyanpur, Solmari, Gendra, Balijan, Budhipara, Agia, Ulupara, AgiaPaharkata, KalpaniChandmari, Bolbolla, Phaphanga, Godhar Bari, TukuraBormahara, Bhimajuli, Paikan, Krishnai, Jyoti Nagar, MolanDubi, Beki Paul, Salpara, Darapara, Dabli, Letheng, Lela, Mondal gram, Makhipara, Dudhnoi, Fafal, Puranibitha, Amjonga, Kachadal, Darangiri, Dosimapara, Rangjuli, Dhanubhanga, Deoshila, Gathiapara, Kothakuthi, Dhupdhara, Sakite, Hakite, Bandapara, Kukurmara, Rajapara,

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Dhupguri, Chukunai Para, Burgrui, Singra, Boko Nagopara, ChakBaho, Boko Jarapara, Boko Dakhurpara, Boko, Barpara, Turukpur, Turukpara, Agucka Boko, lampara, Bripara, Bongaon market, Bamunigaon, Khabibe, Gobardhan, Kumi, Chhaygaon, Champak Nagar, Kharavanga, Kukurmara, Barteypur, Suruteypur, Rampur, Bhagabatipara, Rajapokubi, Batarhat, Haligaon, Bijohnagar, Uparhali, Sarpara, Mirza, Barkuchi, Sontola, Bongara, Khuikuchi, Bullapara, VIP chok, Kahikuchi, Azara, Lankeswar and ends at Jalukbari in Guwahati in the state of Assam.

Project Impact Area

The Project Impact Area (PIA) has been defined as the 2.5 km width of a band on both sides of the project road. In broad sense the PIA may be considered as portion of below mention district.

The Project Districts

The package-1 of the project road comes under Dhubri district of Assam.

Brief features of the district is summarized below:

Dhubri

Dhubri District, with population of about 19.5 lakh is Assam's the 2nd most populous district, located in the state Assam in India. Total geographical area of Dhubri district is 2176 km². Population density of the district is 896 persons per km². There are 9 sub districts in the district.

An official Census 2011 detail of Dhubri, a district of Assam has been released by Directorate of Census Operations in Assam. Enumeration of key persons was also done by census officials in Dhubri District of Assam.

In 2011, Dhubri had population of 1,949,258 of which male and female were 997,848 and 951,410 respectively. In 2001 census, Dhubri had a population of 1,566,396 of which males were 804,999 and remaining 761,397 were females. Dhubri District population constituted 6.25 percent of total Maharashtra population. In 2001 census, this figure for Dhubri District was at 5.88 percent of Maharashtra population.

There was change of 24.44 percent in the population compared to population as per 2001. In the previous census of India 2001, Dhubri District recorded increase of 22.97 percent to its population compared to 1991.

S. Mulya



**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Table 5.1.2: Socio-economic profile of Dhubri District

Description	2011	2001
Population	19.50 Lakhs	15.67 Lakhs
Actual Population	1,949,258	1,566,396
Male	997,848	951,410
Female	804,999	761,397
Population Growth	24.44%	22.97%
Area Sq. Km	2,176	1,664
Density/km2	896	941
Proportion to Assam Population	6.25%	5.88%
Sex Ratio (Per 1000)	953	946
Child Sex Ratio (0-6 Age)	968	965
Average Literacy	58.34	48.17
Male Literacy	63.10	55.84
Female Literacy	53.33	40.02
Total Child Population (0-6 Age)	3,68,262	3,26,739
Male Literates	5,11,551	
Female Literates	4,10,790	41,78,984
Child Proportion (0-6 Age)	18.89%	20.86%

Source: <http://www.census2011.co.in>

Indigenous People Development Plan (IPDP)

Indigenous People Development Plan (IPDP) is an integral part of the Social, Economic and Resettlement Plan of any of the infrastructural projects taken up by the authorities when a considerable number Schedule Tribe population is affected or displaced from their natural habitat. IPDP is also required if after the completion of the project there would be substantial change in the region which might affect the traditional customary right over land of the tribal people or alter their lifestyle in such a manner that they are uprooted or not in a position to follow their tradition, culture or profess their customs or religion.

The Mitigation measures of HIV/ AIDS & Human Trafficking Risks

Awareness campaign should be conducted at regular intervals in the PIA and the road construction sites. Distribution of IEC materials, organizing audiovisual shows and street drama giving a proper idea of the menace of the disease should be undertaken by some reputed NGOs.

Village quacks and ANMs to be trained in detecting and responding to cases of HIV/AIDS at initial level. There should facility at PHCs / referral hospital preferably within PIA to detect the infected persons early.

Counseling by NGOs to be given free of charges to the poor migrating families to create awareness against possible spread of HIV/AIDS outside the area.

J. Mulya



The Gender Issue

Along with men in the Project areas, women will benefit from (i) easier access to markets, (ii) increased local retailing opportunities, and (iii) easier access to health care centres and education facilities as well. Women may also benefit more than men from the increased access to schools and health centres.

5.2 PROJECT ROAD BENEFIT

The development of the road as per 4 lane with paved shoulder can boost the agricultural and industrial development of the surrounding area which can be viewed as boosting economic growth and poverty reduction, bringing substantial social and economic development in the region.

The social benefits arising due to the project will be triggered off due to improved accessibility to various services such as easy access to markets, health facilities, schools, workplace etc which in turn increases the income of the locals, and ultimately elevating their standard of living. The possible direct and indirect positive impacts of the project are listed below.

- ❖ Road network will not only link the village communities to better national markets, but also open up wider work opportunities in distant places. People can shuttle to distant worksites and engage in construction, factories, business as well as domestic works.
- ❖ The immediate benefits of road construction and improvement will come in the form of direct employment opportunities for the roadside communities and specially those who are engaged as wage labourers, petty contractors and suppliers of raw materials.
- ❖ Effective drainage system to ensure that there will be no pooling of water
- ❖ Safety measures for Highway signs, Pavement marking, Traffic signals, Bus bays with passenger shelter.
- ❖ Rectification of geometric deficiencies (both Horizontal & Vertical).
- ❖ Provision of crash barrier at Bridge approaches.
- ❖ Improvement of all Major and Minor Intersections.
- ❖ Facilities for public amenities such as Foot Over Bridge(FOB)

5.3 OTHER BENEFITS:

- ❖ It will give a major fillip to the quest for all weather connectivity.
- ❖ It will reduce travel time between towns and cities by 50% to 60%.
- ❖ It will enhance the spirit of enterprise.




**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

- ❖ Help the locals to ply their trade.
- ❖ Provide direct employment in road construction and allied activities.
- ❖ Lower accident and provide quick accessibility to services like hospital, market, office etc.
- ❖ Will help in growth of tourism activities immensely.




CHAPTER - 6

INDICATIVE DESIGN STANDARDS

6.0 GEOMETRIC DESIGN STANDARDS (FOR HIGHWAYS)

Proposed design basis

The following guiding principles form the basis of all good highway design:

- ❖ A uniform application of design standards for any area is essential from the viewpoint of road safety and the smooth flow of traffic. The selection of optimum design standards reduces the possibility of early obsolescence of the facility, which can be MORT&H thought about by any inadequacy in the original standards.
- ❖ Faulty geometric standards, after construction, are frequently difficult to rectify at a later date and they are always costly. As such, both horizontal and vertical geometry should be accorded due importance at the initial design stage itself and selected standards should not be compromised without the most careful deliberation.
- ❖ The design should thus be consistent within any area and the standards proposed for the different elements should be compatible with one another. It is sometimes necessary to reduce the selected design speed for economic reasons but any abrupt changes in the design speed must be avoided.
- ❖ The selected design should minimize the total transportation cost, including initial construction costs, costs for maintenance of the facility, and the cost borne by the road users.
- ❖ Safety should be built-in into design elements.
- ❖ "Ruling" standards should be followed as a matter of routine. "Minimum" standards should be followed only where serious restrictions are imposed by technical or economic consideration.

6.1 DESIGN CONTROLS

Terrain Classification

- ❖ The geometric design of a highway is influenced significantly by terrain conditions. Economy dictates a sensible choice of different standards for different types of terrain but the guiding principles above will always apply. Where it is necessary to change design standards, this will be done in discrete areas and with a careful eye to consistency and road safety.
- ❖ The Package-1 starts near Chirakuta and ends near Mowatari, before Chapar Bypass (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

- ❖ The road is located in plain terrain and the geometric standards relevant to IRC: SP:84-2014 & 2019 has been adopted to upgrade the road as per 4-lane with paved shoulder configuration.

Design Standard

In general the design standard follows the provisions of IRC: SP: 84-2014 & 2019. The project road will be improved to 4-lane with paved shoulder configuration.

Design Speed

Existing road is developed to four-lane with paved shoulder configuration having minimum design speed of 80kmph and ruling design speed of 100 kmph in plain terrain.

Sight Distance

Stopping sight distance is the clear distance ahead needed by a driver to bring his vehicle to a stop before meeting a stationary object on his path. Desirable minimum sight distance is twice the stopping sight distance. Stopping sight distance is the absolute minimum from safety angle and must be ensured regardless of any consideration.

Design values for stopping sight distance and Desirable minimum sight distance for various speeds:

Design Values (metres)		
Speed (km/h)	Stopping sight distance	Desirable minimum sight distance
100	180	360
80	130	260

Criteria for measuring sight distance:

Sl. No.	Sight Distance	Driver's eye sight	Height of object
1.	Safe stopping distance	1.20 m	0.15 m
2.	Intermediate sight distance	1.20 m	1.20 m

Right-of-Way (ROW)

The width of road land (ROW) for the project road is follows:

PLAIN TERRAIN:

Open Area	Built up Area	Bypass	Forest
35m/40m	35m	45m/50m	35m/40m

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Cross-Sectional Parameters

TCS-1D: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN RURAL AREA
(RECONSTRUCTION OVER EXISTING PAVEMENT)

Carriageway = 2 x 7.0m

Paved Shoulder = 2 x 1.5m

Earthen Shoulder = 2 x 1.5m

Kerb Shyness = 2 x 0.5m

Median = 1.5 m

Roadway Width=22.5m

TCS-2: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH

Carriageway = 2 x 7.0m

Paved Shoulder = 2 x 1.5m

Earthen Shoulder = 2 x 1.5m

Kerb Shyness = 2 x 0.5m

Median = 4.0 m

Roadway Width=25.0m

TCS-2A: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH WITH BOTH
SIDE RETAINING WALL AND STONE PITCHING ALONG THE BERM

Carriageway = 2 x 7.0m

Paved Shoulder = 2 x 1.5m

Earthen Shoulder = 2 x 1.5m

Kerb Shyness = 2 x 0.5m

Median = 4.0 m

Roadway Width=25.0m

TCS-2C: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH
WITH BOTH SIDE RETAINING WALL

Carriageway = 2 x 7.0m

Paved Shoulder = 2 x 1.5m

Earthen Shoulder = 2 x 1.5m

Kerb Shyness = 2 x 0.5m

Median = 4.0 m

Roadway Width=25.0m

TCS-4F: 4 LANE CARRIAGEWAY WITH BOTH SIDE SERVICE ROAD IN BUILT-UP AREA
(RECONSTRUCTION OVER EXISTING PAVEMENT)

Carriageway = 2 x 7.0m

Paved Shoulder = 2 x 2.5m

Kerb Shyness = 2 x 0.5m

Railing = 2 x 0.25m

Median = 1.5m

Service Road = 2 x 5.5m

Cover Drain = 2 x 1.0m

Roadway Width=35.00m

TCS-4F1: 4 LANE CARRIAGEWAY WITH BOTH SIDE SERVICE ROAD IN RURAL AREA
(RECONSTRUCTION OVER EXISTING PAVEMENT)

Carriageway = 2 x 7.0m

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Paved Shoulder = 2 x 2.5m
Kerb Shyness=2 x 0.5m
Railing = 2 x 0.25m
Median = 1.5m
Service Road = 2 x 5.5m
Earthen Shoulder = 2 x 1.0m
Roadway Width=35.00m

TCS-4F2: 4 LANE CARRIAGEWAY WITH RIGHT SIDE SERVICE ROAD IN RURAL AREA (RECONSTRUCTION OVER EXISTING PAVEMENT)

Carriageway = 2 x 7.0m
Paved Shoulder = 1 x 2.5m+1x1.5m
Kerb Shyness=2 x 0.5m
Railing = 1 x 0.25m
Median = 1.5m
Service Road = 1 x 5.5m
Drain=1x1m
Earthen Shoulder = 1 x 1.5m
Roadway Width=28.75m

TCS-5D: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN FOREST STRETCH WITH BOTH SIDE R.C.C RETAINING WALL

Carriageway = 2 x 7.0m
Paved Shoulder = 2 x 1.5m
Earthen Shoulder = 2 x 1.5m
Kerb Shyness = 2 x 0.5m
Median = 1.5m
Roadway Width=22.5m

TCS-5E: 4 LANE CARRIAGEWAY WITH RIGHT SIDE SERVICE ROAD IN FOREST STRETCH (RECONSTRUCTION OVER EXISTING PAVEMENT)

Carriageway = 2 x 7.0m
Paved Shoulder = 1 x 2.5m+1x1.5m
Kerb Shyness=2 x 0.5m
Railing = 1 x 0.25m
Median = 1.5m
Service Road = 1 x 5.5m
Drain=1x1m
Earthen Shoulder = 1 x 1.5m
Roadway Width=28.75m

TCS-6B: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN VUP/SVUP APPROACHES WITH BOTH SIDE SERVICE ROAD

Carriageway = 2 x 7.0m
Paved Shoulder = 2 x 1.5m
Kerb Shyness=4 x 0.5m
Crash Barrier=2x0.5m+2x0.25m
Median = 1.5m
Service Road = 2 x 5.5m
Earthen Shoulder = 2 x 1.0m
Roadway Width=35m

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch.
17.737km)**

TCS-6B1: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN FLYOVER APPROACHES WITH BOTH SIDE SERVICE ROAD WITH DRAIN

Carriageway = 2 x 10.5m

Crash Barrier=2x0.5m

Median = 1.0m

Crash Barrier=2x0.5m

Service Road = 2 x 5.5m

Drain = 2 x 1.0m

Roadway Width=37m

On horizontal curves, the roadway width should be increased corresponding to the extra widening of carriage way for curvature as per below mentioned table

WIDENING OF CARRIAGEWAY AT CURVE

On horizontal curves with radius upto 300 m, width of pavement and roadway shall be increased as per the table given below:

Radius of Curve	Extra Width
75-100 m	0.90 m
101-300 m	0.60 m

Cross-slope/Camber

- The cross-fall on straight sections of road carriageway, paved shoulders and paved portion of median shall be 2.5 percent for bituminous surface and 2.0 percent for cement concrete surface.
- The cross-fall shall be unidirectional for either side carriageway sloping towards the shoulder in straight reaches and towards the lower edge on horizontal curves. The camber on the existing road shall be modified to unidirectional cross-fall.
- The cross-fall for earthen shoulders on straight portions shall be at least 0.5 percent steeper than the slope of the pavement and paved shoulder subject to a minimum of 3.0 percent. On super elevated sections, the earthen portion of the shoulder on the outer side of the curve would be provided with reverse cross-fall of 0.5 percent so that the earth does not drain on the carriageway and the storm water drains out with minimum travel path.

Horizontal Alignment

As a general rule, the horizontal alignment should be fluent and should blend well with the surrounding topography. In a given section there should be consistency and no element of surprise or unexpected situation for the driver.

RADII OF HORIZONTAL CURVES

The desirable minimum and absolute minimum radii of horizontal curves for various classes of terrain are given in the table below:

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch.
17.737km)**

Name of the terrain	Desirable minimum radius	Absolute minimum radius
Plain & Rolling	400m	250m

TRANSITION CURVES

Transition curves are necessary for vehicles to progress from a straight alignment into a circular curve or between curves of different radius. The transition curve also facilitates a gradual application of the super elevation and any widening of the carriageway which may be required for horizontal curves.

The minimum length of the transition curve shall be determined from the following two considerations, the larger of the two values being adopted for design:

$$i) \quad L_s = \frac{0.0215 V^3}{CR}$$

Where, L_s = length of transition in metres

V = speed in km/hr

R = radius of circular curve in metres

$$C = \frac{80}{75+V}$$

subject to a maximum of 0.8 and minimum of 0.5

- ii) The rate of change of superelvation (i.e. the longitudinal grade developed at the pavement edge compared to through grade along the centre line) should be such as not to cause discomfort to travellers or to make the road appear unsightly. The formula for minimum length of transition on this basis for Mountainous and Plain Terrain are:

$$L_s = \frac{1.0 V^2}{R} \quad \text{and} \quad L_s = \frac{2.7 V^2}{R}$$

SUPERELEVATION

Super elevation provided on horizontal curves is based on the following formula:

$$e = \frac{V^2}{225R}$$

Where

e = super elevation (metre/metre).

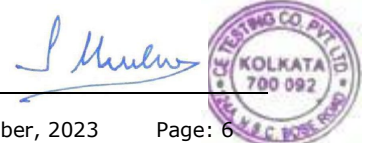
V = speed (km/hr)

R = radius (metres)

Super elevation shall be limited to 7%, if radius of curve is less than the desirable minimum. It shall be limited to 5% if the radius is more than desirable minimum.

RADIUS OF HORIZONTAL CURVES

The radius of horizontal curve is obtained from following formula:



**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

$$R = \frac{V^2}{127(e+f)}$$

Where,

- V = Vehicle speed (km/hr)
e = Super elevation ratio (metre/metre)
f = Coefficient of side friction between vehicle tyre and pavement (taken as 0.15)
R = Radius in metres

SET-BACK DISTANCE AT HORIZONTAL CURVES

Set-back distance from the centreline of the carriageway for obtaining requisite sight distance across the inside of horizontal curves is calculated from following equation

$$M = R - (R - N) \cos \theta$$

where,

- θ = $S/2(R-N)$ radians
m = the minimum set-back distance from centreline of the road to sight obstruction in metres at middle of the curve
r = radius of centre-line of the road in metres
n = distance between the centre-line of road and the inside lane in metre
(n = 1.5 may be taken considering possible widening at curve)
s = stopping sight distance (minimum),
intermediate sight distance (if feasible)

Vertical Alignment

GRADIENT

The project road traverses through Plain terrain and recommended gradients for the same are:

Nature of Terrain	Ruling Gradient	Limiting Gradient
Plain	2.5%	3.3%

GRADE COMPENSATION AT CURVE

The gradient at horizontal curves should be eased by an amount known as 'grade compensation' which is intended to offset extra effort involved at curves. This is calculated by the following formula.

$$\text{Grade compensation (\%)} = \frac{30 + R}{R} \text{ subject to,}$$

Maximum of 75/R where R is radius of the curve in meters. Since grade compensation is not necessary for gradients flatter than 4%, when applying grade compensation correction, the gradients need not be eased beyond 4%.

VERTICAL CURVES

Vertical curves should be provided at all grade changes exceeding those indicated below. The

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

minimum lengths of curve for satisfactory appearance are shown alongside:

Design Speed (km/hr)	Maximum Grade Change (%) not requiring a vertical curve	Minimum Length of vertical curve (m)
80	0.6	50
100	0.5	60

SUMMIT CURVES

The length of summit curves is governed by the choice of sight distance. For the project road length is calculated for safe stopping sight distance on the basis of following formula:

For Safe Stopping sight distance

Case (i) When length of the curve exceeds the required sight distance i.e. $L > S$

$$L = \frac{NS^2}{4.4}$$

where,

N = Deviation angle i.e. the algebraic difference between the two grades

L = Length of parabolic vertical curve in metres

S = Sight distance in metres

Case (ii) When length of the curve is less than the required sight distance i.e. $L < S$

$$L = 2S - \frac{4.4}{N}$$

For Intermediate sight distance

Case (i) When length of the curve exceeds the required sight distance i.e. $L > S$

$$L = \frac{NS^2}{9.6}$$

Case (ii) When length of the curve is less than the required sight distance i.e. $L < S$

$$L = 2S - \frac{9.6}{N}$$

VALLEY CURVES

The length of valley curves should be such that for night travel, the head light beam distance is equal to the stopping sight distance. The length of the curve is calculated as under:

Case (i) When the length of the curve exceeds the required sight distance,
i.e. $L > S$

$$L = \frac{NS^2}{1.50 + 0.035S}$$

[Signature]



**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch.
17.737km)**

Case (ii) When the length of the curve is less than the required sight distance i.e. $L < S$

$$L = 2S - \frac{1.5 + 0.035 S}{N}$$

In both cases,

N = Deviation angle i.e. the algebraic difference between the two grades

L = Length of parabolic vertical curve in metres

S = Stopping sight distance in metres

6.2 FLEXIBLE PAVEMENT DESIGN STANDARD

Design of New Flexible Pavement

Design of new pavement has been carried out based on IRC 37-2018 "Guidelines for the Design of Flexible Pavements" for design life of 20 years. Procedure for the same is given below:

Step 1: To find out initial traffic in the year of completion of construction in terms of the number of the number of commercial vehicles per day (CVPD)

Step 2: To determine traffic growth rate factor by studying the past trends of traffic growth

Step 3: Design life of Pavement

Step 4: To find out Vehicle Damage Factor to convert the number of commercial vehicles of different axle loads and axle configuration to the number of standard axle load repetition. It may be obtained by conducting axle load survey at site.

Step 5: To find out lane distribution factor of traffic over the carriageway

Step 6: To determine design traffic in cumulative number of standard axles (msa) by the following formula mentioned below:

$$N = [365 \times \{(1+r)^n - 1\} / r] \times A \times D \times F$$

Where,

N = Cumulative number of standard axles to be catered for in the design in terms of msa

A = Initial traffic in the year of completion of construction in terms of number of commercial vehicles per day

D = Lane Distribution Factor

n = Design life in years

r = Annual growth rate of commercial vehicles

F = Vehicle damage factor

Step 7: To determine total pavement thickness and crust composition by charts/graphs with respect to CBR and cumulative number of standard axles.

Methodology flow chart for the design of new Flexible pavement has been shown in **Figure 6.1**

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

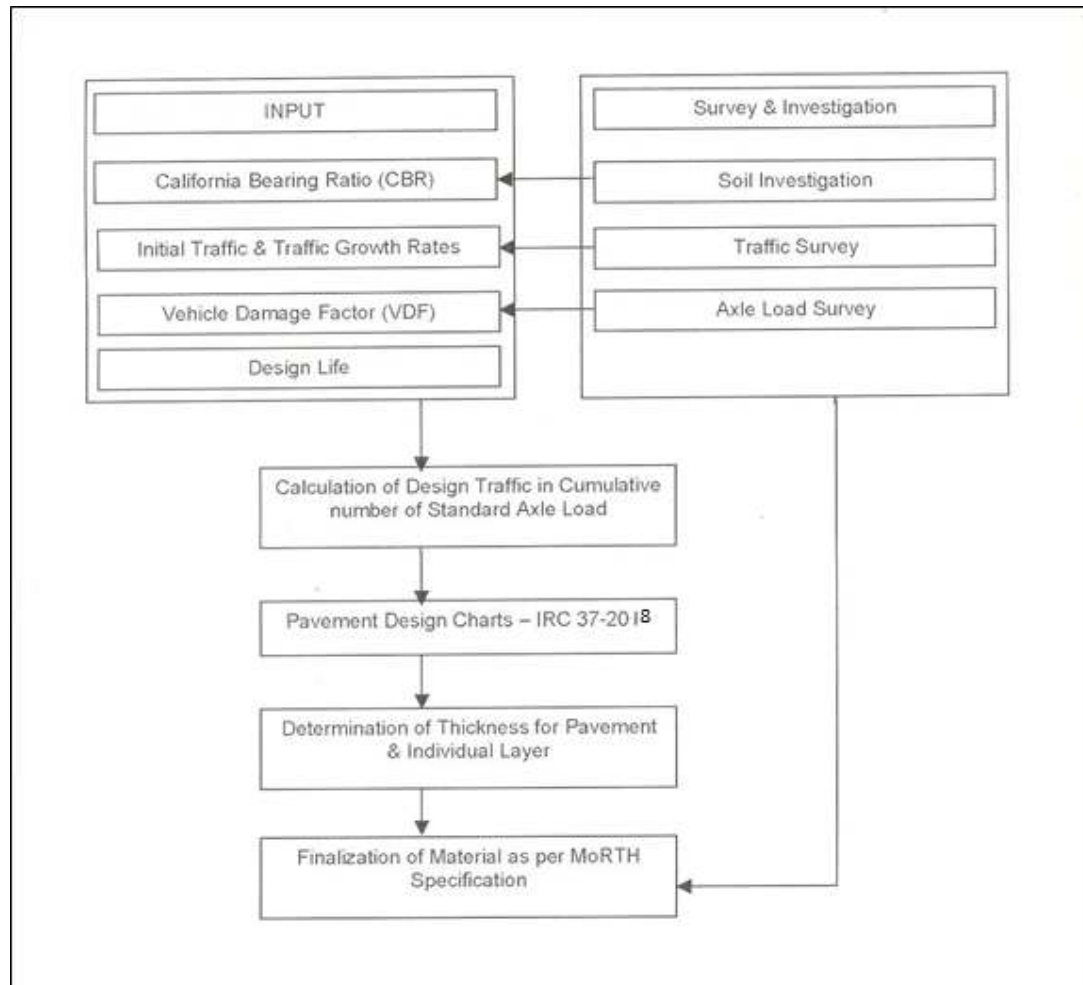


Figure 6.1: Methodology Flow Chart for Design of New Flexible Pavement

6.3 SPECIFICATIONS

The project will use the MORT&H specifications for Road and Bridge Works (Fifth Revision). Where there are no appropriate standards within the MORT&H guidelines, AASHTO specifications may be utilized.

The following Indian standards will be incorporated wherever appropriate:

Ordinary Portland cement	IS: 269
High Strength Ordinary Portland Cement	IS: 8112
Admixtures (where permitted)	IS: 6925 and IS: 9103
Thermo mechanically Treated deformed Bars (TMT/H.Y.S.D)	IS: 1789
Prestressing Steel:	
Uncoated stress relieved low relaxation Strands for 19 T 13 cables	IS: 14268
Sheathing: "Dross-batch" 0.4 mm thick	IS: 18-1985, appendix: 1
Water	IRC: SP33-1989, Clause 5.1 (ii)

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch.
17.737km)**

Bearings

IRC: 83-2018 (Part II) or BS: 5400

Foundations

IRC: 78-2014 and IRC-SP: 33-1989

6.4 DESIGN STANDARDS

(a) Geometric design

- i) Top width of the approach embankment will be kept equal to the overall width (out to out of kerb) of the deck slab.
- ii) All the bridges/VUPs/ROBs/ Flyovers proposed for Reconstruction / New Construction / Additional 2-land shall have separate superstructure for each direction of traffic.
- iii) The span arrangement and span lengths provided will be such that piers/abutments are in line with those of the existing bridges/culverts to ensure smooth flow of water. Spans are either equal to or a multiple of the spans of old structure.
- iv) The linear water way provided will be determined from the consideration of design discharge, effective and adequate drainage.

(b) Loading Standard

- i) All super-structures will be designed for 2 lanes of IRC class A with due consideration to reduction allowed for a multi-lane bridge and single lane of class 70-R, one lane SV, whichever produces worst effect. Superstructure and foundation shall be designed for appropriate live load depending upon their improvement proposal and super-structure arrangement.
- ii) LL on footpath will be taken as 4 KN/m²
- iii) Environmental loadings such as earth pressure, water current, seismic forces and temperature effect will be taken as per IRC/BIS Codes. 15-1893 will be followed in evaluating dynamic increment of earth pressure.

(c) Guiding Standards for Structures

The Structural planning of new bridges or culverts will be guided by the layout of existing structures.

The preliminary designs of proposed structures will be carried out in accordance with the provisions of the following IRC Codes/guidelines.

- ❖ IRC:5-2015 - Section I, General Features of Design
- ❖ IRC:6-2017 - Section II, loads and Stresses
- ❖ IRC:112-2020 - Code for Concrete Road Bridges
- ❖ IRC:22-2015 - Section VI, Composite Construction
- ❖ IRC:40-2002 - Section IV, Brick, stone & Block Masonry
- ❖ IRC:45-1972 - Recommendations for estimating the Resistance of soil
Below Maximum Scour level in the Design of Well
- ❖ IRC:SP:84-2014 -- Four Lane Highway with Paved Shoulder Manual
- ❖ IRC:SP:13-2004 -- Guidelines for design of small bridges and culverts

Foundations of Bridges

- ❖ IRC:78-2014 - Section VII, Foundations and Structure
- ❖ IRC:83-2015 - Section IX,(Part I), Metallic Bearings
- ❖ IRC:83-2015 - Section IX,(Part II), Elastomeric Bearings
- ❖ IRC:83-2018 - Section IX,(Part III), POT Bearings
- ❖ IRC:87-2011 - Guidelines for the Design & Erection of False work for Road Bridges

J. Mulya



**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch.
17.737km)**

- ❖ IRC:SP-33-1989 - Guidelines on Supplemental Measures for Design, Detailing and Durability of Important Bridge Structures
- ❖ IRC:89-1997 - Guidelines for design and construction of river training and control works for road bridges (1st Revision)

Where IRC Codes are silent relevant BIS Codes will be followed. And where even BIS codes are silent, international codes / MOST, MORTH guidelines will be adopted.

(d) Seismic Design

The project road falls in Seismic Zone V, as per the classification specified in IRC:6. All bridges will be designed for Seismic forces as per clause 222.1 of the said code.

(e) Soil Parameters

The Soil parameters used in the preliminary design of foundations for Bridges will be taken from the report of soil investigation and information obtained from local authorities / existing bridge design data.

The following soil parameters will be used for material for back fill behind abutment of bridges and culverts and the abutment structure will be designed accordingly.

$$\begin{aligned}\phi &= 30^\circ \\ \delta &= 20^\circ \\ \gamma_d &= 20 \text{ KN/m}^3 \\ \gamma_{\text{sub}} &= 10 \text{ KN/m}^3\end{aligned}$$

A 600 mm thick granular material filter behind abutment and adequate weep holes in abutment walls will be provided for proper drainage.

(f) Hydraulic design:

The relevant hydraulic data for fixing linear water way of bridges will be taken from the river hydraulic survey done by us and hydraulic data obtained from PWD / Flood Control and Irrigation Department.

For the cross: drainage structures, both the empirical and rational analytical approach as detailed out in IRC-SP-13-2004 will be used to check the adequacy of the waterways provided. Synthetic unit hydrograph method as developed by CWC will be used if relevant subzone flood estimation reports are available in time.

(g) Foundations:

For major bridges, either well or pile foundation and for minor bridges well, pile or open foundation will be adopted based on the soil boring data for those bridges.

(h) Substructure:

RC wall type piers and wall type / spill through type abutment will be provided in the bridges, matching the requirements, site conditions and constraints. Their design will be carried out in conformity with IRC-78-2014. The shape, size and alignment will be matching with the existing structure from aesthetic and hydraulic considerations.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

(i) Superstructure:

I) MORT&H STANDARD

Drawings of RC Beam and slab and PSC super-structure will be adopted wherever applicable. RC slab will form the deck for all new culverts, Multi-cell box structure may be adopted in the minor bridges and culverts, if found appropriate.

II) BEARINGS:

Neoprene/metallic/POT bearings will be used in the bridges as required for specific span, loads etc. and tar paper will be used in the culverts.

III) RAILINGS:

Reinforced concrete railings in M-30 grade concrete following MOST standard will be provided.

IV) EXPANSION JOINTS:

Burried type expansion/strip seal joints as per MORT&H standard will be used.

V) WEARING COURSE:

65mm thick asphaltic concrete wearing course will be adopted.

vi) APPROACH SLAB:

R.C. approach slabs, 3.50 m long and 300 mm thick in M-30 concrete will be used at either end of the bridges and culverts to ensure riding comfort and to reduce vehicular surcharge on the abutment walls. One end of the approach slab is supported on R.C. bracket projecting out, from dirt wall while the rest of the slab is placed on compacted soil as per the guidelines issued by MORT&H. A leveling course, 10 cm thick in M-20 / M-15 grade concrete will be used under the approach slab.

VI) DRAINAGE SPOUTS

100mm dia drainage spout will be used for deck drainage at least one on both sides of carriageway per span.

viii) TMT REINFORCEMENT AND PRESTRESSING CABLES:

Fe-500 high yield strength deformed bars conforming to IS-1786 will be used as reinforcement in all R.C. works. Uncoated stress relieved low relaxation strands conforming to IS-14268 will be used in PSC works.

(j) Protection Works

Protection works in the major bridge will be provided matching the protection work used in the existing bridges. IRC-89-1997 will be followed in detailing the protection works.

- i) Return walls of appropriate length will be provided in all bridges and culverts to stop the spilling of earth into the waterway,
- ii) Flooring will be provided over the base raft of culverts to guard against deterioration of the base raft
- iii) Perimetral cut-off walls around the base raft of culverts and boulder apron on both upstream and downstream sides will be provided to reduce chances of scouring,
- iv) The perimetral cut-off walls will also increase the effective depth of foundation in addition to their protective functions.

CHAPTER - 7

TRAFFIC STUDIES AND DEMAND FORECASTS DESIGN

7.0 PROJECT DESCRIPTION

The Project Road starts near Chirakuta and ends at Jalukbari interchange in Guwahati. The total length of the road section is 209.998km (As per Topographic survey).

The main objective of the Consultancy Services is to prepare Detailed Project Reports for rehabilitation and up-gradation of the existing two lane to 4 - lane with paved shoulder of National Highway configuration.

The Detailed Project Report would inter-alia include Detailed Highway Design, Design of Pavement and overlay with options for flexible or rigid pavements, Design of bridges and cross-drainage structures and grade separated structures, design of service roads, quantities of various items, detailed cost estimates, Environmental Impact Assessments (EIA) and Social Impact Assessment (SIA), preparation and production for implementation of tender document.

The Package-1 of the project road starts near Chirakuta and ends near Mowatari, before Chapar Bypass (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain.

7.1 OBJECTIVE & SCOPE

The objective of the traffic studies carried out as part of this assignment is for technical understanding and assessment of the project. In order to assess the project, volume of traffic that uses the corridor and the future traffic demand were estimated with various types of traffic surveys as stipulated in the TOR.

The detailed scope of services is as follows:

- To carry out 7 days continuous 24 hours Classified Traffic Volume Count Survey at locations in consultation with Client.
- To carry out Origin-Destination (O-D) Surveys (1 day x24 hours) and Commodity Survey on the project road as well as in the influence Zone if required, to establish traffic viability
- To carry out intersection count survey (1 day x 12 hours) at major junctions along the project road to assess the peak hour traffic.

- To analyze the data collected through possible leakage points and study of travel pattern to determine through traffic for important segments of the route.
- Determination of possible leakage points and alternative diversion routes by detailed reconnaissance of the study area network.
- To carry out Axle Load survey (2 days x 24 hours) to ascertain the vehicle damage factor on the road.
- Calculation of design MSA values based on Traffic volume for use in the pavement design.

The details of the data collection, primary as well as secondary, results from its analysis are presented in the following sections.

7.2 TRAFFIC SURVEYS

In order to understand the characteristics and the volume of traffic using the project road, data on existing road network, traffic volume and origin-destination of trips of vehicles plying on the project road were collected through primary surveys. For this purpose, a detailed reconnaissance survey was conducted to identify appropriate locations for primary traffic surveys. The details on the types of primary traffic surveys carried out on the Project Road and their locations are given in the following sections, followed by findings from the analysis of this data.

7.2.1 SURVEY LOCATIONS

At the beginning of the study, a detailed reconnaissance survey has been carried out to identify traffic homogeneous sections so that each homogeneous section will have similar traffic volume and composition. Based on the above, the total project corridor has been divided into four homogeneous sections.

Homogeneous Section - I: Km 0.000 to Km 99.450

Homogeneous Section - II: Km 99.450 to Km 160.400

Homogeneous Section - III: Km 160.400 to Km 205.000

Homogeneous Section - IV: Km 205.000 to Km 215.787

Package-8 fall under Homogeneous Section - II

Photographs taken during Traffic Survey are presented below:



OD survey near Bahalpur



OD survey near Fofanga



**OD survey near Dhupdhara
(Ch. 141.000 km)**



**OD survey near Kukurmara
(Ch. 186.000 km)**



**OD survey near Lankeswar
(Ch. 214.000 km)**



OD survey on NH-17 near Bilasipara



CTVC Survey near Bahalpur (Ch. 31.000 km)



CTVC Survey near Fofanga (Ch. 91.000 km)



CTVC Survey near Dhupdhara (Ch. 141.000 km)



CTVC Survey near Kukurmara (Ch. 186.000 km)



CTVC Survey near Lankeswar (Ch. 214.000 km)



CTVC Survey on NH-17 near Bilasipara

	
TMC survey near Bilasipura Junction (4 legged) (Ch. 0.000 km)	TMC survey near North Salmara(3 legged) (Ch. 50.700 Km)
	
TMC survey near Makri Bazar(4 legged) (Ch. 80.000 km)	TMC survey near Paiakn Junction (3 legged)(Ch. 99.450 Km)
	
TMC survey near Dudhnoi Junction (4 legged) (Ch. 114.900 Km)	TMC survey near Boko Junction (4 legged) (Ch. 160.400 Km)

	
TMC survey near Mirza Junction (4 legged)(Ch. 196.900 Km)	TMC survey near Airport Junction (4 legged) (Ch. 205.100 Km)
	
TMC survey near Jalukbari Junction (Ch. 222.200 Km)	Pedestrian count survey near Bilasipura Junction (Ch. 0.000 km)
	
Pedestrian count survey near North Salmara (Ch. 50.700 Km)	Pedestrian count survey near Makri Bazar (Ch. 80.000 km)



Pedestrian count survey near Paikan Junction (Ch. 99.450 Km)



Pedestrian count survey near Dudhnoi Junction (Ch. 114.900 Km)



Pedestrian count survey near Boko Junction (Ch. 160.400 Km)



Pedestrian count survey near Mirza Junction (Ch. 196.900 Km)



Pedestrian count survey near Airport Junction (Ch. 205.100 Km)



Pedestrian count survey near Jalukbari Junction (Ch. 222.200 Km)

	
Axle load survey near Jogighopa Station (Ch.66.000 km)	Axle load survey near Kukurmara (Ch.186.000 km)

7.2.2 ORIGIN – DESTINATION SURVEY LOCATIONS

Five locations have been identified along the project road stretch for conducting O-D survey. The identified locations are

- **OD -1: Ch. 31.000 km near Bahalpur**
- **OD -2: Ch. 91.000 km near Fofanga**
- **OD -3: Ch. 141.000 km Near Dhudhara**
- **OD -4: Ch. 186.000 km near Kukurmara**
- **OD -5: Ch. 214.000 km near Lankeswar**

7.2.3 CLASSIFIED TRAFFIC VOLUME COUNT LOCATIONS

Five locations have been identified for Classified Traffic Volume Count Survey along the project road stretch. The identified locations are

- **CTVC-1: Ch. 31.000 km near Bahalpur**
- **CTVC-2: Ch. 91.000 km near Fofanga**
- **CTVC-3: Ch. 141.000 km near Dhupdhara**
- **CTVC-4: Ch. 186.000 km near Kukurmara**
- **CTVC-5: Ch. 214.000 km near Lankeswar**

The above location is (i) on a straight stretch for clear visibility and identification of vehicles, (ii) outside urban/built-up area to avoid local traffic.

Additional CTVC and OD Survey has been conducted on NH-17 to assess the potential diversion of traffic on the project road as well as to identify the VDF on the said road developed as NH standard due to generation of commercial traffic movement from NH-17.

7.2.4 AXLE LOAD SURVEY LOCATION

Identified locations for conducting Axle Load survey are given below:

- **Axle-1: Ch. 66.000 km near Jogighopa Station**
- **Axle-2: Ch. 186.000 km near Kukurmara**

7.2.5 TURNING MOVEMENT SURVEY LOCATIONS

Turning Movement Count Survey has been conducted at following 3-legged and 4-legged intersections on the project road stretch:

- **TMC-1 : Ch. 0.000 km near Bilasipura Junction(4 legged)**
- **TMC-2 : Ch. 50.700 Km near North Salmara (3 legged)**
- **TMC-3 : Ch. 52.555 Km at Tulungia (3 legged)** [Intersection Volume count for this junction has been carried out for **Hapachara-Tulungia Stretch**]
- **TMC-4 : Ch. 80.000 km near Makri Bazar (4 legged)**
- **TMC-5 : Ch. 99.450 Km near Paikan Junction (3 legged)**
- **TMC-6 : Ch. 114.900 Km near Dudhnoi Junction (4 legged)**
- **TMC-7 : Ch. 160.400 Km near Boko Junction (3 legged)**
- **TMC-8 : Ch. 196.900 Km near Mirza Junction (4 legged)**
- **TMC-9 : Ch. 205.100 Km near Airport Junction (4 legged)**
- **TMC-10 : Ch. 222.200 Km near Jalukbari Junction (3 legged)**

7.2.6 PEDESTRIAN COUNT/ANIMAL CROSS TRAFFIC COUNT SURVEY LOCATION

Pedestrian Count Survey has been conducted at nine locations on the project road stretch which is as follows:

- **PED-1: Ch.0.000 km near Bilasipura Junction**
- **PED-2: Ch.50.700 Km near North Salmara**
- **PED-3: Ch.80.000 km near Makri Bazar**
- **PED-4: Ch.99.450 Km near Paikan Junction**
- **PED-5: Ch. 114.900 Km near Dudhnoi Junction**
- **PED-6: Ch. 160.400 Km near Boko Junction**
- **PED-7: Ch. 196.900 Km near Mirza Junction**
- **PED-8: Ch. 205.100 Km near Airport Junction**
- **PED-9: Ch. 222.200 Km near Jalukbari Junction**

Photographs taken during Traffic Survey are presented below Fig 7.1:

Fig -7.1: Location Map of Traffic Survey

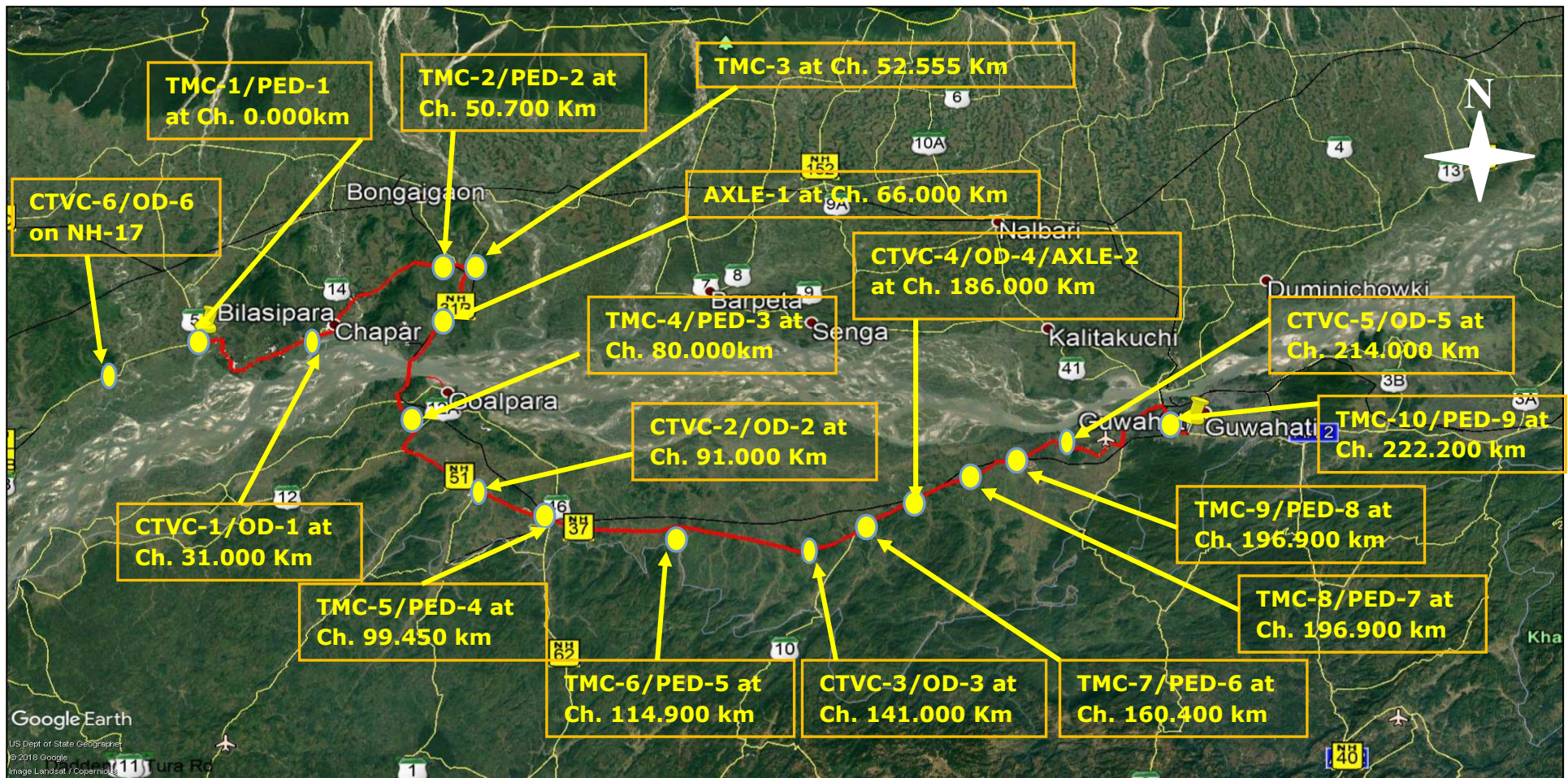


Table- 7.1: Details of Traffic Survey Location

Sl. No	Type of Survey	Nos. Proposed	Duration	Locations
1	Classified Traffic Volume Count	6	CTVC-1, CTVC -2, CTVC-3, CTVC-4, CTVC-5 (7 days x 24 hours) CTVC-6 (3 days x 24 hours)	• CTVC-1: At Ch. 31.000 km near Bahalpur Junction • CTVC-2: At Ch. 91.000 km after Agia Junction • CTVC-3: At Ch. 141.000 km Near Dhudhara • CTVC-4: At Ch. 186.000 km after Kukurmara Bridge • CTVC-5: At Ch. 214.000 km Near Forest School Bus Stop • CTVC-6: On NH-17 towards Dhubri after Bangalipara Junction
2	Origin Destination and Commodity Movement Characteristics	6	OD 1, OD 2, OD 3, OD 4, OD 5, OD 6 (1 day x 24 hours)	• OD-1: At Ch. 31.000 km near Bahalpur Junction • OD-2: At Ch. 91.000 km after Agia Junction • OD-3: At Ch. 141.000 km Near Dhudhara • OD-4: At Ch. 186.000 km after Kukurmara Bridge • OD-5: At Ch. 214.000 km Near Forest School Bus Stop • OD-6: On NH-17 towards Dhubri after Bangalipara Junction
3	Axle Loading Characteristics	2	Axle 1, Axle 2 (2 days x 24 hours)	• AXLE-1: At Ch. 66.000 km near Jogighopa Station • AXLE-2: At Ch. 186.000 km after Kukurmara Bridge

Sl. No	Type of Survey	Nos. Proposed	Duration	Locations
4	Intersection Volume Count	10	TMC-1, TMC -2, TMC-3, TMC-4, TMC-5, TMC-6, TMC-7, TMC-8, TMC-9, TMC-10 (1 day x 12 hours)	• TMC-1: At Ch. 0.000 km at Bilasipura Junction(4 legged) • TMC-2: At Ch. 50.700 Km at North Salmara (3 legged) • TMC-3: At Ch. 52.555 Km at Tulungia (3 legged) [Intersection Volume count for this junction has been carried out for Hapachara-Tulungia Stretch] • TMC-4: At Ch. 80.000 km at Makri Bazar (4 legged) • TMC-5:At Ch. 99.450 Km at Paikan Junction (3 legged) • TMC-6:At Ch. 114.900 Km at Dudhnoi Junction (4 legged) • TMC-7: At Ch. 160.400 Km at Boko Junction (3 legged) • TMC-8: At Ch. 196.900 Km at Mirza Junction (4 legged) • TMC-9: At Ch. 205.100 Km at Airport Junction (4 legged) • TMC-10: At Ch. 222.200 Km at Jalukbari Junction (3 legged)
5	Speed-Delay Characteristics	Entire Stretch		224.585 Km
6	Pedestrian / animal crossing traffic count	9	PED-1, PED-2, PED-3, PED-4, PED-5, PED-6, PED-7, PED-8, PED-9 (1 day x 12 hours)	• PED-1:At Ch. 0.000 km at Bilasipura Junction(4 legged) • PED-2:At Ch. 50.700 Km at North Salmara (3 legged) • PED-3: At Ch. 80.000 km at Makri Bazar (4 legged) • PED-4: At Ch. 99.450 Km at Paikan Junction (3 legged)

Sl. No	Type of Survey	Nos. Proposed	Duration	Locations
				• PED-5: At Ch. 114.900 Km at Dudhnoi Junction (4 legged) • PED-6: At Ch. 160.400 Km at Boko Junction (3 legged) • PED-7: At Ch. 196.900 Km at Mirza Junction (4 legged) • PED-8: At Ch. 205.100 Km at Airport Junction (4 legged) • PED-9: At Ch. 222.200 Km at Jalukbari Junction (3 legged)

Trained enumerators were used for counting traffic under the supervision of qualified and experienced transport planners/supervisors. The data collected from the traffic surveys was coded and entered into the computer for its analysis and interpretation of results with respect to existing traffic, travel pattern and for forecasting purposes. The detail analysis of survey data are presented in the following sections.

7.3 ORIGIN DESTINATION SURVEY

7.3.1 ROAD SIDE INTERVIEWS FOR O-D

To understand the travel demand pattern in the region, Origin and Destination (O-D) Survey was carried out at five locations. The location of the Origin Destination survey as mention below:

- **OD -1: Ch. 31.000 km near Bahalpur**
- **OD -2: Ch. 91.000 km near Fofanga**
- **OD -3: Ch. 141.000 km Near Dhupdhara**
- **OD -4: Ch. 186.000 km near Kukurmara**
- **OD -5: Ch. 214.000 km at Lankeswar**
- **OD -6: On NH-17 near Bilasipara**

The O-D surveys on the project road were carried out based on the roadside interview method as per IRC: 102-1988. Both passenger and commercial vehicles plying on the

project road were stopped on a random sampling basis and interviewed. Police assistance was arranged at the survey locations for successfully carrying out these surveys. The travel characteristics obtained by O-D survey facilitate the identification of the traffic characteristics based on its origin and destination.



Trained enumerators under the supervision of transport planners collected the trip characteristics using the survey forms designed for this purpose. The O-D survey elicited characteristics like origin, destination, frequency, length of trip, etc., both for passenger and goods vehicles. The information collected during roadside interviews was analyzed to obtain the trip distribution based on a zoning system suitably designed in the study.

7.3.2 SAMPLE SIZE CONSIDERED FOR O-D SURVEYS

As described earlier, the vehicles for the OD survey were interviewed on a random sample basis.

Table 7.2(a) & Table 7.2(f) shows the ADT and the sample size (both in absolute numbers and in percentage terms) captured during the survey.

For Homogeneous Section – I:

Table -7.2(a): Sample Size Consideration at Ch. 31.000 km near Bahalpur

Road Name : Bilasipura-Jalukbari				Date	06.08.2018
Location : Bahalpur (Ch. 31.000 Km)				Time	8.00am to 8.00 am
Vehicle Type	Sample Collected	Actual Volume	Exp. Fact.	Composition	Sample Size %
LCV	84	704	8.38	11.40	12
Bus	108	341	3.16	14.65	32
Car	381	2810	7.38	51.70	14
2 - Axle	82	405	4.94	11.13	20
3 - Axle	53	269	5.08	7.19	20
MAV	29	201	6.93	3.93	14
	737	4730			16 %

Table -7.2(b): Sample Size Consideration at Ch.91.000 km at Fofanga near Agia Junction

Road Name : Bilasipura-Jalukbari				Date	08.08.2018
Location : Fofanga (Ch. 91.000 Km)				Time	8.00am to 8.00 am
Vehicle Type	Sample Collected	Actual Volume	Exp. Fact.	Composition	Sample Size %
LCV	200	1047	5.24	17.08	19
Bus	126	614	4.87	10.76	21
Car	765	3775	4.93	65.33	20
2 - Axle	40	201	5.03	3.42	20
3 - Axle	28	121	4.32	2.39	23
MAV	12	47	3.92	1.02	26
	1171	5805			20 %

For Homogeneous Section – II:

Table -7.2(c): Sample Size Consideration at Ch. 141.000 km near Dhupbhara

Road Name : Bilasipura-Jalukbari				Date	17.08.2018
Location : Dhupdhara (Ch. 141.000 Km)				Time	8.00am to 8.00 am
Vehicle Type	Sample Collected	Actual Volume	Exp. Fact.	Composition	Sample Size %
LCV	112	563	5.03	13.51	20
Bus	93	445	4.78	11.22	21
Car	538	2677	4.98	64.90	20
2 - Axle	64	291	4.55	7.72	22
3 - Axle	12	48	4.00	1.45	25
MAV	10	45	4.50	1.21	22
	829	4069			20 %

For Homogeneous Section – III:

Table -7.2(d): Sample Size Consideration at Ch. 186.000 km near Kukurmara Bridge

Road Name : Bilasipura-Jalukbari				Date	16.08.2018
Location : Kukurmara Bridge (Ch. 186.000 Km)				Time	8.00am to 8.00 am
Vehicle Type	Sample Collected	Actual Volume	Exp. Fact.	Composition	Sample Size %
LCV	238	1155	4.85	15.50	21
Bus	121	609	5.03	7.88	20
Car	897	4631	5.16	58.44	19
2 - Axle	201	955	4.75	13.09	21
3 - Axle	57	284	4.98	3.71	20
MAV	21	91	4.33	1.37	23
	1535	7725			20 %

For Homogeneous Section – IV

Table -7.2(e): Sample Size Consideration at Ch. 214.000 km at Lankeswar near Forest School Bus Stop

Road Name : Bilasipura-Jalukbari				Date	18.08.2018
Location : Lankeswar (Ch. 214.000 Km)				Time	8.00am to 8.00 am
Vehicle Type	Sample Collected	Actual Volume	Exp. Fact.	Composition	Sample Size %
282	1885	6.68	10.89	15	282
205	1152	5.62	7.92	18	205
1735	22415	12.92	67.01	8	1735
246	1667	6.78	9.50	15	246
78	371	4.76	3.01	21	78
43	200	4.65	1.66	22	43
	2589	27690			9%

Table -7.2(f): Sample Size Consideration on NH-17 near Bilasipara

Road Name : Bilasipura-Jalukbari				Date	10.08.2018
Location : Bilasipara (on NH-17)				Time	8.00am to 8.00 am
Vehicle Type	Sample Collected	Actual Volume	Exp. Fact.	Composition	Sample Size %
LCV	123	576	4.68	13.84	21
Bus	81	413	5.10	9.11	20
Car	486	2518	5.18	54.67	19
2 - Axle	78	382	4.90	8.77	20
3 - Axle	89	447	5.02	10.01	20
MAV	32	112	3.50	3.60	29
	889	4448			20%

7.3.3 ZONING SYSTEM

For understanding the spatial dimensions of the trip characteristics of the vehicles interviewed during the O-D survey, a scientifically derived zoning system was adopted. Two major types of areas were identified on a broad basis, i.e.

Immediate Influence Area (IIA) of the Project Road: This region contributes to most of the trips observed on the Project Road, and primarily includes the towns/cities and districts around and near the Project Road.

Project Influence Area (PIA) of the Project Road: This region contributes trips, but to a lesser degree when compared to IIA.

While defining zone boundaries, the following were considered:

- ✓ Important towns and industrial centers along the project road and competing roads in the region.
- ✓ Administrative boundaries of district and state boundaries.
- ✓ Configuration of the project roads in the regional road network with respect to other SHs & NHs.

The Zoning System considered in this study has been presented in **Table 7.3 (a)** and **Table 7.3 (f)**

For Homogeneous Section – I:

Table -7.3(a): Zone code for OD at Ch. 31.000 km near Bahalpur

Zone Code	Name of Zone
1	Near Project Road(Biswanath Charali, Na Bazar, Panibhoral)
2	West Side of Project Road (Alomganj, Berbhang, Bogribari, Debitola,Ratiadah,Satrasal)
3	North West Side of Project Road (Agomani,Balajan, Basbari, Bashbari,Bongaigaon, Boxirhat, Fakiragram, Halakura, Hatidura, Kokrajar, Nayahat, Paglahat, Sapotgram, Shapotgram, Tamahat)
4	North East Side of Project Road (Bagribari,Bangalipara,Belguri,Bijni,Dhemdhema,Ghasbari,Nalbari,Panbari,Rongia,Salmara,Silbari, Simlaguri)
5	South West Side of Project Road (Airkata, Fulbari, Gandamari)
6	Rest of Assam (Dhubri, Golakganj, Mankachar, Tura, Chariali, Dhubguri, Kukurmama, Makijara, Naliya, Poshuakhal)
7	Rest of India (Andhra Pradesh,Bagdogra,Coochbihar,Hariyana,Kanpur,Kolkata,Malda, Siliguri)

Table -7.3(b): Zone code for OD at Ch. 91.000 km near Fofanga

Zone Code	Name of Zone
1	Near Project Road(Biswanath Charali, Na Bazar, Panibhoral)
2	West Side of Project Road (Alomganj, Berbhang, Bogribari, Debitola, Ratiadah, Satrasal)
3	North West Side of Project Road (Agomani,Balajan,Basbari,Bashbari,Bongaigaon,Boxirhat,Fakiragram,Hatidura,Kokrajar,Nayahat,Paglahat,Sapotgram,Shapotgram,Tamahat,Tufanganj)
4	North East Side of Project Road (Bagribari,Bangalipara,Belguri,Bijni,Dhemdhema,Ghasbari,Nalbari,Panbari,Rongia,Salmara,Silbari, Simlaguri)
5	South West Side of Project Road (Airkata, Fulbari, Gandamari)
6	Rest of Assam (Dhubri, Golakganj, Mankachar, Tura, Chariali, Dhubguri, Kukurmama, Makijara, Naliya, Poshuakhal)
7	Rest of India (Andhra Pradesh, Bagdogra, Coochbihar, Hariyana, Kanpur, Kolkata, Malda, Siliguri)

For Homogeneous Section – II:

Table -7.3(c): Zone code for OD at Ch. 141.000 km near Dhupdhara

Zone Code	Name of Zone
1	Near Project Road(Biswanath Charali, Na Bazar, Panibhoral)
2	West Side of Project Road (Alomganj, Berbhang, Bogribari, Debitola, Ratiadah, Satrasal)
3	North West Side of Project Road (Agomani,Balajan,Basbari,Bashbari,Bongaigaon,Boxirhat,Fakiragram, Halakura,Hatidura,Kokrajar,Nayahat,Paglahat,Sapotgram,Shapotgram,Tamahat,Tufanganj)
4	North East Side of Project Road (Bagribari,Bangalipara,Belguri,Bijni,Dhemdhema,Ghasbari,Nalbari,Panbari,Rongia,Salmara,Silbari, Simlaguri)
5	South West Side of Project Road (Airkata, Fulbari, Gandamari)
6	Rest of Assam (Dhubri, Golakganj, Mankachar, Tura, Chariali, Dhubguri, Kukurmama, Makijara, Naliya, Poshuakhal)
7	Rest of India (Andhra Pradesh, Bagdogra, Coochbihar, Hariyana, Kanpur, Kolkata, Malda, Siliguri)

For Homogeneous Section – III:

Table -7.3(d): Zone code for OD at Ch. 186.000 km near Kukurmara

Zone Code	Name of Zone
1	Near Project Road(Biswanath Charali,Na Bazar,Panibhoral)
2	West Side of Project Road (Alomganj,Berbhanggi,Bogribari,Debitola,Ratiadah,Satrasal)
3	North West Side of Project Road (Agomani,Balajan,Basbari,Bashbari,Bongaigaon,Boxirhat,Fakiragram, Halakura,Kokrajar,Nayahat,Paglahat,Sapotgram,Shapotgram,Tamahat,Tufanganj)
4	North East Side of Project Road (Bagribari,Bangalipara,Belguri,Bijni,Dhemdhema,Ghasbari,Nalbari,Panbari,Rongia,Salmara,Silbari, Simlaguri)
5	South West Side of Project Road (Airkata, Fulbari, Gandamari)
6	Rest of Assam (Dhubri,Golakganj,Mankachar,Tura,Chariali,Dhubguri,Kukurmama, Makijara,Naliya,Poshuakhal)
7	Rest of India (Andhra Pradesh,Bagdogra,Coochbihar,Hariyana,Kanpur,Kolkata,Malda, Siliguri)

For Homogeneous Section – IV:

Table -7.3(e): Zone code for OD at Ch. 214.000 km near Lankeswar

Zone Code	Name of Zone
1	Near Project Road (Biswanath Charali,Na Bazar,Panibhoral)
2	North West Side of Project Road (Agomani,Balajan,Basbari,Bashbari,Bongaigaon,Dhupguri,Boxirhat,Fakiragram,Halakura,Hatidura,Kokrajar,Nayahat,Paglahat,Sapotgram,Shapotgram,Tamahat,Tufanganj)
3	North East Side of Project Road (Bagribari,Bangalipara,Barpeta,Belguri,Bijni,Dhemdhema,Ghasbari,Nalbari,Panbari,Rongia,Salmara,Silbari,Simlaguri,Tezpur)
4	South West Side of Project Road (Dhubri,Golakganj,Mankachar,Chariali,Naliya,Poshuakhal)
5	Rest of Assam (Silchar, Meghalaya etc)
6	Rest of india (Andhra Pradesh,Hariyana,Kanpur,Kolkata,Malda,Siliguri,Silong)

Table -7.3(f): Zone code for OD on NH-17

Zone Code	Name of Zone
1	Near Project Road(Biswanath Charali, Na Bazar, Panibhoral)
2	West Side of Project Road (Alomganj, Berbhang, Bogribari, Debitola, Ratiadah, Satrasal)
3	North West Side of Project Road (Agomani,Balajan,Basbari,Bashbari,Bongaigaon,Boxirhat,Fakiragram, Halakura,Hatidura,Kokrajhar,Nayahat,Paglahat,Sapotgram,Shapotgram,Tamahat,Tufanganj)
4	North East Side of Project Road (Bagribari,Bangalipara,Belguri,Bijni,Dhemdhema,Ghasbari,Nalbari,Panbari,Rongia,Salmara,Silbari, Simlaguri)
5	South West Side of Project Road (Airkata, Fulbari, Gandamari)
6	Rest of Assam (Dhubri,Golakganj, Mankachar, Tura, Chariali, Dhubguri, Kukurmama, Makijara, Naliya)
7	Rest of India (Andhra Pradesh, Bagdogra, Coochbihar, Hariyana,Kanpur,Kolkata, Malda, Siliguri)

7.3.4 TRAVEL PATTERN

The origins and destinations of various types of vehicles observed at the O-D survey location have been analyzed for O-D Matrices as per the Zoning System presented. Details OD calculations are given in **Appendix 7.1**

For Homogeneous Section – I:

Table -7.4(a): Combined OD Matrix at Ch. 31.000 km near Bahalpur

Count of all vehicles	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
1	189	3	28	50	96	1	16	383
2	3	0	0	0	0	0	0	3
3	49	0	3	0	14	0	3	69
4	63	2	0	0	29	0	9	103
5	67	0	5	33	1	0	4	110
6	0	0	0	0	0	1	1	2
7	35	0	4	9	3	0	16	67
Grand Total	406	5	40	92	143	2	49	737

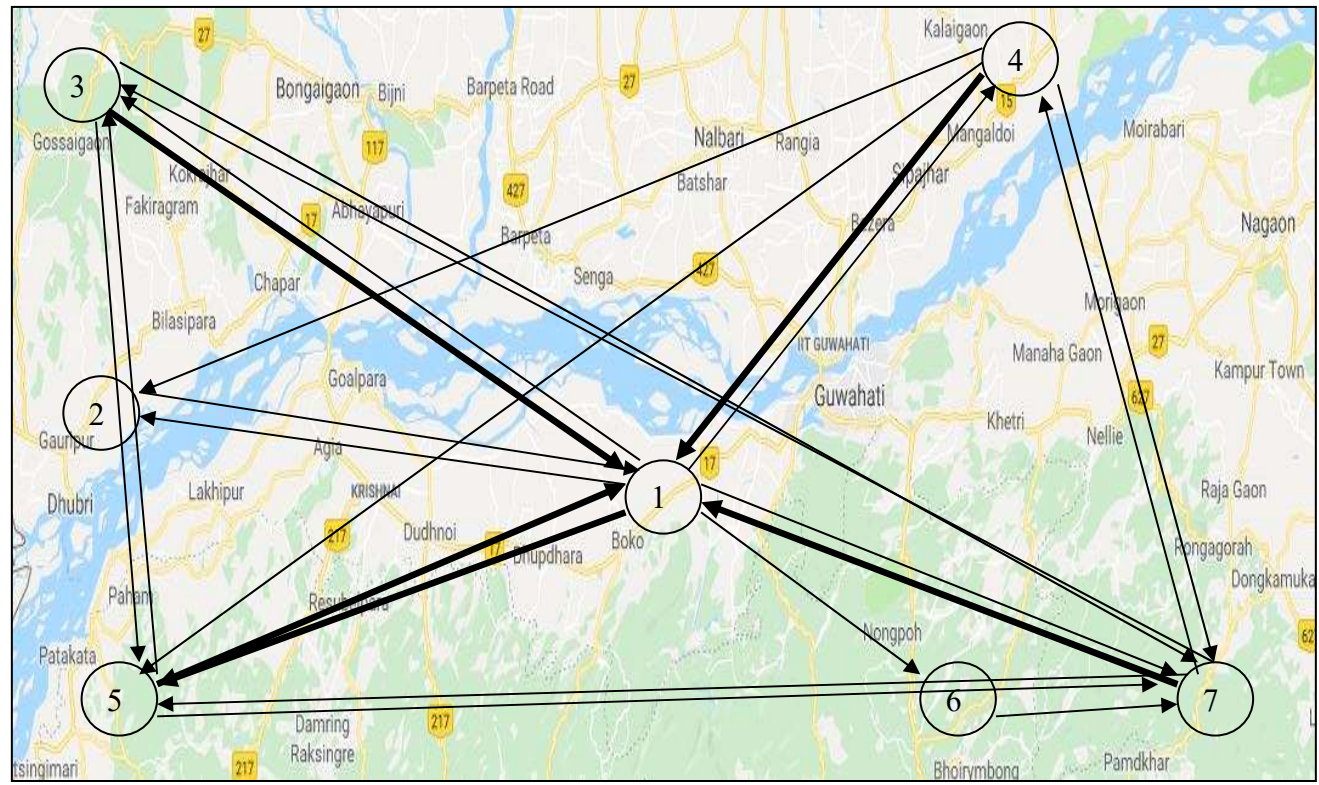


Fig -7.2(a): Zone Diagram for O-D at Ch. 31.000 km near Bahalpur

Table -7.4(b): Zone influencing factor at Ch. 31.000 km near Bahalpur

Zone Code	Name of Zone	Trip Attraction	Trip Production	ZIF (%)
1	Near Project Road (Biswanath Charali, Na Bazar, Panibhoral)	406	383	53.53
2	West Side of Project Road (Alomganj, Berbhangi, Bogribari, Debitola, Ratiadah, Satrasal)	5	3	0.54
3	North West Side of Project Road (Agomani, Balajan, Basbari, Bashbari, Bongaigaon, Boxirhat, Fakiragram, Halakura, Hatidura, Kokrajar, Nayahat, Paglahat, Sapotgram, Shapotgram, Tamahat, Tufanganj)	40	69	7.39
4	North East Side of Project Road (Bagribari, Bangalipara, Belguri, Bijni, Dhemdhema, Ghasbari, Nalbari, Panbari, Rongia, Salmara, Silbari, Simlaguri)	92	103	13.23
5	South West Side of Project Road (Airkata, Fulbari, Gandamari)	143	110	17.16
6	Rest of Assam (Dhubri, Golakganj, Mankachar, Tura, Chariali, Dhubguri,	2	2	0.27

Zone Code	Name of Zone	Trip Attraction	Trip Production	ZIF (%)
	Kukurmama, Makijara, Naliya, Poshuakhal)			
7	Rest of India (Andhra Pradesh, Bagdogra, Coochbihar, Hariyana, Kanpur, Kolkata, Malda, Siliguri)	49	67	7.87
Total=		737	737	100

Table -7.5(a): Combined OD Matrix at Ch. 91.000 km near Fofanga

Count of all vehicles	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
1	448	18	112	12	142	1	58	791
2	1	0	0	0	0	0	0	1
3	113	0	0	3	15	0	7	138
4	32	0	0	1	5	0	4	42
5	143	0	1	3	15	0	17	179
6	4	0	0	0	2	0	1	7
7	9	0	0	1	1	1	1	13
Grand Total	750	18	113	20	180	2	88	1171

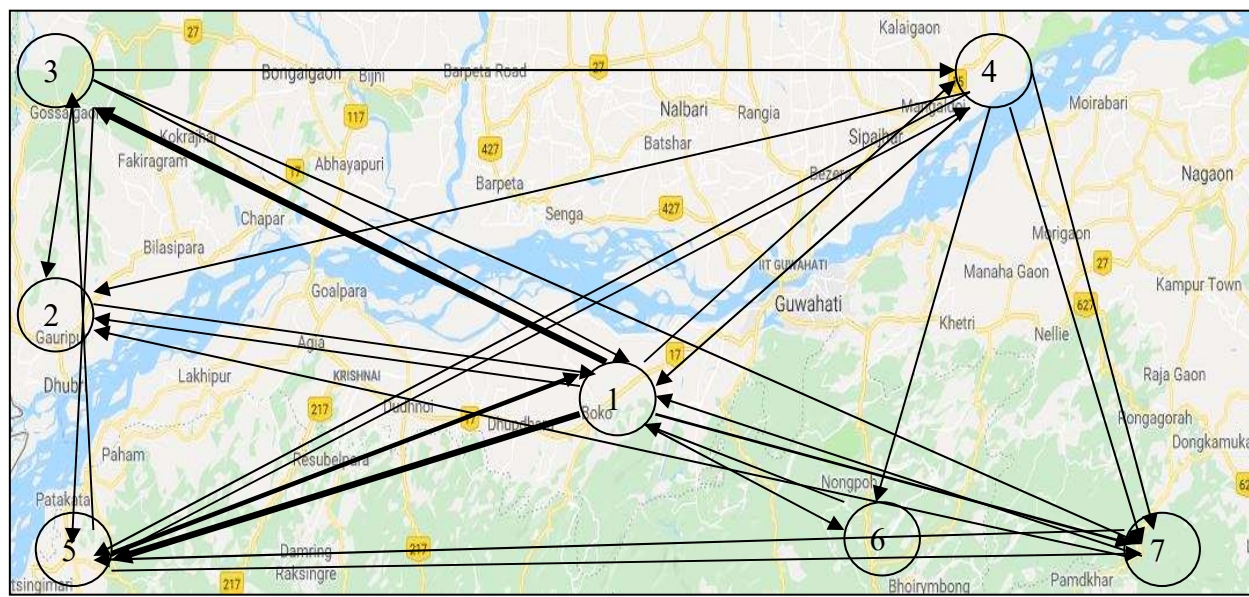


Fig -7.2(b): Zone Diagram for O-D at Ch. 91.000 km near Fofanga

Table -7.5(b): Zone influencing factor at Ch. 91.000 km near Fofanga

Zone Code	Name of Zone	Trip Attraction	Trip Production	ZIF (%)
1	Near Project Road (Biswanath Charali, Na Bazar, Panibhoral)	750	791	65.8
2	West Side of Project Road (Alomganj, Berbhangi, Bogribari, Debitola, Ratiadah, Satrasal)	18	1	0.8
3	North West Side of Project Road (Agomani, Balajan, Basbari, Bashbari, Bongaigaon, Boxirhat, Fakiragram, Halakura, Hatidura, Kokrajar, Nayahat, Paglahat, Sapotgram, Shapotgram, Tamahat, Tufanganj)	113	138	10.7
4	North East Side of Project Road (Bagribari, Bangalipara, Belguri, Bijni, Dhemdhema, Ghasbari, Nalbari, Panbari, Rongia, Salmara, Silbari, Simlaguri)	20	42	2.6
5	South West Side of Project Road (Airkata, Fulbari, Gandamari)	180	179	15.3
6	Rest of Assam (Dhubri, Golakganj, Mankachar, Tura, Chariali, Dhubguri, Kukurmama, Makijara, Naliya, Poshuakhal)	2	7	0.4
7	Rest of India (Andhra Pradesh, Bagdogra, Coochbihar, Hariyana, Kanpur, Kolkata, Malda, Siliguri)	88	13	4.3
Total=		1171	1171	100

For Homogeneous Section – II:

Table -7.6(a): Combined OD Matrix at Ch. 141.000 km near Dhupdhara

Count of all vehicles	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
1	551	7	27	3	82	10	17	697
2	13	0	0	0	0	0	0	13
3	28	1	0	1	0	1	1	32
4	15	1	0	0	2	1	1	20
5	48	0	1	1	0	0	1	51
6	1	0	0	0	0	0	0	1
7	13	1	0	0	0	0	1	15
Grand Total	669	10	28	5	84	12	21	829

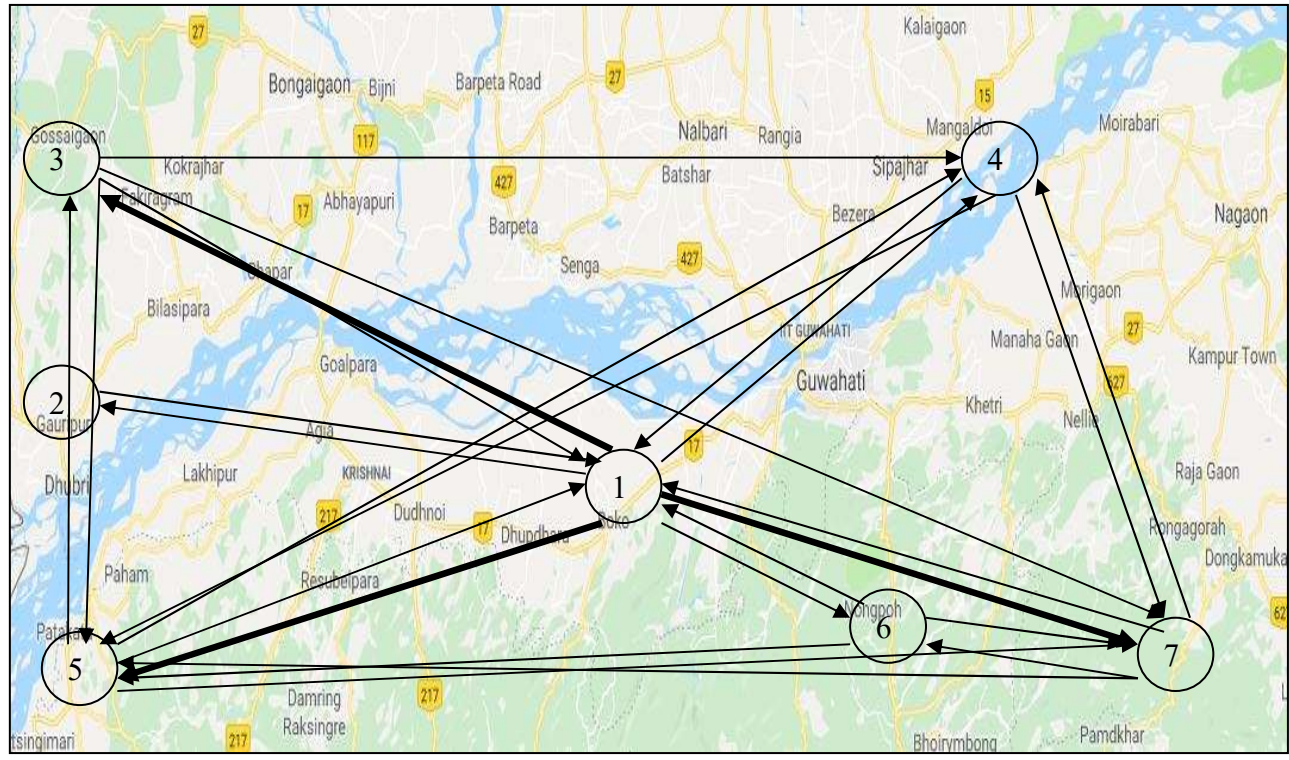


Fig -7.2(c): Zone Diagram for O-D at Ch. 141.000 km near Dhupdhara

Table -7.6(b): Zone influencing factor at Ch. 141.000 km near Dhupdhara

Zone Code	Name of Zone	Trip Attraction	Trip Production	ZIF (%)
1	Near Project Road (Biswanath Charali, Na Bazar, Panibhoral)	669	697	82.4
2	West Side of Project Road (Alomganj, Berbhangi, Bogribari, Debitola, Ratiadah, Satrasal)	10	13	1.4
3	North West Side of Project Road (Agomani, Balajan, Basbari, Bashbari, Bongaigaon, Boxirhat, Fakiragram, Halakura, Hatidura, Kokrajar, Nayahat, Paglahat, Sapotgram, Shapotgram, Tamahat, Tufanganj)	28	32	3.6
4	North East Side of Project Road (Bagribari, Bangalipara, Belguri, Bijni, Dhemdhema, Ghasbari, Nalbari, Panbari, Rongia, Salmara, Silbari, Simlaguri)	5	20	1.5
5	South West Side of Project Road (Airkata, Fulbari, Gandamari)	84	51	8.1
6	Rest of Assam (Dhubri, Golakganj, Mankachar, Tura, Chariali, Dhubguri, Kukurmama, Makijara, Naliya, Poshuakhal)	12	1	0.8
7	Rest of India	21	15	2.2

Zone Code	Name of Zone	Trip Attraction	Trip Production	ZIF (%)
	(Andhra Pradesh, Bagdogra, Coochbihar, Hariyana, Kanpur, Kolkata, Malda, Siliguri)			
Total=		829	829	100

For Homogeneous Section – III:

Table -7.7(a): Combined OD Matrix at Ch. 186.000 km near Kukurmara

Count of all vehicles	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
1	1034	22	29	35	45	46	39	1250
2	5	0	0	0	1	0	0	6
3	47	0	1	1	1	0	1	51
4	21	2	1	0	0	0	3	27
5	58	0	0	4	1	2	0	65
6	36	9	3	3	6	2	4	63
7	47	2	4	2	3	7	8	73
Grand Total	1248	35	38	45	57	57	55	1535

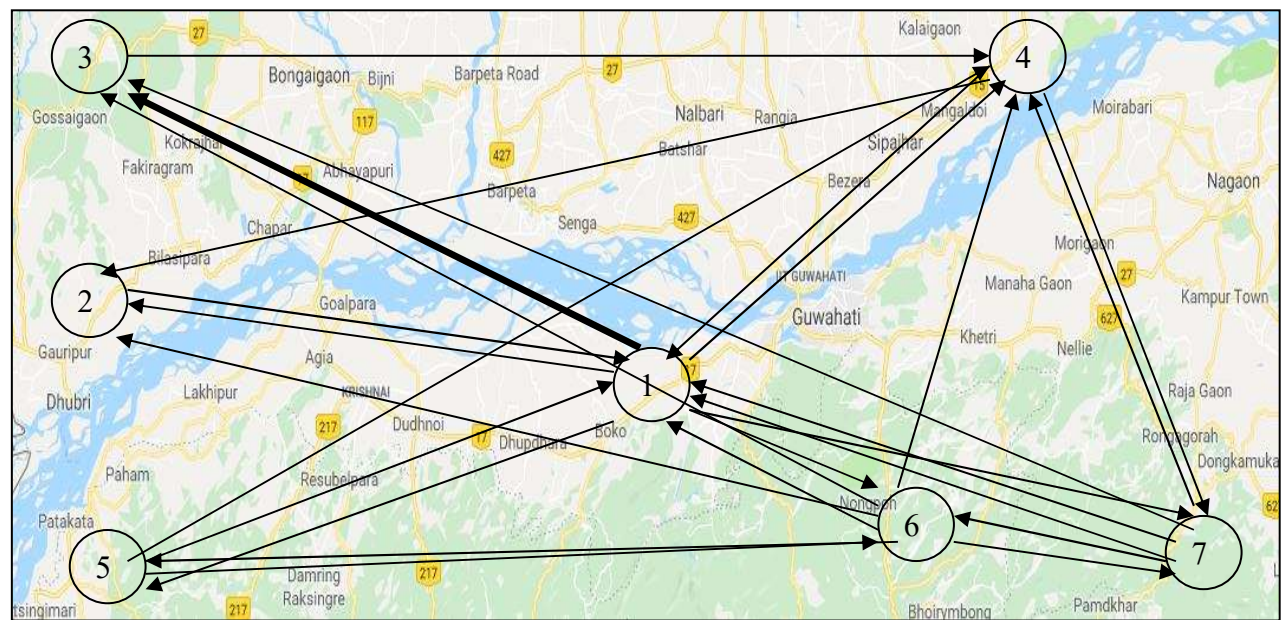


Fig -7.2(d): Zone Diagram for O-D at Ch. 186.000 km near Kukurmara

Table -7.7(b): Zone influencing factor at Ch. 186.000 km near Kukurmara

Zone Code	Name of Zone	Trip Attraction	Trip Production	ZIF (%)
1	Near Project Road (Biswanath Charali, Na Bazar, Panibhoral)	1248	1250	81.4
2	West Side of Project Road (Alomganj, Berbhangi, Bogribari, Debitola, Ratiadah, Satrasal)	35	6	1.3
3	North West Side of Project Road (Agomani, Balajan, Basbari, Bashbari, Bongaigaon, Boxirhat, Fakiragram, Halakura, Hatidura, Kokrajar, Nayahat, Paglahat, Sapotgram, Shapotgram, Tamahat, Tufanganj)	38	51	2.9
4	North East Side of Project Road (Bagribari, Bangalipara, Belguri, Bijni, Dhemdhema, Ghasbari, Nalbari, Panbari, Rongia, Salmara, Silbari, Simlaguri)	45	27	2.3
5	South West Side of Project Road (Airkata, Fulbari, Gandamari)	57	65	4.0
6	Rest of Assam (Dhubri, Golakganj, Mankachar, Tura, Chariali, Dhubguri, Kukurmama, Makijara, Naliya, Poshuakhal)	57	63	3.9
7	Rest of India (Andhra Pradesh, Bagdogra, Coochbihar, Hariyana, Kanpur, Kolkata, Malda, Siliguri)	55	73	4.2
Total=		1535	1535	100

For Homogeneous Section – IV:

Table -7.8(a): Combined OD Matrix at Ch. 214.000 km near Lankeswar

Count of all vehicles	Destination Zone						
Origin Zone	1	2	3	4	5	6	Grand Total
1	1247	128	167	52	161	57	1812
2	32	0	4	0	5	0	41
3	207	35	31	2	21	13	309
4	148	0	16	0	15	8	187
5	116	4	22	0	18	4	164
6	48	7	11	0	4	6	76
Grand Total	1798	174	251	54	224	88	2589

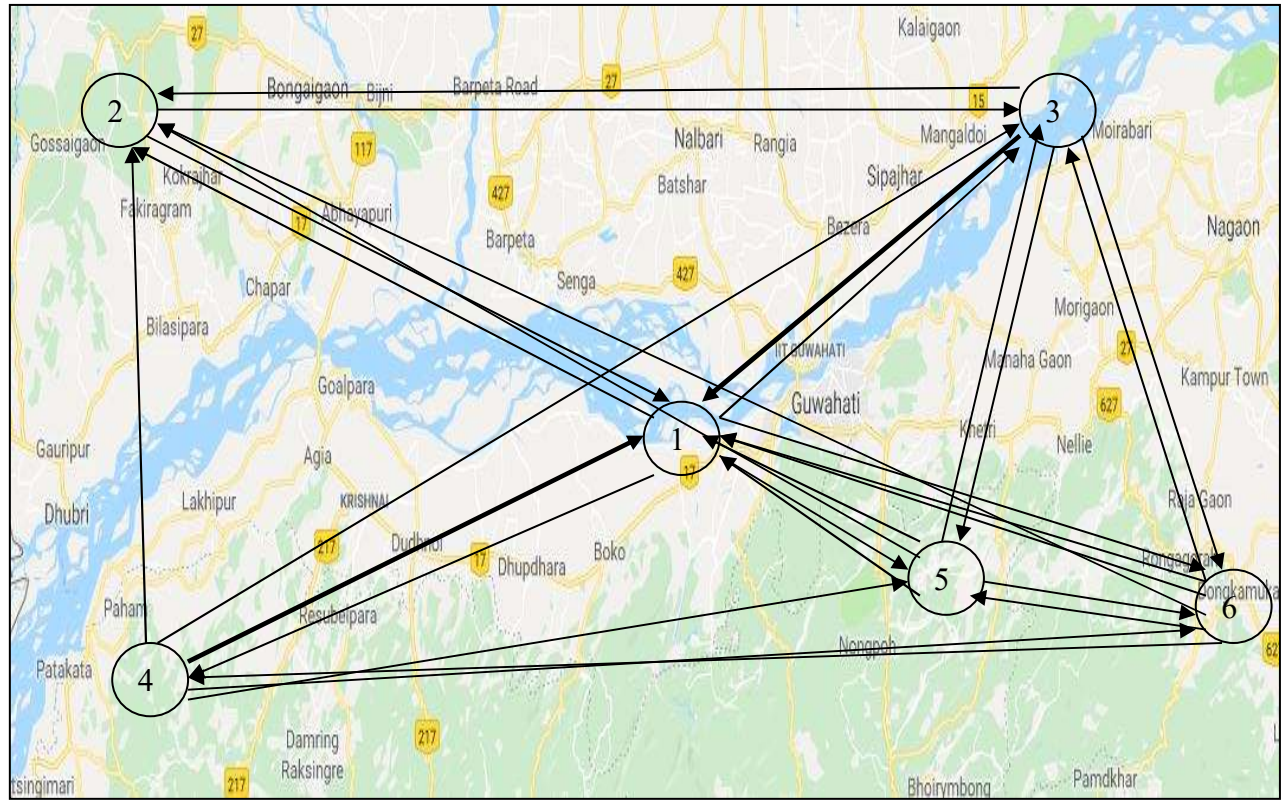


Fig -7.2(e): Zone Diagram for O-D at Ch. 214.000 km near Lankeswar

Table -7.8(b): Zone influencing factor at Ch. 214.000 km near Lankeswar

Zone Code	Name of Zone	Trip Attraction	Trip Production	ZIF (%)
1	Near Project Road(Biswanath Charali,Na Bazar,Panibhorai)	1798	1812	69.7
2	North West Side of Project Road (Agomani,Balajan,Basbari,Bashbari,Bongaigaon,Dhupguri,Boxirhat,Fakiragram,Halakura,Hatidura,Kokrajar,Nayahat,Paglahat,Sapotgram,Shapotgram,Tamahat,Tufanganj)	174	41	4.2
3	North East Side of Project Road (Bagribari,Bangalipara,Barpeta,Belguri,Bijni,Dhemdhema,Ghasbari,Nalbari,Panbari,Rongia,Salmara,Silbari,Simlaguri,Tezpur)	251	309	10.8
4	South West Side of Project Road (Dhubri,Golakganj,Mankachar,Chariali,Naliya,Poshuakhal)	54	187	4.7
5	Rest of Assam (Silchar, Meghalaya etc)	224	164	7.5
6	Rest of India	88	76	3.2

Zone Code	Name of Zone	Trip Attraction	Trip Production	ZIF (%)
	(Andhrapradesh,Bagdogra,Coochbihar,Hariyana,Kanpur,Kolkata, Malda,Siliguri,Silong)			
Total=		2589	2589	100

Table -7.9(a): Combined OD Matrix on NH - 17

Count of all vehicles	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
1	114	13	73	50	86	3	20	359
2	16	0	3	7	0	0	0	26
3	90	1	30	13	15	0	7	156
4	44	7	33	19	34	2	7	146
5	64	0	12	39	7	0	0	122
6	6	0	4	6	0	0	0	16
7	43	0	5	11	1	0	4	64
Grand Total	377	21	160	145	143	5	38	889

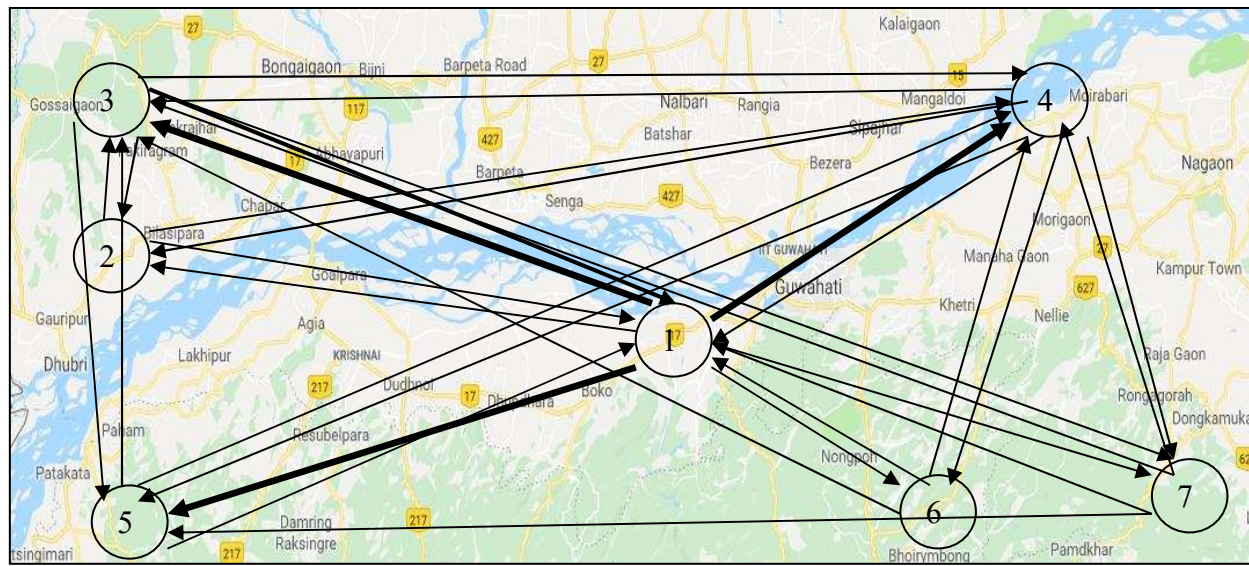


Fig -7.2(f): Zone Diagram for O-D on NH - 17

Table -7.9(b): Zone influencing factor on NH - 17

Zone Code	Name of Zone	Trip Attraction	Trip Production	ZIF (%)
1	Near Project Road (Biswanath Charali, Na Bazar, Panibhoral)	377	359	41.4
2	West Side of Project Road (Alomganj, Berbhangi, Bogribari, Debitola, Ratiadah, Satrasal)	21	26	2.6
3	North West Side of Project Road (Agomani, Balajan, Basbari, Bashbari, Bongaigaon, Boxirhat, Fakiragram, Halakura, Hatidura, Kokrajar, Nayahat, Paglahat, Sapotgram, Shapotgram, Tamahat, Tufanganj)	160	156	17.8
4	North East Side of Project Road (Bagribari, Bangalipara, Belguri, Bijni, Dhemdhema, Ghasbari, Nalbari, Panbari, Rongia, Salmara, Silbari, Simlaguri)	145	146	16.4
5	South West Side of Project Road (Airkata, Fulbari, Gandamari)	143	122	14.9
6	Rest of Assam (Dhubri, Golakganj, Mankachar, Tura, Chariali, Dhubguri, Kukurmama, Makijara, Naliya, Poshuakhal)	5	16	1.2
7	Rest of India (Andhra Pradesh, Bagdogra, Coochbihar, Hariyana, Kanpur, Kolkata, Malda, Siliguri)	38	64	5.7
Total=		889	889	100

7.3.5 DIVERTED TRAFFIC

From the origin Destination survey and site verification, it has been viewed that the traffic towards **Zone-3** and **Zone-4** will follow the entire project road. The percentage of diverted vehicle is calculated from OD analysis. The percentage of vehicles is given below in Table 7.10 (a) to Table 7.10 (e)

Table -7.10 (a): Diverted traffic percentage of 3 Axle from NH-17 to Project road

Count of 3 Axle	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
1	4	1	6	3	13	0	6	33
2	0	0	0	0	0	0	0	0
3	2	0	0	1	2	0	3	8
4	2	1	1	0	7	1	0	12
5	4	0	0	3	1	0	0	8

Count of 3 Axle	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
6	0	0	0	0	0	0	0	0
7	19	0	3	4	0	0	2	28
Grand Total	31	2	10	11	23	1	11	89

Percentage of diverted 3 Axle traffic on Project Road = 1 %

Table -7.10 (b): Diverted traffic percentage of 2 Axle from NH-17 to Project road

Count of 2 Axle	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
1	11	4	7	7	4	0	1	34
2	0	0	0	0	0	0	0	0
3	6	0	2	1	0	0	3	12
4	4	0	4	0	4	0	0	12
5	5	0	0	6	1	0	1	12
6	0	0	0	0	0	0	0	0
7	8	0	0	0	0	0	0	8
Grand Total	34	4	13	14	9	0	4	78

Percentage of diverted 2 Axle traffic on Project Road = 3 %

Table -7.10(c): Diverted traffic percentage of Bus from NH-17 to Project road

Count of Bus	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
1	6	0	7	2	11	0	1	27
2	0	0	0	0	0	0	0	0
3	4	0	3	2	0	0	0	9
4	5	0	4	1	8	0	1	19
5	13	0	0	8	1	0	0	22
6	1	0	0	1	0	0	0	2
7	0	0	1	1	0	0	0	2
Grand Total	29	0	15	15	20	0	2	81

Percentage of diverted Bus traffic on Project Road = 4 %

Table -7.10(d): Diverted traffic percentage of Car from NH-17 to Project road

Count of Car	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
1	71	7	41	33	40	3	10	205
2	10	0	2	5	0	0	0	17
3	58	1	19	8	6	0	0	92
4	29	5	19	13	13	1	5	85
5	33	0	10	17	3	0	0	63
6	3	0	3	4	0	0	0	10
7	7	0	1	4	0	0	2	14
Grand Total	211	13	95	84	62	4	17	486

Percentage of diverted Car traffic on Project Road = 3 %

Table -7.10(e): Diverted traffic percentage of LCV from NH-17 to Project road

Count of LCV	Destination Zone							
Origin Zone	1	2	3	4	5	6	7	Grand Total
1	17	0	9	4	15	0	0	45
2	6	0	0	2	0	0	0	8
3	18	0	4	1	6	0	1	30
4	4	1	5	5	1	0	1	17
5	8	0	1	4	0	0	0	13
6	1	0	1	1	0	0	0	3
7	4	0	0	2	1	0	0	7
Grand Total	58	1	20	19	23	0	2	123

Percentage of diverted LCV traffic on Project Road = 2 %

7.3.6 CONCLUSION

It is concluded from analysis that certain percentage of NH-17 traffic will follow proposed project road after developing this. The percentage has been presented in the below **Table 7.11:**

Table 7.11: Percentage of traffic Diverted from NH-17 to Project Road

Types of vehicles	Total	No of Traffic Diverted from NH-17	% of vehicles towards Project road
3-Axle	89	1	1%
2-Axle	78	3	3%
Bus	81	3	4%
Car	486	14	3%
LCV	123	3	2%

7.4 CLASSIFIED TRAFFIC VOLUME COUNTS

Classified directional traffic volumes were counted manually for 7 continuous days at the identified locations

- **CTVC-1: Ch. 31.000 km at Bahalpur**
- **CTVC-2: Ch. 91.000 km at Fofanga**
- **CTVC-3: Ch. 141.000 km at Dhupdhara**
- **CTVC-4: Ch. 186.000 km near Kukurmara**
- **CTVC-5: Ch. 214.000 km at Lankeswar**

Below to obtain the following.

- Average Daily Traffic (ADT)
- Temporal variation
- Traffic composition
- Seasonal Variation
- Annual Average Daily Traffic (AADT)
- Peak Season AADT
- Estimated total traffic on project road
-

Also additional CTVC survey has been conducted on NH-17 to assess the diverted traffic on the project road.

The details of the above are presented in the following sections. Details of CTVC Analysis are produced in a separate volume **Appendix-7.2**



7.4.1 AVERAGE DAILY TRAFFIC

The traffic volumes counted in 15 minute intervals have been aggregated to one-hour volumes. These are presented in a separate volume field investigation report **Appendix 7.2**. The hourly volumes have been aggregated into daily volumes for the entire survey period (7-days). The daily volumes are then averaged for ADT. To express the classified vehicular count in terms of PCUs, the PCU factors as given in IRC-64:1990 have been considered. For ready reference, the PCU Factors considered in the analysis are given in **Table 7.12**

Table- 7.12: PCU Factors Considered for the Study

Sl. No.	Vehicle Type		PCU Factor
1	Two Wheeler		0.50
2	Car/Jeep/ Van/Taxi/ Auto		1.00
3	Bus	Mini	1.50
4		Standard	3.00
5	LCV		1.50
6	Truck	2-Axle	3.00
7		3 -Axle	3.00
8		Multi-Axle	4.50
9	Agricultural Tractor	With Trailer	4.50
10		Without Trailer	1.50
11	Cycle		0.50
12	Cycle Rickshaw		2.00
13	Hand Cart		3.00
14	Animal Drawn	Bullock Cart	8.00
15		Horse	4.00

The summary of ADT, as observed on the Project Road and NH, in terms of vehicles in Number and PCUs at different survey locations is given in **Table 7.13(a)** to **Table 7.13 (e)** and **Table 7.13(f)** respectively.

For Homogeneous Section – I

Table -7.13 (a): ADT as Observed on Bahalpur (Ch. 31.000 Km)

Vehicle Type	Bahalpur (Ch. 31.000 km)	
	In Number	In PCU
Two Wheeler	2054	1027
Car/Jeep/Van/Taxi/Auto	2507	2507
Mini Bus	7	11
Standard Bus	284	852
LCV	560	840
2-Axle	390	1171
3-Axle	291	873
Multi-Axle	168	754
Tractor With Trailer	7	30
Tractor Without Trailer	12	19
Cycle	859	429
Cycle Rickshaw	17	34
Hand Cart	12	37
Bullock Cart	1	9
Horse Cart	0	0
Total Motorized Vehicles (Number)	6281	-
Total Non Motorized Vehicles (Number)	889	-
Total Vehicle (Number) per day	7170	-
Total Motorized Vehicles (PCU)	-	8083
Total Non Motorized Vehicles (PCU)	-	509
Total PCU per day	-	8592
Total Commercial Vehicle per day (Number)	1706	-

Table -7.13 (b): ADT as Observed on Fofanga (Ch. 91.000 Km)

Vehicle Type	Fofanga (Ch. 91.000 Km)	
	In Number	In PCU
Two Wheeler	2406	1203
Car/Jeep/Van/Taxi/Auto	3496	3496
Mini Bus	72	107
Standard Bus	385	1154
LCV	712	1068
2-Axle	172	516
3-Axle	92	276
Multi-Axle	34	151
Tractor With Trailer	13	58
Tractor Without Trailer	40	61
Cycle	483	242
Cycle Rickshaw	10	20
Hand Cart	6	19
Bullock Cart	0	1
Horse Cart	8	31
Total Motorized Vehicles (Number)	7421	-
Total Non Motorized Vehicles (Number)	508	-
Total Vehicle (Number) per day	7929	-
Total Motorized Vehicles (PCU)	-	8091
Total Non Motorized Vehicles (PCU)	-	312
Total PCU per day	-	8403
Total Commercial Vehicle per day (Number)	1479	-

For Homogeneous Section – II

Table -7.13 (c): ADT as Observed on Dhupdhara(Ch. 141.000 Km)

Vehicle Type	Dhupdhara (Ch. 141.000 Km)	
	In Number	In PCU
Two Wheeler	2964	1482
Car/Jeep/Van/Taxi/Auto	2559	2559
Mini Bus	84	125
Standard Bus	342	1026
LCV	518	778
2-Axle	247	740
3-Axle	63	189
Multi-Axle	49	222
Tractor With Trailer	2	10
Tractor Without Trailer	10	14
Cycle	2455	1227
Cycle Rickshaw	129	259
Hand Cart	44	132
Bullock Cart	0	0
Horse Cart	0	0
Total Motorized Vehicles (Number)	6838	-
Total Non Motorized Vehicles (Number)	2628	-
Total Vehicle (Number) per day	9466	-
Total Motorized Vehicles (PCU)	-	7145
Total Non Motorized Vehicles (PCU)	-	1619
Total PCU per day	-	8764
Total Commercial Vehicle per day (Number)	1305	-

For Homogeneous Section – III

Table -7.13 (d): ADT as Observed on Kukurmara (Ch. 186.000 Km)

Vehicle Type	Near Kukurmara (Ch. 186.000 Km)	
	In Number	In PCU
Two Wheeler	4080	2040
Car/Jeep/Van/Taxi/Auto	4181	4181
Mini Bus	27	40
Standard Bus	523	1568
LCV	1045	1568
2-Axle	759	2277
3-Axle	145	435
Multi-Axle	74	333
Tractor With Trailer	7	33
Tractor Without Trailer	8	12
Cycle	426	213
Cycle Rickshaw	9	17
Hand Cart	1	3
Bullock Cart	0	0
Horse Cart	0	0
Total Motorized Vehicles (Number)	10849	-
Total Non Motorized Vehicles (Number)	435	-
Total Vehicle (Number) per day	11284	-
Total Motorized Vehicles (PCU)	-	12488
Total Non Motorized Vehicles (PCU)	-	233
Total PCU per day	-	12721
Total Commercial Vehicle per day (Number)	2580	-

For Homogeneous Section – IV

Table -7.13 (e): ADT as Observed on Lankeswar (Ch. 214.000 Km)

Vehicle Type	Lankeswar (Ch. 214.000 Km)	
	In Number	In PCU
Two Wheeler	10688	5344
Car/Jeep/Van/Taxi/Auto	19085	19085
Mini Bus	35	53
Standard Bus	829	2487
LCV	1375	2062
2-Axle	1317	3951
3-Axle	326	978
Multi-Axle	185	831
Tractor With Trailer	4	17
Tractor Without Trailer	7	11
Cycle	203	102
Cycle Rickshaw	24	48
Hand Cart	2	7
Bullock Cart	0	0
Horse Cart	0	0
Total Motorized Vehicles (Number)	33850	-
Total Non Motorized Vehicles (Number)	229	-
Total Vehicle (Number) per day	34079	-
Total Motorized Vehicles (PCU)	-	34817
Total Non Motorized Vehicles (PCU)	-	156
Total PCU per day	-	34973
Total Commercial Vehicle per day (Number)	4070	-

Table -7.13(f): ADT as Observed near Bilasipara on NH-17

Vehicle Type	On NH – 17 near Bilasipara	
	In Number	In PCU
Two Wheeler	2413	1207
Car/Jeep/Van/Taxi/Auto	2428	2428
Mini Bus	27	41
Standard Bus	377	1130
LCV	511	766
2-Axle	384	1153
3-Axle	442	1327
Multi-Axle	125	563
Tractor With Trailer	5	24
Tractor Without Trailer	8	12
Cycle	471	235
Cycle Rickshaw	58	116
Hand Cart	43	129
Bullock Cart	1	6
Horse Cart	8	32
Total Motorized Vehicles (Number)	6721	-
Total Non Motorized Vehicles (Number)	581	-
Total Vehicle (Number) per day	7302	-
Total Motorized Vehicles (PCU)	-	8650
Total Non Motorized Vehicles (PCU)	-	518
Total PCU per day	-	9168
Total Commercial Vehicle per day (Number)	1872	-

7.4.2 TEMPORAL VARIATION

Analysis has been carried out to understand the following parameters on temporal variation of traffic on the Project Road

- Daily variation of traffic,
- Hourly variation of traffic, and

The results and findings from the above analysis are given below.

A. Daily Variation

For Homogeneous Section – I

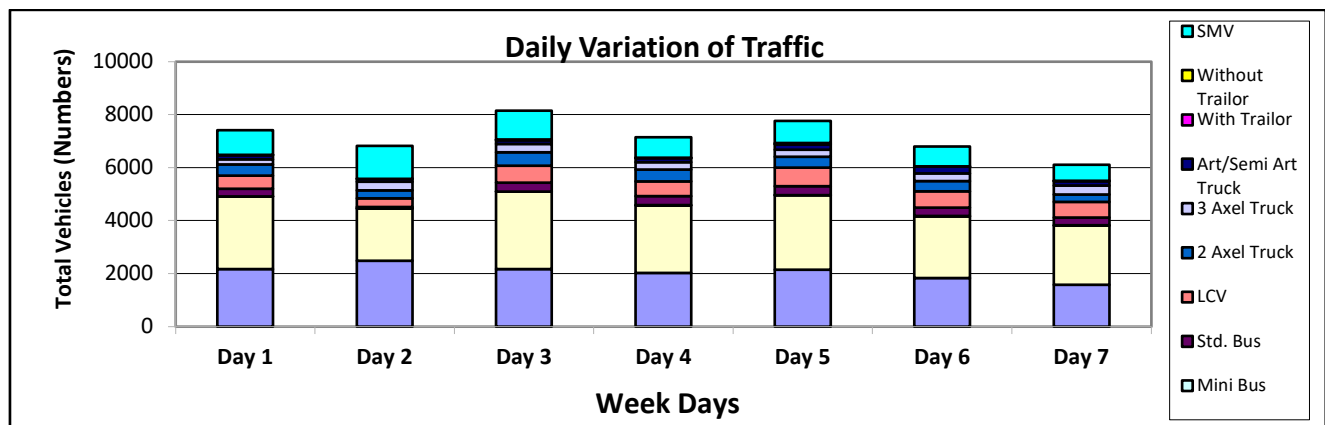


Figure- 7.3 (a): Daily Variation of Traffic at Ch. 31.000 km (Vehicles/Day)

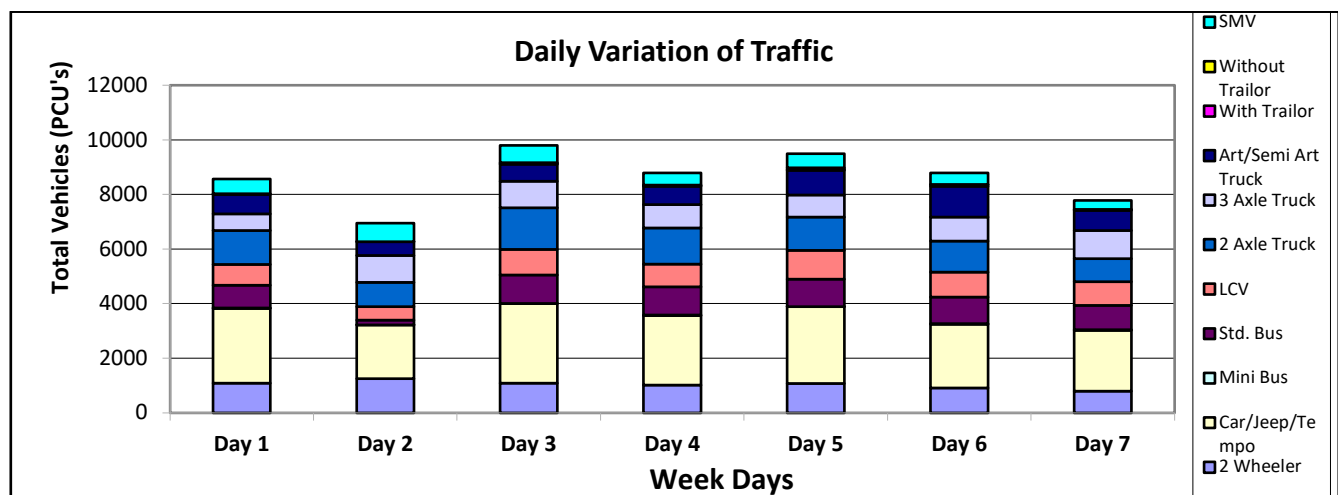


Figure -7.3 (b): Daily Variation of Traffic at Ch. 31.000 km (PCU/Day)

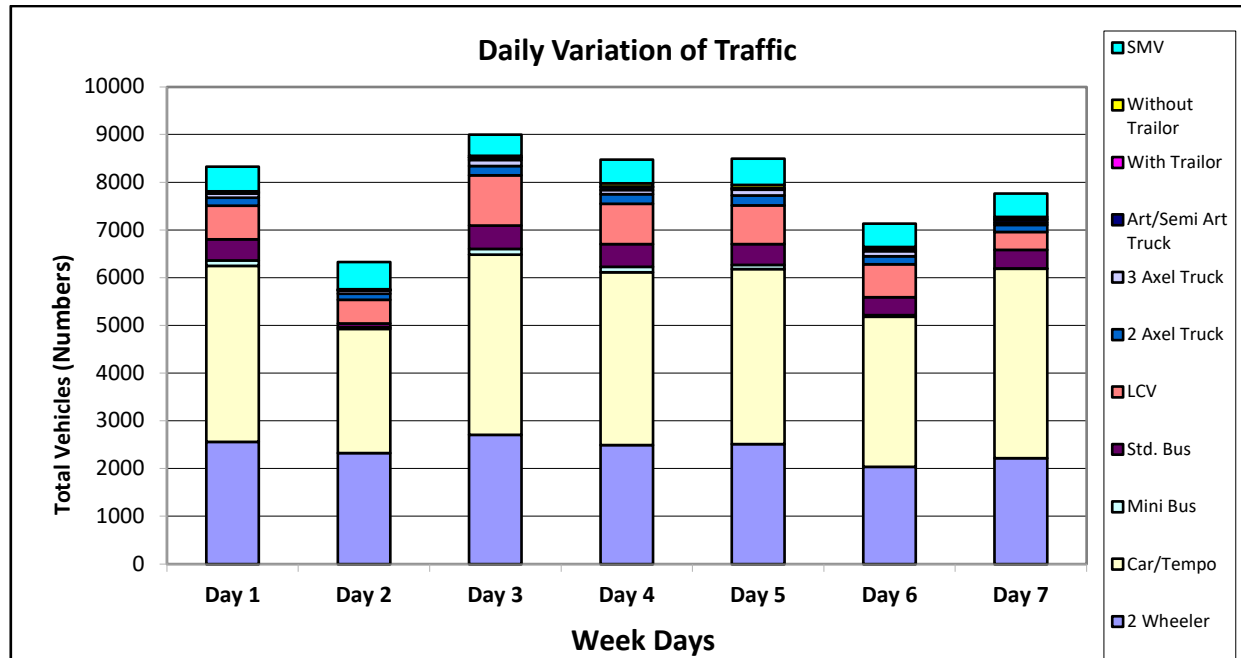


Figure- 7.4(a): Daily Variation of Traffic at Ch. 91.000 Km (Vehicles/Day)

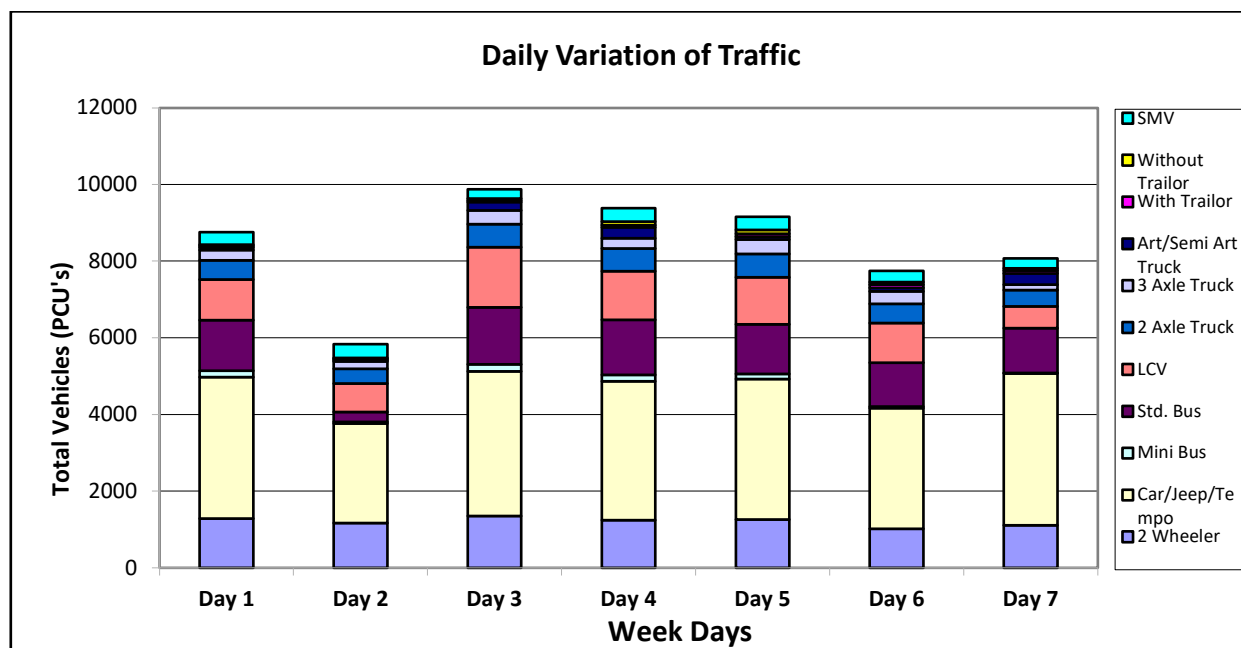


Figure- 7.4(b): Daily Variation of Traffic at Ch. 91.000 Km (PCU/Day)

For Homogeneous Section – II

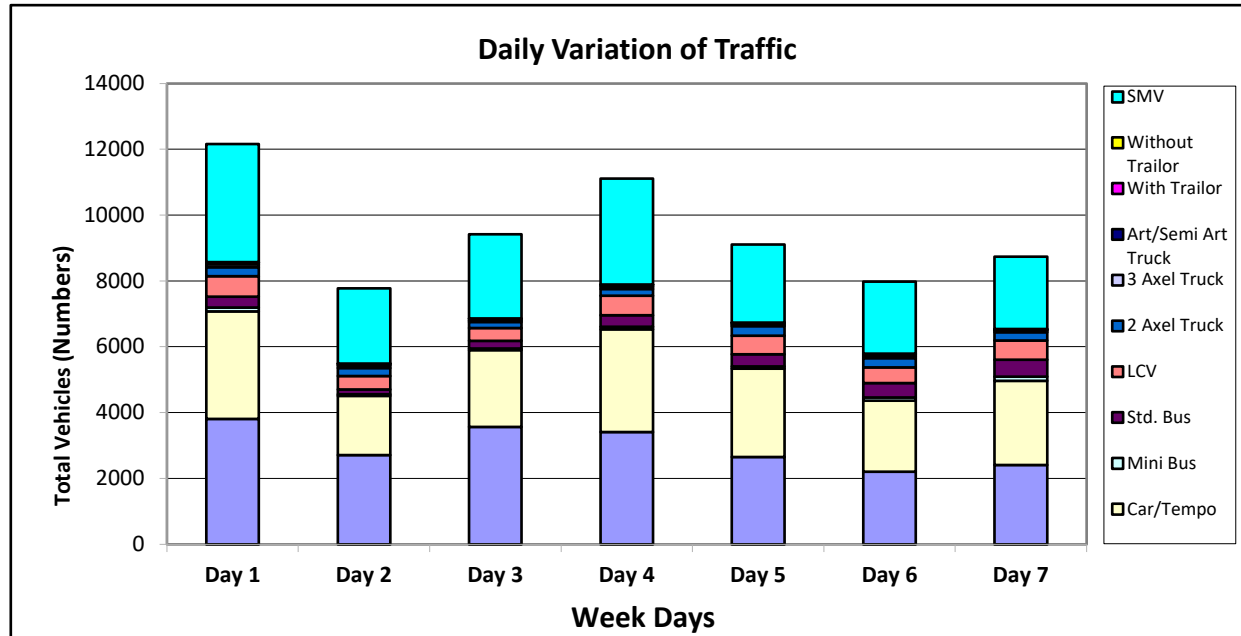


Figure- 7.5(a): Daily Variation of Traffic at Ch. 141.000 Km (Vehicles/Day)

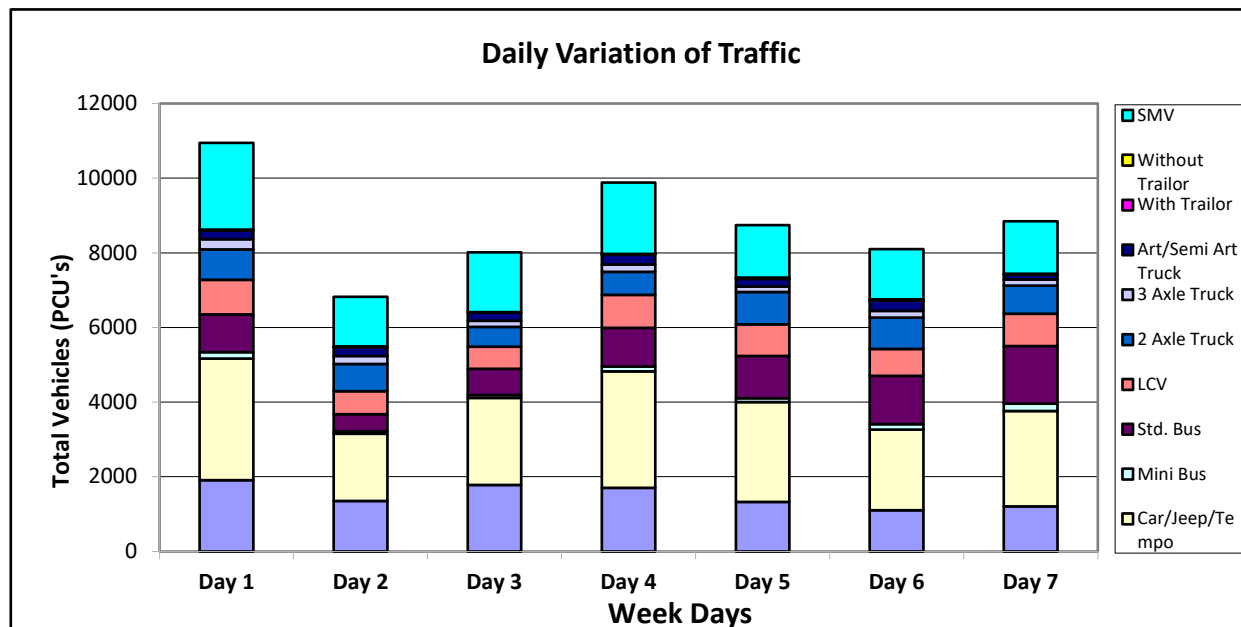


Figure- 7.5(b): Daily Variation of Traffic at Ch. 141.000 Km (PCU/Day)

For Homogeneous Section – III

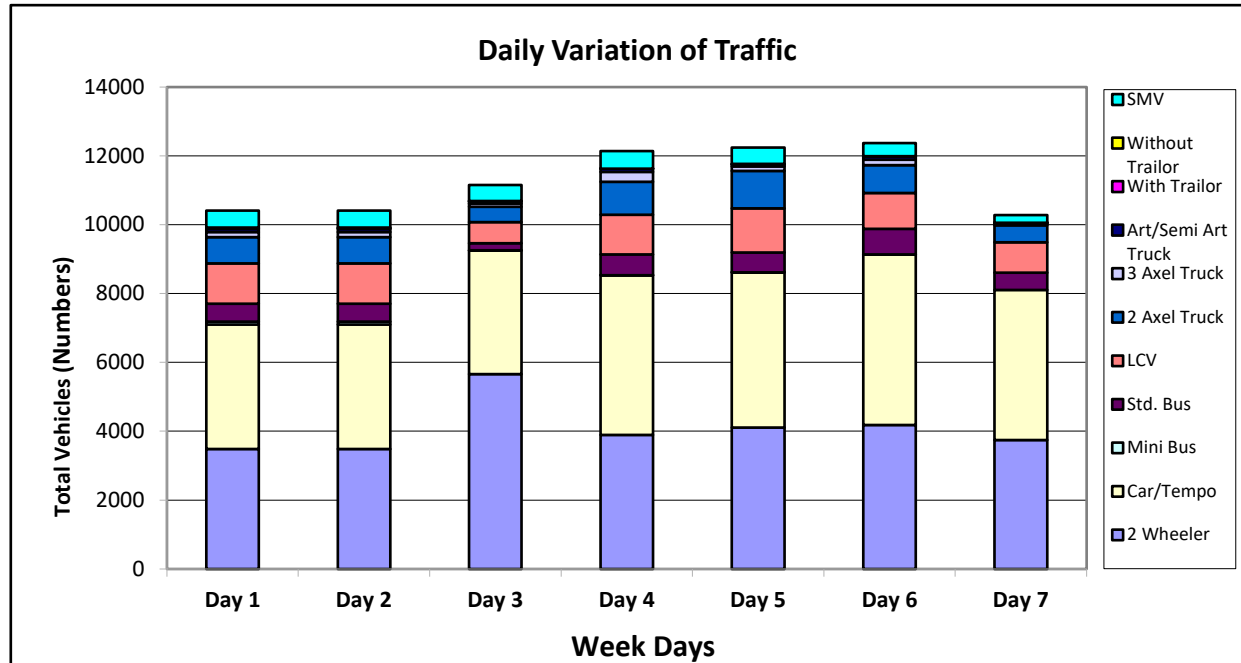


Figure- 7.6(a): Daily Variation of Traffic at Ch. 186.000 Km (Vehicles/Day)

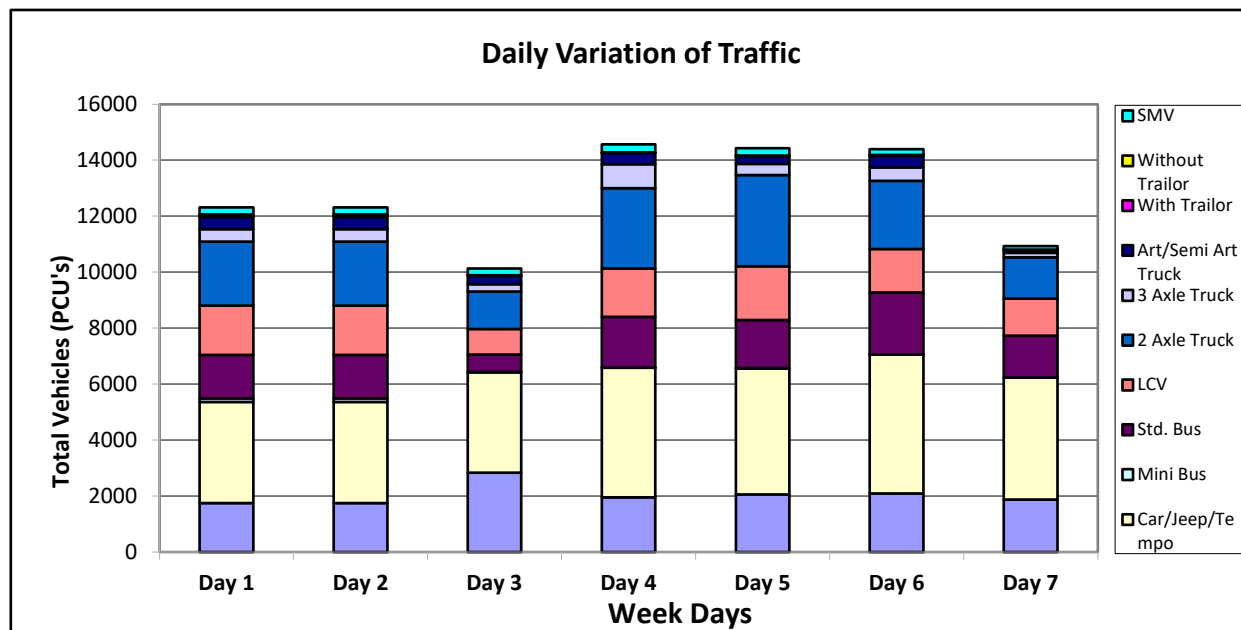


Figure- 7.6(b): Daily Variation of Traffic at Ch. 186.000 Km (PCU/Day)

For Homogeneous Section – IV

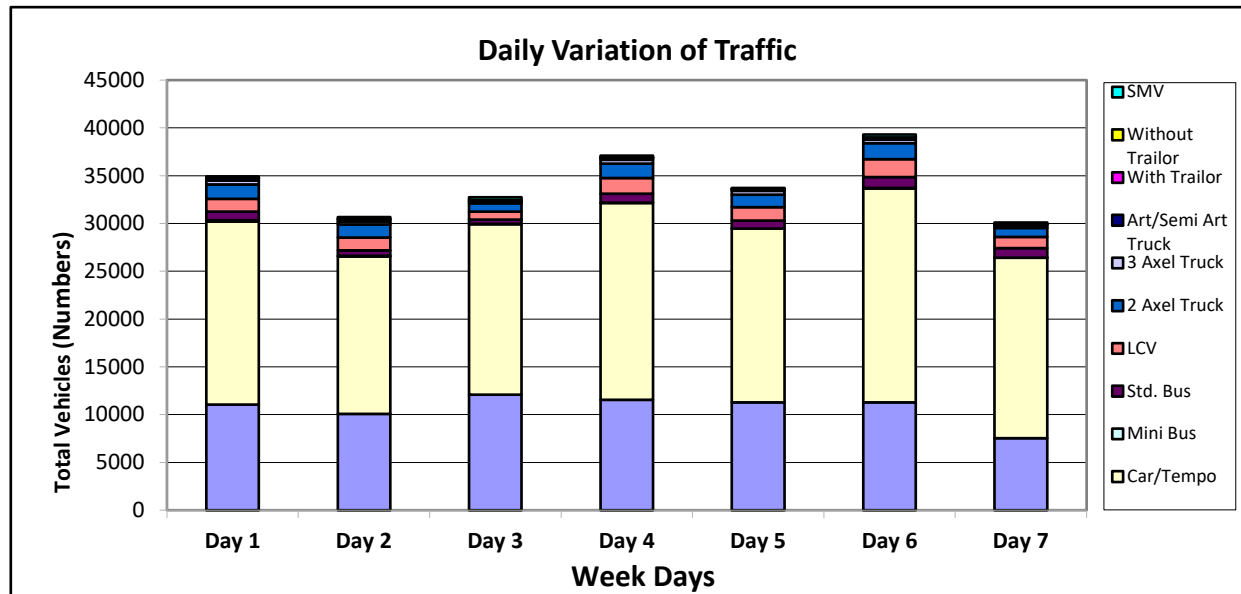


Figure- 7.7(a): Daily Variation of Traffic at Ch. 214.000 Km (Vehicles/Day)

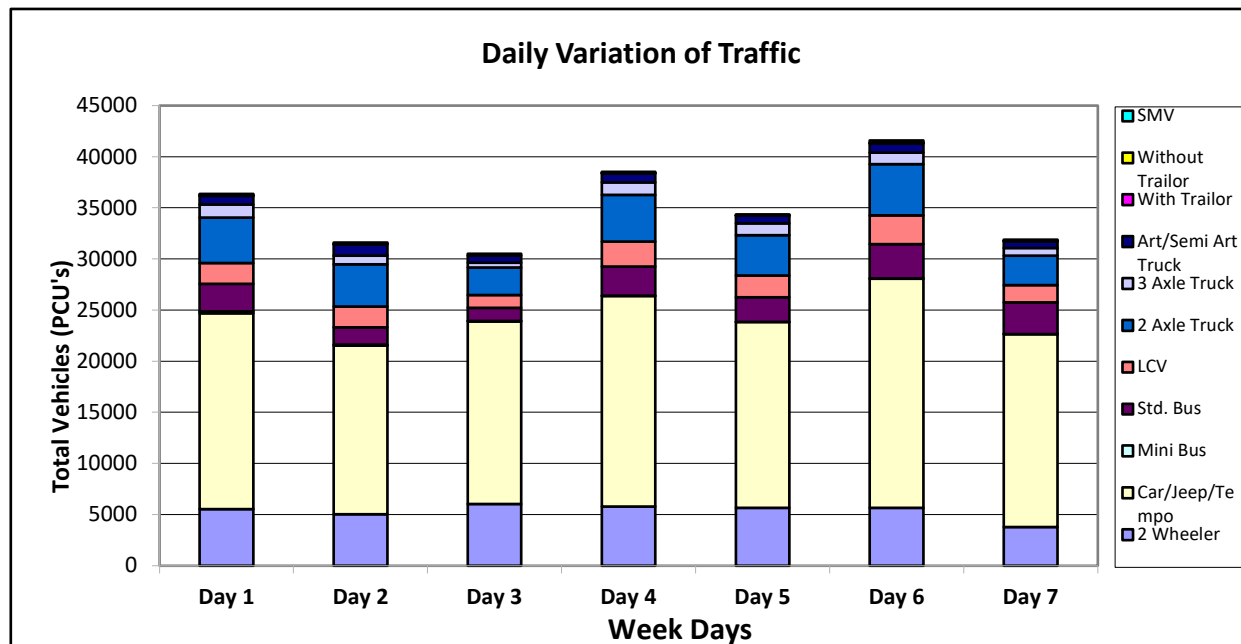


Figure- 7.7(b): Daily Variation of Traffic at Ch. 214.000 Km (PCU/Day)

From the above figure, the following conclusions are made:

For Homogeneous Section – I

- At location-1, Ch 31.000 km near Bahalpur,
The daily variation of fast moving vehicle in number is within +12.44% to -12.47% and in PCU is within +13.38% to -22.48% with respect to average daily traffic.

The daily variation of slow moving vehicle in number is within +39.98% to -31.30% and in PCU is within +34.34% to -35.09 % with respect to average daily traffic.
- At location-2, Ch.91.000 Km near Fofanga,

The daily variation of fast moving vehicle in number is within +15.26% to -22.41% and in PCU is within +19.03% to -32.39% with respect to average daily traffic.

The daily variation of slow moving vehicle in number is within +11.71% to -13.12% and in PCU is within +16.72% to -22.35 % with respect to average daily traffic.

For Homogeneous Section – II

- At location-3, Ch. 141.000 Km near Dhupdhara,
The daily variation of fast moving vehicle in number is within +25.30% to -19.75% and in PCU is within +20.66% to -23.15% with respect to average daily traffic.

The daily variation of slow moving vehicle in number is within +36.40% to -16.87% and in PCU is within +43.64% to -17.77 % with respect to average daily traffic.

For Homogeneous Section – III

- At location-4, Ch. 186.000 Km near Kukurmara,
The daily variation of fast moving vehicle in number is within +10.52% to -8.63% and in PCU is within +14.27% to -20.86% with respect to average daily traffic.

The daily variation of slow moving vehicle in number is within +17.39% to -49.00% and in PCU is within +22.53% to -46.57 % with respect to average daily traffic.

For Homogeneous Section – IV

- At location-5, Ch.214.000 Km near Lankeswar,
The daily variation of fast moving vehicle in number is within +15.20% to -11.55% and in PCU is within +18.85% to -12.97% with respect to average daily traffic.

The daily variation of slow moving vehicle in number is within +36.51% to -35.89% and in PCU is within +36.41% to -38.52 % with respect to average daily traffic.

B. Hourly Variation

Similar to daily variation, analysis has also been carried out for hourly variation. The hourly variations will be useful in the Capacity and LOS analysis, in planning of various road side infrastructure facilities, etc. The hourly variations in traffic (in Vehicles and PCUs per Day) observed at the count station on the Project Road have been presented in the following Fig 7.8(a) to Fig 7.12(b).

For Homogeneous Section – I

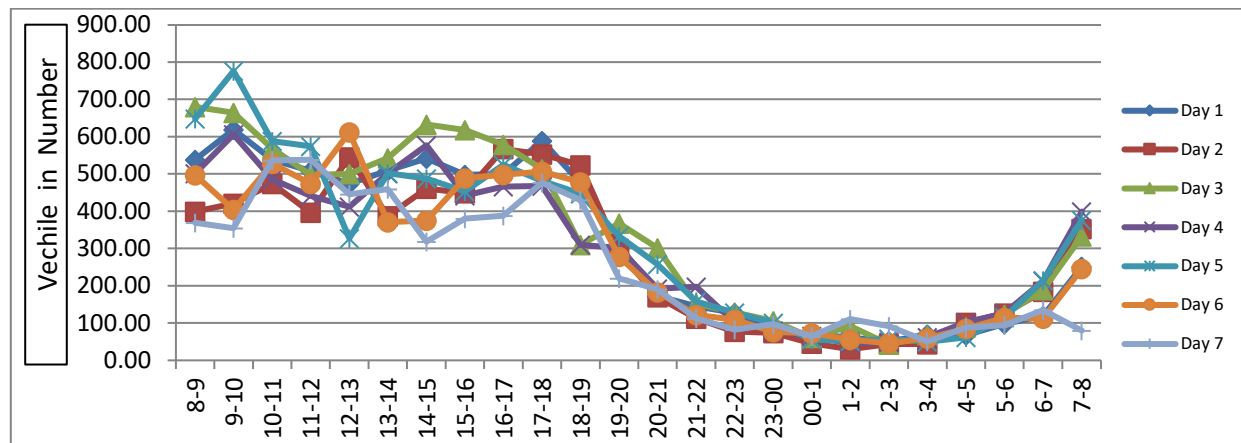


Figure -7.8(a): Hourly Variation of Traffic at Ch. 31.000 km (Vehicles/Day)

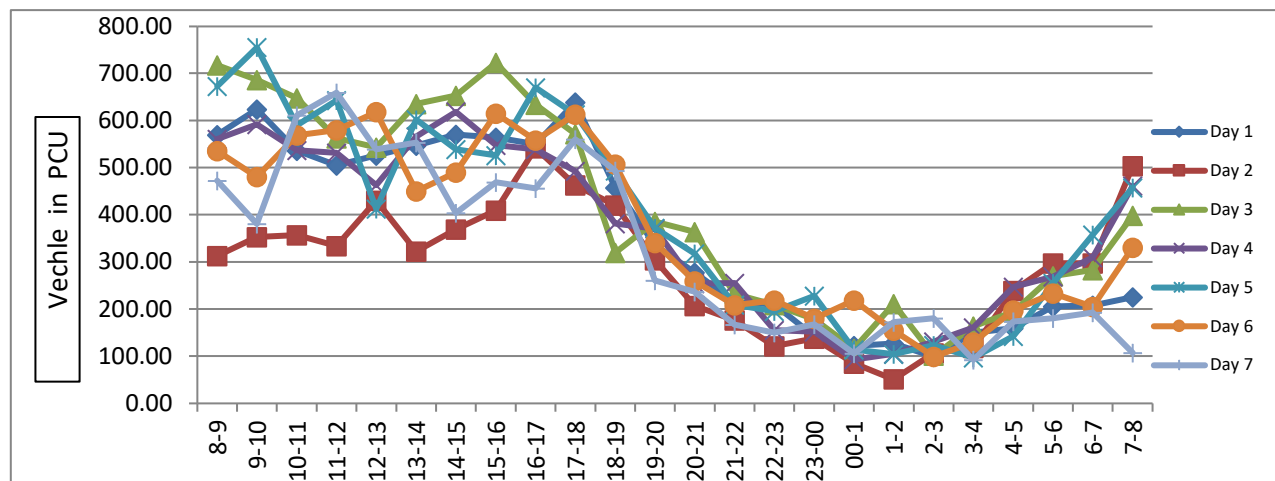


Figure -7.8(b): Hourly Variation of Traffic at Ch. 31.000 km (PCU/Day)

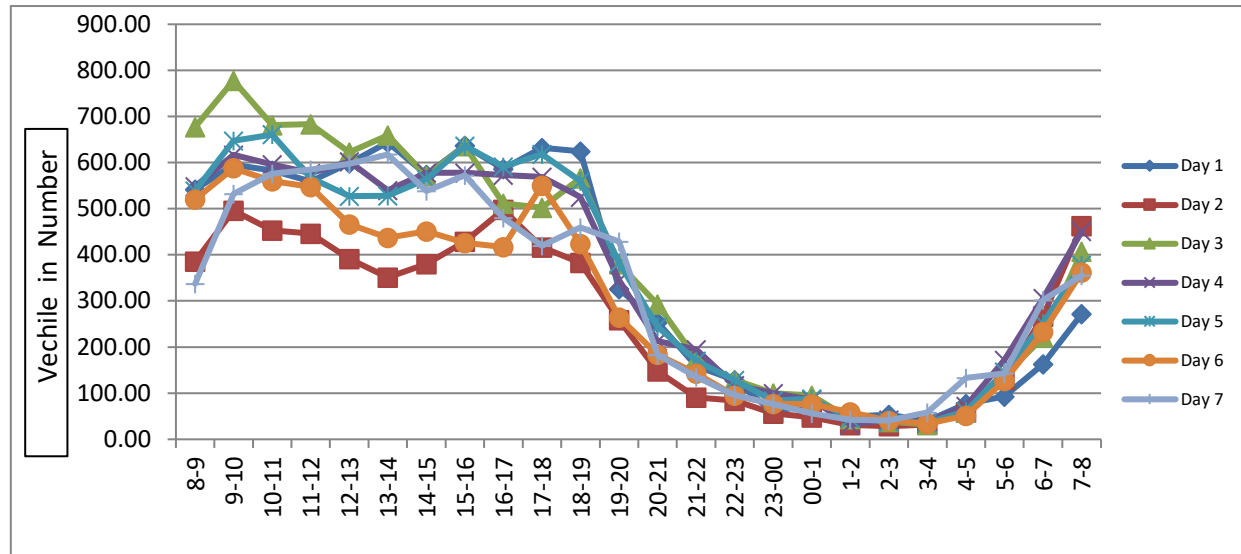


Figure -7.9(a): Hourly Variation of Traffic at Ch. 91.000 Km (Vehicles/Day)

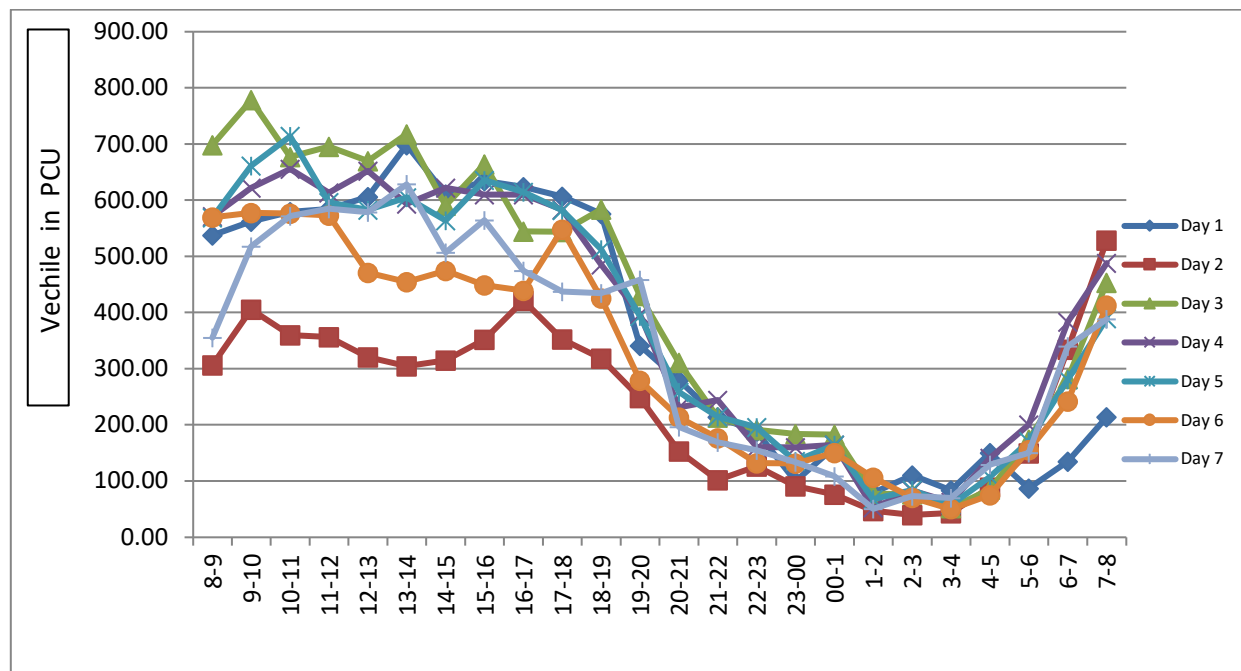


Figure -7.9(b): Hourly Variation of Traffic at Ch. 91.000 Km (PCU/Day)

For Homogeneous Section – II

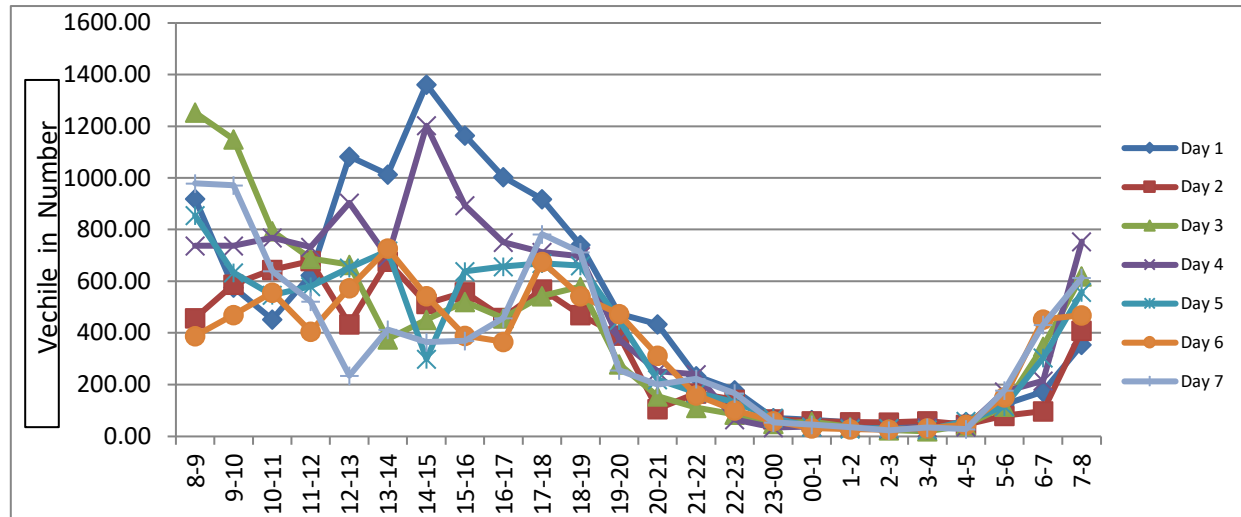


Figure -7.10(a): Hourly Variation of Traffic at Ch. 141.000 Km (Vehicles/Day)

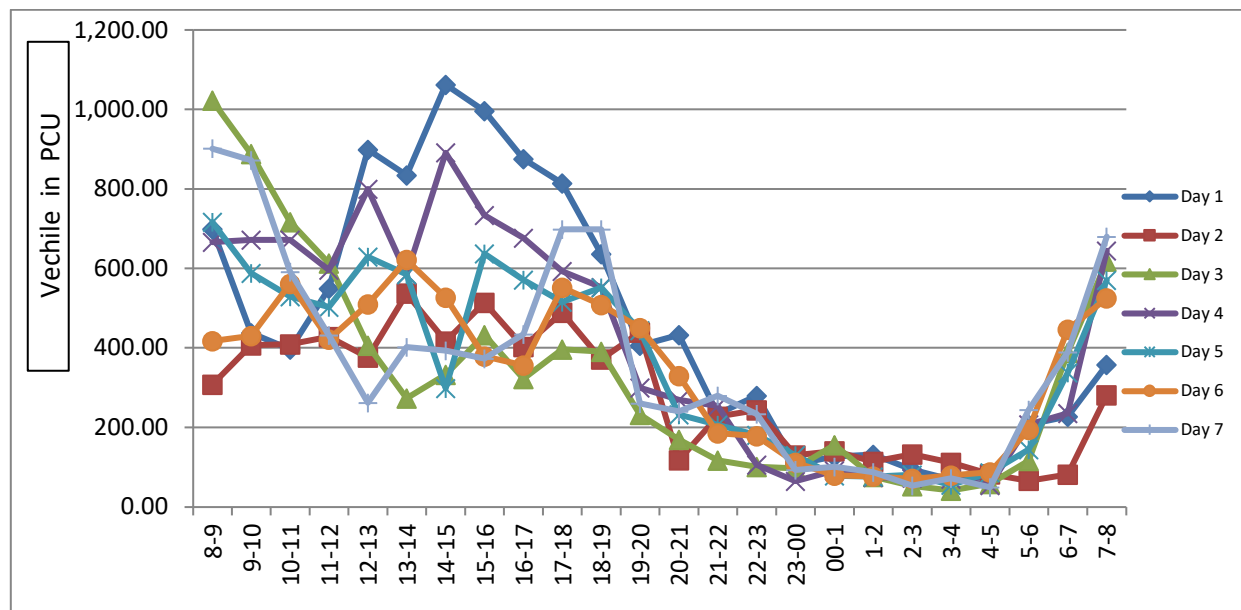


Figure -7.10(b): Hourly Variation of Traffic at Ch. 141.000 Km (PCU/Day)

For Homogeneous Section – III

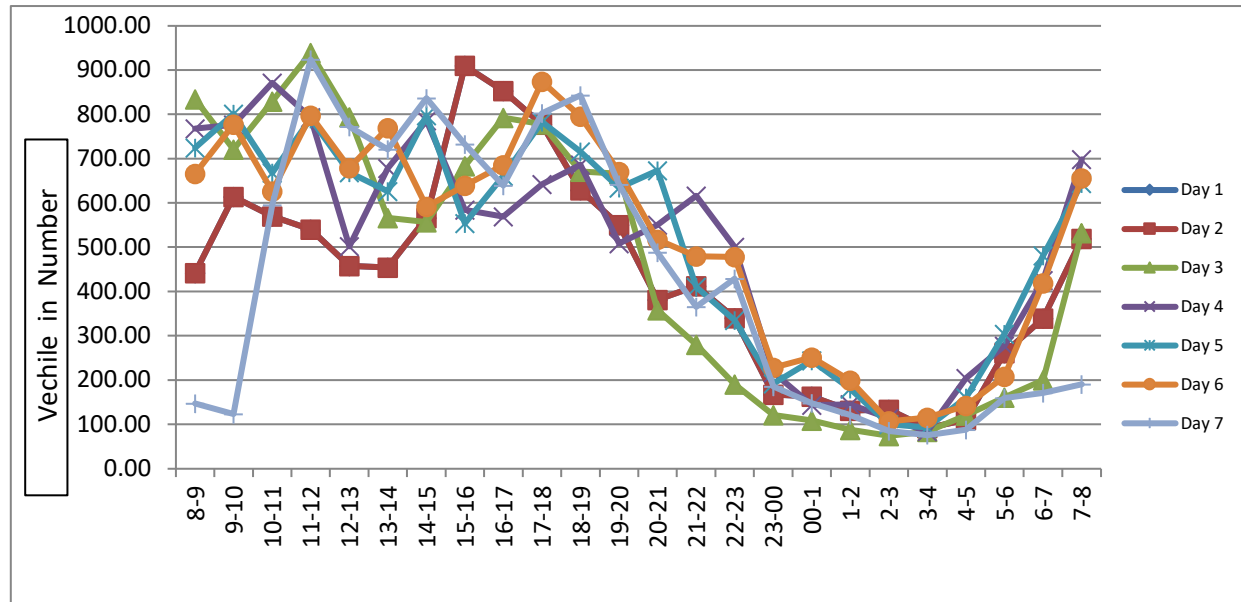


Figure -7.11(a): Hourly Variation of Traffic at Ch. 186.000 Km (Vehicles/Day)

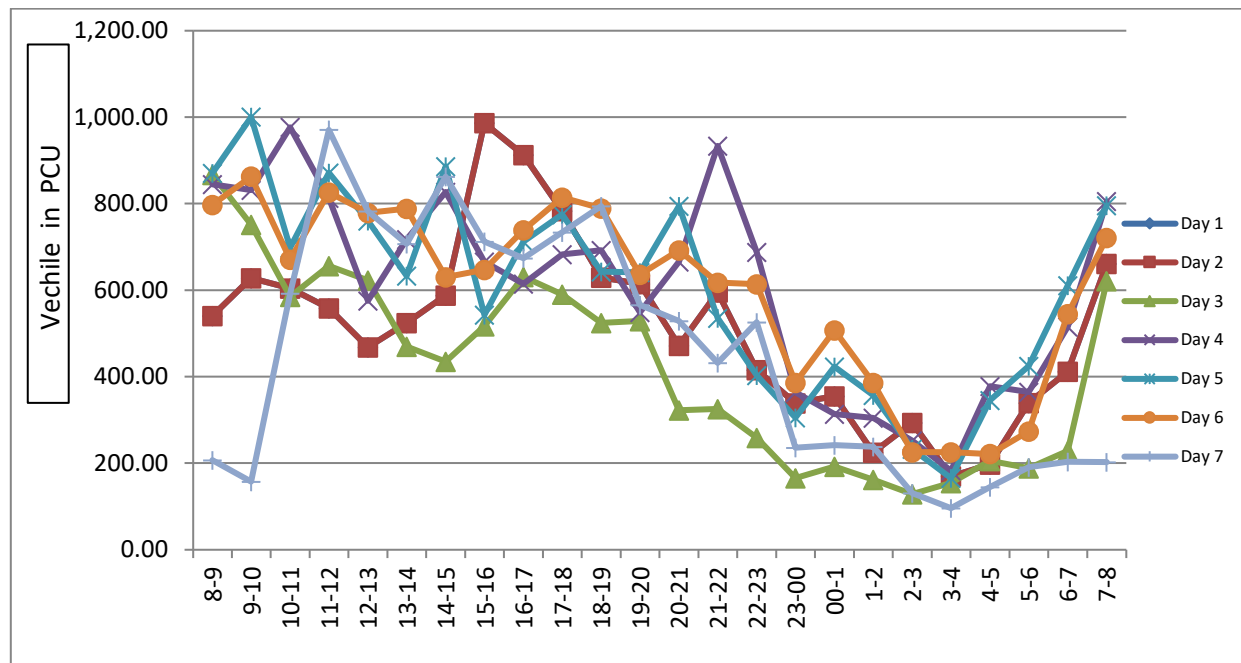


Figure -7.11(b): Hourly Variation of Traffic at Ch. 186.000 Km (PCU/Day)

For Homogeneous Section – IV

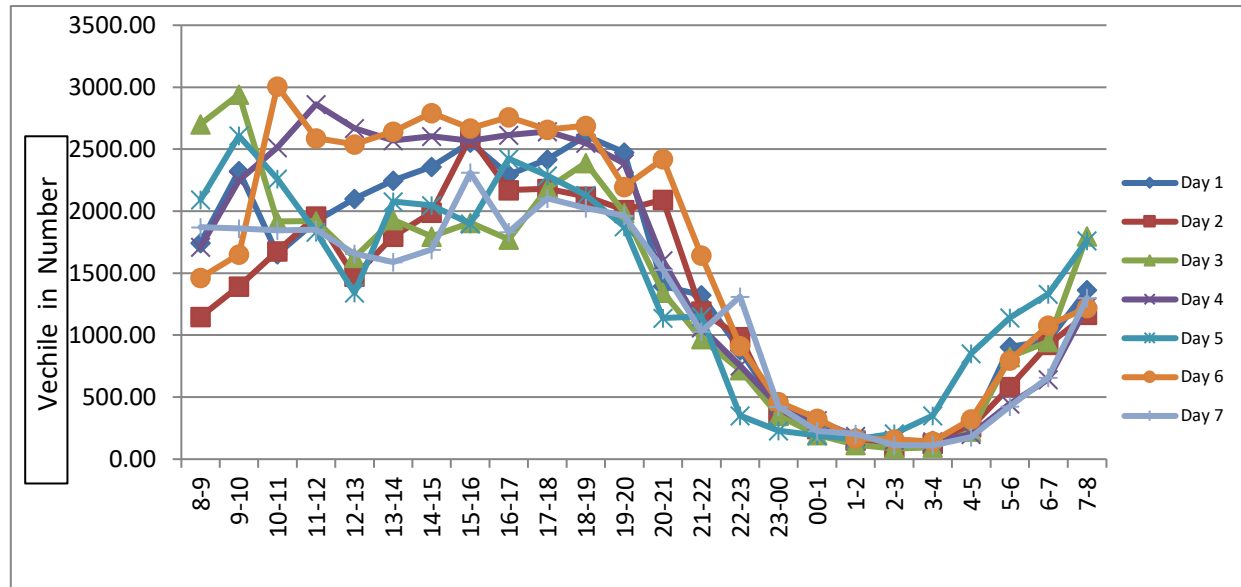


Figure -7.12(a): Hourly Variation of Traffic at Ch. 214.000 Km (Vehicles/Day)

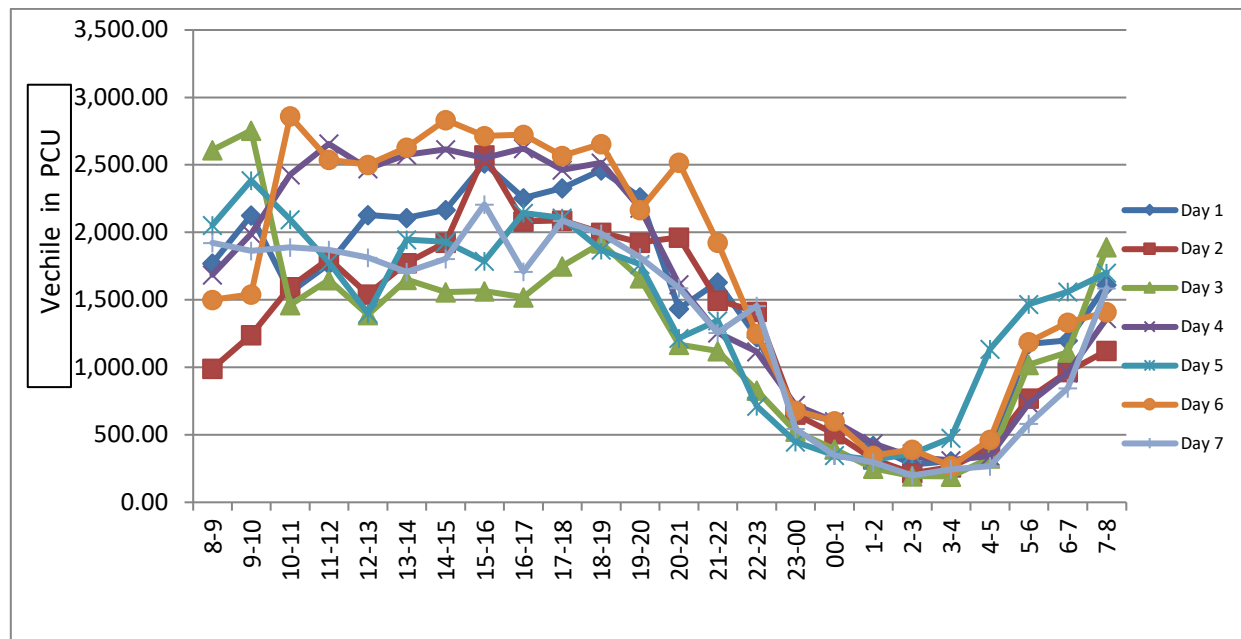


Figure -7.12(b): Hourly Variation of Traffic at Ch. 214.000 Km (PCU/Day)

From these above figures on hourly variation the following can be derived.

- The passenger traffic at all the locations, and therefore on the Project Road, moves mostly during the day time, and it is very low particularly in the night.
- No of Commercial vehicles are very low within the time period of 1.00 am to 4.00 am and Max commercial vehicles are found from 10.00 am to 3.00 pm.

C. Directional Distribution

Like hourly variations, directional distribution of traffic will be useful in the Capacity and LOS analysis and in planning of various road side infrastructure facilities, etc.

The directional distribution observed at the count stations on the Project Road have been presented in **Table 7.14 (a)** to **Table 7.14 (e)**.

For Homogeneous Section – I

Table- 7.14 (a): Directional Distribution at Bahalpur (Ch. 31.000 Km)

Time Interval (Hour)		Bahalpur (Ch. 31.000 km)			
		Traffic (PCU)		Directional Distribution	
From	To	Up	Down	Up	Down
8	9	1878	1962	48.91%	51.09%
9	10	1981	1889	51.18%	48.82%
10	11	1899	1947	49.37%	50.63%
11	12	1881	1933	49.32%	50.68%
12	13	1831	1700	51.86%	48.14%
13	14	1819	1856	49.49%	50.51%
14	15	1912	1731	52.48%	47.52%
15	16	2000	1852	51.92%	48.08%
16	17	2157	1790	54.65%	45.35%
17	18	2085	1866	52.77%	47.23%
18	19	1473	1599	47.95%	52.05%
19	20	1134	1234	47.88%	52.12%
20	21	881	1034	45.99%	54.01%
21	22	712	750	48.72%	51.28%
22	23	699	560	55.50%	44.50%
23	0	638	547	53.86%	46.14%
0	1	425	429	49.77%	50.23%
1	2	414	510	44.81%	55.19%
2	3	395	446	46.94%	53.06%
3	4	456	453	50.17%	49.83%
4	5	541	811	39.99%	60.01%
5	6	599	1111	35.03%	64.97%
6	7	810	1042	43.73%	56.27%
7	8	1274	1209	51.32%	48.68%
Total		29888	30256	49.69%	50.31%

The overall directional distribution is found 50:50 based on the traffic count at Ch.31.000 Km .

Table- 7.14 (b): Directional Distribution at Fofanga (Ch. 91.000 Km)

Time Interval (Hour)		Fofanga (Ch. 91.000 Km)			
		Traffic (PCU)		Directional Distribution	
From	To	Up	Down	Up	Down
8	9	2056	1550	57.02%	42.98%
9	10	2088	2037	50.62%	49.38%
10	11	2065	2069	49.95%	50.05%
11	12	2181	1823	54.47%	45.53%
12	13	1951	1929	50.28%	49.72%
13	14	2142	1861	53.51%	46.49%
14	15	1941	1743	52.69%	47.31%
15	16	1949	1960	49.85%	50.15%
16	17	1751	1976	46.97%	53.03%
17	18	1756	1898	48.06%	51.94%
18	19	1545	1790	46.33%	53.67%
19	20	960	1587	37.70%	62.30%
20	21	708	935	43.09%	56.91%
21	22	527	806	39.51%	60.49%
22	23	454	692	39.62%	60.38%
23	0	386	547	41.39%	58.61%
0	1	480	526	47.74%	52.26%
1	2	302	178	62.88%	37.12%
2	3	362	175	67.44%	32.56%
3	4	231	187	55.26%	44.74%
4	5	418	357	53.94%	46.06%
5	6	685	401	63.08%	36.92%
6	7	1187	809	59.46%	40.54%
7	8	1659	1216	57.71%	42.29%
Total		29777	29046	50.62%	49.38%

The overall directional distribution is found 51:49 based on the traffic count at Ch.91.000 Km .

For Homogeneous Section – II

Table- 7.14 (c): Directional Distribution at Dhupdhara (Ch. 141.000 Km)

Time Interval (Hour)		Dhupdhara (Ch. 141.000 Km)			
		Traffic (PCU)		Directional Distribution (%)	
From	To	Up	Down	Up	Down
8	9	1952	1791	52.15%	47.85%
9	10	1665	1786	48.25%	51.75%
10	11	1436	1572	47.73%	52.27%
11	12	1321	1478	47.20%	52.80%
12	13	1459	1454	50.09%	49.91%
13	14	1370	1422	49.08%	50.92%
14	15	1746	1548	53.01%	46.99%
15	16	1486	1727	46.25%	53.75%
16	17	1355	1533	46.92%	53.08%
17	18	1389	1751	44.24%	55.76%
18	19	1285	1410	47.68%	52.32%
19	20	786	899	46.65%	53.35%
20	21	636	621	50.60%	49.40%
21	22	533	589	47.53%	52.47%
22	23	452	516	46.72%	53.28%
23	0	307	193	61.46%	38.54%
0	1	351	265	56.98%	43.02%
1	2	211	272	0.00%	0.00%
2	3	189	216	0.00%	0.00%
3	4	181	185	49.38%	50.62%
4	5	177	147	54.64%	45.36%
5	6	470	377	55.46%	44.54%
6	7	633	710	47.15%	52.85%
7	8	1350	1313	50.69%	49.31%
Total		22735	23767	48.89%	51.11%

The overall directional distribution is found 49:51 based on the traffic count at Ch 141.000 Km.

For Homogeneous Section – III

Table- 7.14 (d): Directional Distribution at Kukurmara (Ch. 186.000 Km)

Time Interval (Hour)		Near Kukurmara (Ch. 186.000 Km)			
		Traffic (PCU)		Directional Distribution (%)	
From	To	Up	Down	Up	Down
8	9	1573	1573	50.00%	50.00%
9	10	1640	1529	51.75%	48.25%
10	11	1686	1899	47.04%	52.96%
11	12	1863	1876	49.83%	50.17%
12	13	1480	1608	47.92%	52.08%
13	14	1557	1546	50.17%	49.83%
14	15	1879	1619	53.71%	46.29%
15	16	1867	2163	46.32%	53.68%
16	17	1891	2030	48.22%	51.78%
17	18	1941	1781	52.14%	47.86%
18	19	1687	1628	50.90%	49.10%
19	20	1599	1322	54.75%	45.25%
20	21	1585	903	63.72%	36.28%
21	22	1524	1368	52.70%	47.30%
22	23	1185	1124	51.32%	48.68%
23	0	663	786	45.76%	54.24%
0	1	673	785	46.16%	53.84%
1	2	513	640	0.00%	0.00%
2	3	737	361	0.00%	0.00%
3	4	480	294	62.02%	37.98%
4	5	725	401	64.40%	35.60%
5	6	699	728	48.98%	51.02%
6	7	933	859	52.06%	47.94%
7	8	1444	1590	47.59%	52.41%
Total		31817	30408	51.13%	48.87%

The overall directional distribution is found 51:49 based on the traffic count at Ch 186.000 Km.

For Homogeneous Section – IV

Table- 7.14 (e): Directional Distribution at lankeswar (Ch. 214.000 Km)

Time Interval (Hour)		Lankeswar (Ch. 214.000 Km)			
		Traffic (PCU)		Directional Distribution (%)	
From	To	Up	Down	Up	Down
8	9	4537	4589	49.72%	50.28%
9	10	5382	4766	53.04%	46.96%
10	11	4401	4751	48.09%	51.91%
11	12	4876	5047	49.14%	50.86%
12	13	4610	4906	48.44%	51.56%
13	14	4645	5329	46.57%	53.43%
14	15	5301	4961	51.66%	48.34%
15	16	5789	5780	50.04%	49.96%
16	17	5339	5021	51.54%	48.46%
17	18	5576	5287	51.33%	48.67%
18	19	5287	5643	48.37%	51.63%
19	20	5044	4849	50.99%	49.01%
20	21	4030	3762	51.72%	48.28%
21	22	3650	3120	53.91%	46.09%
22	23	3320	2723	54.94%	45.06%
23	0	1361	1763	43.56%	56.44%
0	1	841	1604	34.40%	65.60%
1	2	675	1043	0.00%	0.00%
2	3	612	612	0.00%	0.00%
3	4	710	600	54.20%	45.80%
4	5	941	763	55.21%	44.79%
5	6	2446	1835	57.13%	42.87%
6	7	2238	2862	43.88%	56.12%
7	8	3339	4317	43.61%	56.39%
Total		84944	85927	49.71%	50.29%

The overall directional distribution is found 50:50 based on the traffic count at Ch 214.000 Km.

7.4.3 TRAFFIC COMPOSITION

While detailed traffic counts are presented in **Appendix-7.2**, for ready reference and easier appreciation, the composition of traffic at various count locations has been shown in **Figure 7.13 to Fig 7.17**

For Homogeneous Section – I

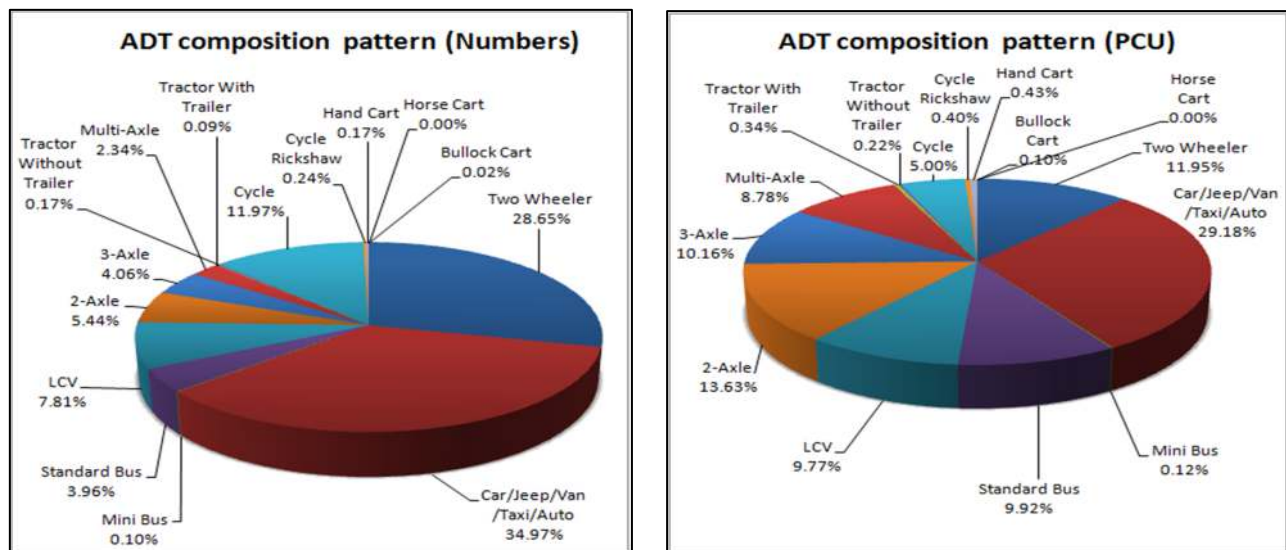


Figure -7.13: Traffic Composition (At Ch. 31.000 km)

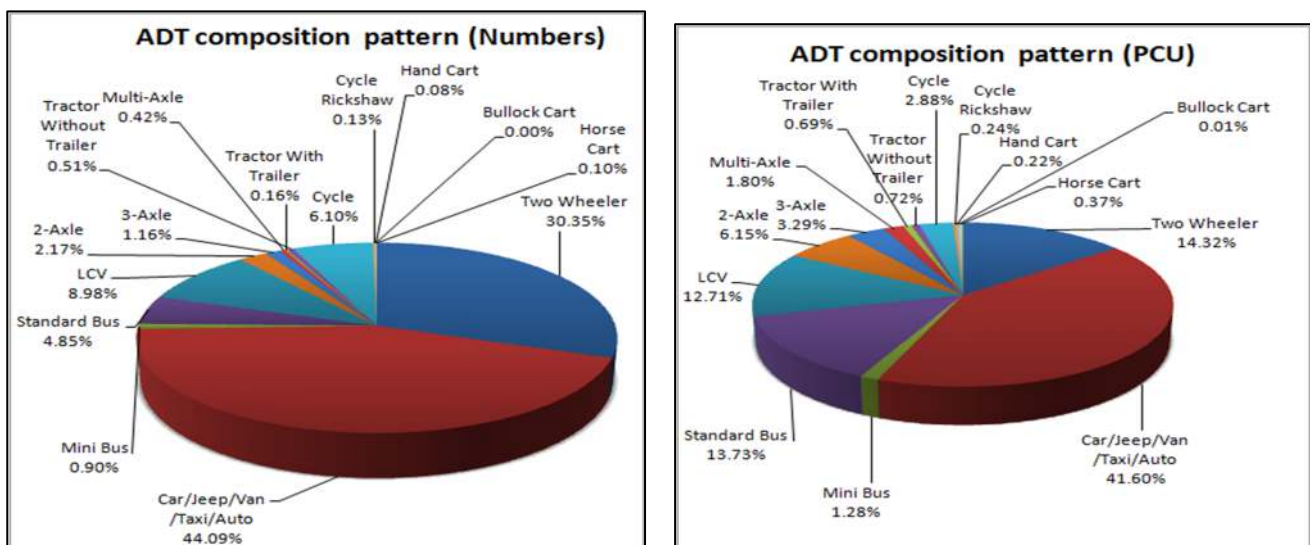


Figure -7.14: Traffic Composition (At Ch. 91.000 km)

For Homogeneous Section – II

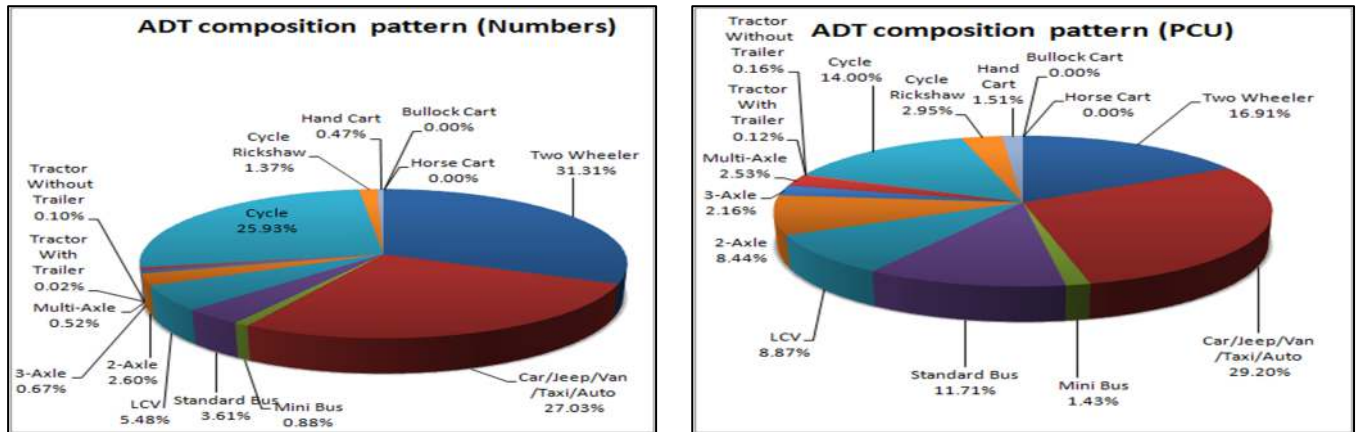


Figure -7.15: Traffic Composition (At Ch. 141.000 km)

For Homogeneous Section – III

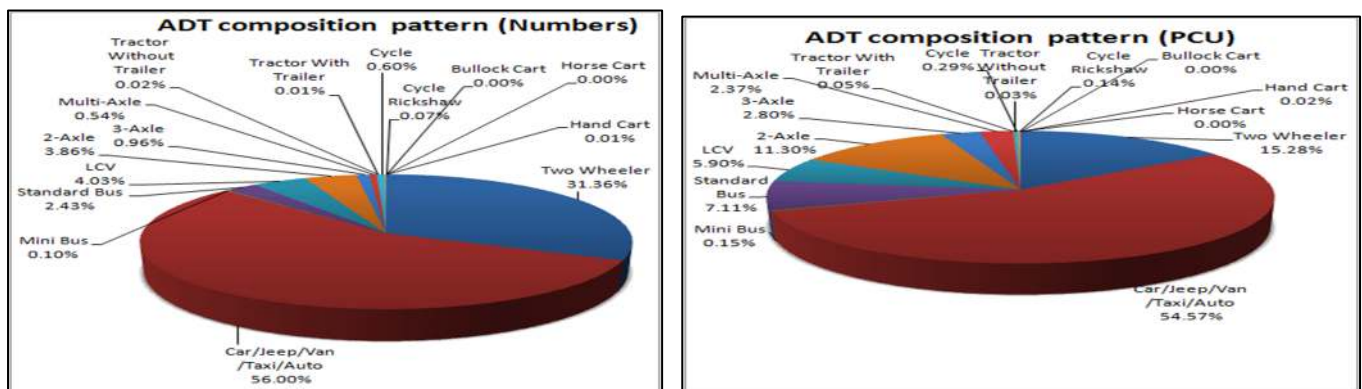


Figure -7.16: Traffic Composition (At Ch. 186.000 km)

For Homogeneous Section – IV

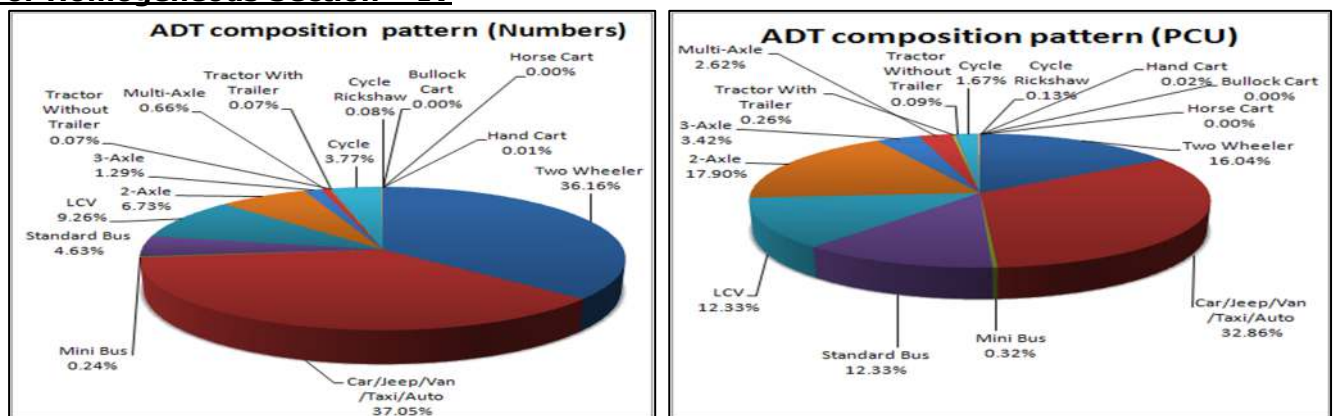


Figure -7.17: Traffic Composition (At Ch. 214.000 km)

The traffic composition shown in the above figures has been summarized in **Tables 7.15 (a)** to **Table 7.15 (e)**

For Homogeneous Section – I

Table- 7.15 (a): Summary of Traffic Composition near Bahalpur (Ch. 31.000 km)

Type of Vehicle	% of Total	ADT
Two Wheeler	28.65	2054
Car/Jeep/Van/Taxi/Auto	34.97	2507
Mini Bus	0.10	7
Standard Bus	3.96	284
LCV	7.81	560
2-Axle	5.44	390
3-Axle	4.06	291
Multi-Axle	2.34	168
Tractor With Trailer	0.09	7
Tractor Without Trailer	0.17	12
Cycle	11.97	859
Cycle Rickshaw	0.24	17
Hand Cart	0.17	12
Bullock Cart	0.02	1
Horse Cart	0.00	0
Total in Number	100.00	7170

Table- 7.15(b): Summary of Traffic Composition near Fofanga (Ch. 91.000 Km)

Type of Vehicle	% of Total	ADT
Two Wheeler	30.35	2406
Car/Jeep/Van/Taxi/Auto	44.09	3496
Mini Bus	0.90	72
Standard Bus	4.85	385
LCV	8.98	712
2-Axle	2.17	172
3-Axle	1.16	92
Multi-Axle	0.42	34
Tractor With Trailer	0.16	13
Tractor Without Trailer	0.51	40
Cycle	6.10	483
Cycle Rickshaw	0.13	10
Hand Cart	0.08	6
Bullock Cart	0.00	0
Horse Cart	0.10	8
Total in Number	100.00	7929

For Homogeneous Section – II

Table- 7.15(c): Summary of Traffic Composition near Dhupdhara (Ch. 141.000 Km)

Type of Vehicle	% of Total	ADT
Two Wheeler	31.31	2964
Car/Jeep/Van/Taxi/Auto	27.03	2559
Mini Bus	0.88	84
Standard Bus	3.61	342
LCV	5.48	518
2-Axle	2.60	247
3-Axle	0.67	63
Multi-Axle	0.52	49
Tractor With Trailer	0.02	2
Tractor Without Trailer	0.10	10
Cycle	25.93	2455
Cycle Rickshaw	1.37	129
Hand Cart	0.47	44
Bullock Cart	0.00	0
Horse Cart	0.00	0
Total in Number	100.00	9466

For Homogeneous Section – III

Table- 7.15(d): Summary of Traffic Composition near Kukurmara (Ch. 186.000 Km)

Type of Vehicle	% of Total	ADT
Two Wheeler	36.16	4080
Car/Jeep/Van/Taxi/Auto	37.05	4181
Mini Bus	0.24	27
Standard Bus	4.63	523
LCV	9.26	1045
2-Axle	6.73	759
3-Axle	1.29	145
Multi-Axle	0.66	74
Tractor With Trailer	0.07	7
Tractor Without Trailer	0.07	8
Cycle	3.77	426
Cycle Rickshaw	0.08	9
Hand Cart	0.01	1
Bullock Cart	0.00	0
Horse Cart	0.00	0
Total in Number	100.00	11284

For Homogeneous Section – IV

Table- 7.15(e): Summary of Traffic Composition at Lankeswar (Ch. 214.000 Km)

Type of Vehicle	% of Total	ADT
Two Wheeler	31.36	10688
Car/Jeep/Van/Taxi/Auto	56.00	19085
Mini Bus	0.10	35
Standard Bus	2.43	829
LCV	4.03	1375
2-Axle	3.86	1317
3-Axle	0.96	326
Multi-Axle	0.54	185
Tractor With Trailer	0.01	4
Tractor Without Trailer	0.02	7
Cycle	0.60	203
Cycle Rickshaw	0.07	24
Hand Cart	0.01	2
Bullock Cart	0.00	0
Horse Cart	0.00	0
Total in Number	100.00	34079

From the traffic composition table, it is found that

For Homogeneous Section – I

- Total motorized traffic varies from 88%to 93% of the total traffic.
- Total Non- motorized traffic varies from 7% to 12% of the total traffic.
- Car and 2-wheeler traffic varies from 64% to 75%of the total traffic.
- Commercial traffic varies from 18% to 24%of the total traffic.

For Homogeneous Section – II

- Total motorized traffic is 72% of the total traffic.
- Total Non- motorized traffic is 28 % of the total traffic.
- Car and 2-wheeler traffic is 59 % of the total traffic.
- Commercial traffic is 13% of the total traffic.

For Homogeneous Section – III

- Total motorized traffic is 96% of the total traffic.
- Total Non- motorized traffic is 4 % of the total traffic.
- Car and 2-wheeler traffic is 74 % of the total traffic.
- Commercial traffic is 22 % of the total traffic.

For Homogeneous Section – IV

- Total motorized traffic is 99 % of the total traffic.
- Total Non- motorized traffic is 1 % of the total traffic.
- Car and 2-wheeler traffic is 88 % of the total traffic.
- Commercial traffic is 11 % of the total traffic.

7.4.4 SEASONAL CORRECTION

The traffic plying on any road generally varies over different periods of year depending on the cycle of different socio-economic activities in the regions through which it passes. Therefore, in order to have more realistic picture of the traffic on the project road, it is required to assess seasonal variation in traffic to estimate Annual Average Daily Traffic (AADT) and Peak Season ADT. Therefore, the ADT observed during the survey duration is multiplied by a Seasonal Correction Factor (SCF) to derive AADT and Peak season ADT. The seasonal correction factor is generally derived from secondary data sources such as past month-wise traffic data on the project road, sales of fuel at different filling stations along the project highway etc.

In the absence of any other data, either of the project road or in the vicinity, only the monthly figures of fuel sales collected from one petrol bunk on the project road is considered in the estimation of seasonal variation and seasonal correction factors.

➤ Seasonal Correction Factor

For the present study, firstly the petrol and diesel sale figures collected from, Gaurang Service Station Near Bilasipara , Chapar Service Station Near Chapar, NRL Energy Station Near Hadlapara, Pancharatna Fuel Imm Kalysanpur Near N. Salmara, Basumatry Oil Service Near Pancharatna Salmara, Kamakha Oil Service Near Ulubari Agia, Tukreswari Service Station Near Tukura Pt-II, Parbati Oil Service Near Tukupea Arhan Fuel Station Near Dudhnoi, Dudhnoi Oil service Near Dudhnoi, Veeky Enterprises Pvt. Ltd Near Dudhnoi Fuel Centre on the project road for the years 2016-2018 have been analyzed for estimation of Average Seasonal Correction Factor (ASCF) and Peak Seasonal Correction Factor (PSCF). As the traffic surveys were conducted in the month of August, the above factors for the month of August is considered. The fuel sales figures at the filling station in the region and summary of seasonal correction factor are presented season wise in **Table 7.16 & 7.17** respectively.

Table 7.16: Summary of Petrol and Diesel sales data

Year	Month	Petrol Sales Data (in Litre)											
		Gaurang Service Station, Bilasipara	Chapar Service Station, Chapar	NRL Energy Station, Hadlpara	Pancharatna Fuel Imm,Kalysan pur, Near N. Salmara	Basumatry Oil Service,Pan charatna Salmara	Kamakha Oil Service,UI ubari Agia	Tukreswari Service Station, Tukura Pt-II	Parbati Oil Service,Tuk upea	Arhan Fuel Station, Dudhnoi	Dudhnoi Oil service,D udhnoi	Veeky Enterpris es Pvt. Ltd, Dudhnoi	Avg. Sales Per Station (Lt.)
2016	Jan	48246	39968	60318	28215	17390	50213	51518	70586	71926	69147	65329	52,134
2016	Feb	50761	40168	53827	25819	19560	42918	53816	68929	70532	75488	63469	51,390
2016	Mar	55213	35265	61123	30589	14395	49719	48498	65432	68565	73445	60892	51,194
2016	Apr	51298	35568	50119	22004	20886	53696	45778	75715	70429	70445	59429	50,488
2016	May	35627	40965	57479	27431	18955	57563	50116	70669	68989	64429	61462	50,335
2016	Jun	44169	35624	45982	19493	21393	60512	45521	60127	75785	60994	57427	47,912
2016	Jul	39546	39021	50429	21169	17564	52817	39516	55224	70989	67432	55829	46,321
2016	Aug	35181	32011	45999	18903	13989	50892	41156	60653	68275	71469	57008	45,049
2016	Sep	42915	40115	54119	15998	19115	57610	43565	68650	59669	68334	59882	48,179
2016	Oct	47125	41516	45983	24439	14795	60518	48988	60995	65223	64986	48007	47,507
2016	Nov	53976	37915	53469	29446	17335	58719	38980	68538	59249	70423	52406	49,132
2016	Dec	57987	37994	60921	31290	16595	61982	39445	70159	65424	68423	59298	51,774
2017	Jan	50150	42201	51213	20215	21667	49560	55008	78895	80115	80439	70009	54,497
2017	Feb	49496	45001	55870	18360	20988	50998	57108	75862	78523	78460	68329	54,454
2017	Mar	61429	39186	60976	16511	19767	55915	48511	70192	75619	75828	65829	53,615
2017	Apr	58237	40981	49931	19298	22933	60862	55809	68394	77463	70782	64239	53,539
2017	May	48923	37950	40991	15113	18778	50989	51883	59602	79445	65246	60339	48,114
2017	Jun	42447	35915	45144	14109	19975	53219	49829	56989	65163	60879	62429	46,009
2017	Jul	35170	32901	53889	16317	17634	50112	40329	55445	60199	64328	57868	44,017
2017	Aug	39775	35963	49003	19111	19899	49915	47501	60609	63615	60893	59298	45,962
2017	Sep	32007	40981	56424	21699	22131	40159	39887	58560	57623	65682	61008	45,106
2017	Oct	37568	59873	51536	18552	17665	60115	42149	63429	68535	68642	59429	49,772
2017	Nov	36429	56828	60119	13501	20112	53151	40159	70119	70123	70829	60134	50,137
2017	Dec	39201	61245	54710	17986	19588	59111	37009	69005	72715	73462	65429	51,769
2018	Jan	49387	51507	60318	81719	22531	59113	59119	78560	85186	85236	75023	64,336
2018	Feb	41501	50909	53827	21566	20557	62565	57436	75630	84861	82783	73446	56,826
2018	Mar	40031	53802	61123	20956	23598	58863	55888	68455	80681	80114	70321	55,803

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana (Lot-1) Package 1A **Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam**

**Final Detailed Project Report
Traffic Studies And Demand Forecasts Design**

Year	Month	Petrol Sales Data (in Litre)											
		Gaurang Service Station, Bilasipara	Chapar Service Station, Chapar	NRL Energy Station, Hadlpara	Pancharatna Fuel Imm, Kalysanpur, Near N. Salmara	Basumatry Oil Service, Pancharatna Salmara	Kamakha Oil Service, Ulubari Agia	Tukreswari Service Station, Tukura Pt-II	Parbati Oil Service, Tukupea	Arhan Fuel Station, Dudhnoi	Dudhnoi Oil service, Dudhnoi	Veeky Enterprises Pvt. Ltd, Dudhnoi	Avg. Sales Per Station (Lt.)
2018	Apr	38543	48765	0	22483	26250	0	0	0	0	0	0	34,010
2018	May	41295	50294	0	19586	22349	0	0	0	0	0	0	33,381
2018	Jun	37264	44680	0	21384	25830	0	0	0	0	0	0	32,290

Year	Month	Diesel Sales Data (in Litre)											
		Gaurang Service Station, Bilasipara	Chapar Service Station, Chapar	NRL Energy Station, Hadlpara	Pancharatna Fuel Imm, Kalysanpur, Near N. Salmara	Basumatry Oil Service, Pancharatna Salmara	Kamakha Oil Service, Ulubari Agia	Tukreswari Service Station, Tukura Pt-II	Parbati Oil Service, Tukupea	Arhan Fuel Station, Dudhnoi	Dudhnoi Oil service, Dudhnoi	Veeky Enterprises Pvt. Ltd, Dudhnoi	Avg. Sales Per Station (Lt.)
2016	Jan	133200	135125	129874	119560	112503	155362	140 105	173918	120985	130215	139086	134,983
2016	Feb	146497	149875	120926	108203	100785	147605	135 918	170913	113835	128519	141839	132,900
2016	Mar	149528	162401	135003	90915	115230	150279	138811	160519	118985	125846	137169	134,971
2016	Apr	160952	131913	125708	100508	109890	153443	130715	169786	125876	120753	141439	133,726
2016	May	147295	129171	121449	115918	119112	151357	125898	160992	122435	129181	135663	132,588
2016	Jun	155354	145169	120051	130811	105915	140782	128001	169575	119944	122180	130796	133,507
2016	Jul	142691	128006	118879	112655	110219	147004	130181	155185	113875	138649	125832	129,380
2016	Aug	137927	117607	110503	128515	101016	139890	125876	159829	120788	135208	132529	128,153
2016	Sep	142685	121308	115519	110901	100715	140965	128116	165989	123629	124498	125276	127,236
2016	Oct	153693	140107	107788	100859	113004	139001	132009	170892	118236	120829	120899	128,847
2016	Nov	157177	134988	119005	121564	122753	148520	119151	168981	126553	128384	130758	134,349
2016	Dec	160700	141908	125509	135462	116301	151481	115661	170993	130775	135149	135239	138,107
2017	Jan	147513	156515	159113	141530	117005	150119	145121	180815	135785	149008	145007	147,957

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana (Lot-1) Package 1A **Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam**

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Year	Month	Diesel Sales Data (in Litre)											Avg. Sales Per Station (Lt.)
		Gaurang Service Station, Bilasipara	Chapar Service Station, Chapar	NRL Energy Station, Hadlpara	Pancharatna Fuel Imm, Kalysanpur, Near N. Salmara	Basumatry Oil Service, Pancharatna Salmara	Kamakha Oil Service, Ulubari Agia	Tukreswari Service Station, Tukura Pt-II	Parbati Oil Service, Tukupea	Arhan Fuel Station, Dudhnoi	Dudhnoi Oil service, Dudhnoi	Veeky Enterprises Pvt. Ltd, Dudhnoi	
2017	Feb	137319	140319	155416	152315	113701	153459	138101	175129	140384	148079	143209	145,221
2017	Mar	150116	145292	150119	147003	119552	148929	140261	170239	130485	130409	140270	142,970
2017	Apr	142954	151296	151448	149876	105801	155114	135986	167982	125786	138789	135826	141,896
2017	May	158537	141761	160198	135296	113090	150166	140942	170495	120998	140448	140112	142,913
2017	Jun	136523	160156	178821	149820	102077	148999	135119	160889	125665	130483	143463	142,910
2017	Jul	128752	155298	149762	135493	109333	135723	139445	169392	119369	139784	145329	138,880
2017	Aug	130819	153762	145321	140669	100889	137469	125792	159829	123449	144363	140429	136,617
2017	Sep	149751	157295	160116	146112	119502	140518	128891	168239	130889	140145	143823	144,116
2017	Oct	159007	160132	140106	130991	101123	130492	120111	173429	125352	138669	135269	137,698
2017	Nov	139900	165942	129723	142004	109159	133629	128559	160463	119983	139459	130429	136,295
2017	Dec	141876	163829	135445	150936	111344	135165	135469	168449	123449	145698	140820	141,135
2018	Jan	169451	130560	131891	151360	129513	130120	120652	160299	140061	140898	149239	141,277
2018	Feb	150312	125890	128119	146549	120918	125161	129445	155469	151560	138765	145626	137,983
2018	Mar	155430	135165	138978	150443	125998	121560	126433	165334	143261	136869	141689	140,105
2018	Apr	151233	132598	0	146813	128359	0	0	0	0	0	0	139,751
2018	May	147382	138316	0	143264	130582	0	0	0	0	0	0	139,886
2018	Jun	139953	140935	0	145394	127726	0	0	0	0	0	0	138,502

[Signature]



Table- 7.17: Summary of Seasonal Variation Factor (Petrol and Diesel)

Month	Avg. Sales (Lt.)		Avg Seasonal Correction Factor		Peak Seasonal Correction Factor	
	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel
Jan	56,989	141,406	0.85	0.97	1.00	1.00
Feb	54,223	138,701	0.90	0.99	1.05	1.02
Mar	53,537	139,349	0.91	0.98	1.06	1.01
Apr	46,012	138,458	1.06	0.99	1.24	1.02
May	43,943	138,462	1.11	0.99	1.30	1.02
Jun	42,070	138,307	1.16	0.99	1.35	1.02
Jul	45,169	134,130	1.08	1.02	1.26	1.05
Aug	45,505	132,385	1.07	1.04	1.25	1.07
Sep	46,642	135,676	1.04	1.01	1.22	1.04
Oct	48,639	133,273	1.00	1.03	1.17	1.06
Nov	49,635	135,322	0.98	1.01	1.15	1.04
Dec	51,772	139,621	0.94	0.98	1.10	1.01
Avg. Sale per Month	48,678	137,091				

Average Seasonal Correction Factor for Petrol operated vehicles =	1.07
Average Seasonal Correction Factor for Diesel operated vehicles =	1.04
Peak Seasonal Correction Factor for Petrol operated vehicles =	1.25
Peak Seasonal Correction Factor for Diesel operated vehicle =	1.07

The Average Seasonal Correction Factor (ASCF) has been applied on the ADT observed at the count location to derive AADT which will be used for pavement design and Economic Analysis. On the other hand Peak Seasonal Correction Factor (PSCF) has been applied on the ADT to derive Peak Season ADT which will be used for the Capacity Assessment.

7.4.5 ANNUAL AVERAGE DAILY TRAFFIC (AADT)

The Average seasonal correction factors for petrol and diesel driven vehicles, described in the previous sections have been applied to ADT to derive AADT. AADT is used for traffic projection, pavement design and economic analysis. The AADT values are presented in **Table 7.18(a)** to **Table 7.18(e)**.

For Homogeneous Section – I

Table -7.18(a): Estimates of AADT as observed on Bahalpur (Ch. 31.000 Km)

Vehicle Type	Bahalpur (Ch. 31.000 km)	
	In Number	In PCU
Two Wheeler	2198	1099
Car/Jeep/Van/Taxi/Auto	2639	2639
Mini Bus	7	11
Standard Bus	294	882
LCV	580	870
2-Axle Truck	404	1212
3-Axle Truck	301	904
Multi-Axle	174	781
Tractor With Trailer	7	31
Tractor Without Trailer	13	19
Cycle	859	429
Cycle Rickshaw	17	34
Hand Cart	12	37
Bullock Cart	1	9
Horse Cart	0	0
Total Motorized Vehicles (Number)	6617	-
Total Non Motorized Vehicles (Number)	889	-
Total Vehicles (Number)per day	7506	
Total Motorized Vehicles (PCU)	-	8448
Total Non Motorized Vehicles (PCU)	-	509
Total PCU per day		8957
Total Commercial Vehicle per day	1767	-

Table -7.18(b): Estimates of AADT as observed on Fofanga (Ch. 91.000 Km)

Vehicle Type	Fofanga (Ch. 91.000 Km)	
	In Number	In PCU
Two Wheeler	2574	1287
Car/Jeep/Van/Taxi/Auto	3756	3756
Mini Bus	75	113
Standard Bus	414	1242
LCV	749	1122
2-Axle Truck	190	570
3-Axle Truck	100	300
Multi-Axle	35	158
Tractor With Trailer	13	59
Tractor Without Trailer	42	63
Cycle	483	242
Cycle Rickshaw	10	20
Hand Cart	6	18
Bullock Cart	0	0
Horse Cart	8	32
Total Motorized Vehicles (Number)	7948	-
Total Non Motorized Vehicles (Number)	507	-
Total Vehicles (Number)per day	8455	-
Total Motorized Vehicles (PCU)	-	8670
Total Non Motorized Vehicles (PCU)	-	312
Total PCU per day	-	8982
Total Commercial Vehicle per day	1575	-

For Homogeneous Section – II

Table -7.18(c): Estimates of AADT as observed on Dhupdhara (Ch. 141.000 Km)

Vehicle Type	Dhupdhara (Ch. 141.000 Km)	
	In Number	In PCU
Two Wheeler	3170	1585
Car/Jeep/Van/Taxi/Auto	2770	2770
Mini Bus	89	134
Standard Bus	370	1110
LCV	547	821
2-Axle Truck	267	801
3-Axle Truck	70	210
Multi-Axle	51	230
Tractor With Trailer	2	9
Tractor Without Trailer	10	15
Cycle	2455	1228
Cycle Rickshaw	129	258
Hand Cart	44	132
Bullock Cart	0	0
Horse Cart	0	0
Total Motorized Vehicles (Number)	7346	-
Total Non Motorized Vehicles (Number)	2628	-
Total Vehicles (Number)per day	9974	-
Total Motorized Vehicles (PCU)	-	7685
Total Non Motorized Vehicles (PCU)	-	1618
Total PCU per day	-	9303
Total Commercial Vehicle per day	1395	-

For Homogeneous Section – III

Table -7.18(d): Estimates of AADT as observed on Kukurmara (Ch. 186.000 Km)

Vehicle Type	Near Kukurmara (Ch. 186.000 Km)	
	In Number	In PCU
Two Wheeler	4364	2182
Car/Jeep/Van/Taxi/Auto	4477	4477
Mini Bus	29	45
Standard Bus	558	1674
LCV	1091	1635
2-Axle Truck	798	2394
3-Axle Truck	155	465
Multi-Axle	77	347
Tractor With Trailer	8	36
Tractor Without Trailer	8	12
Cycle	426	213
Cycle Rickshaw	9	18
Hand Cart	1	3
Bullock Cart	0	0
Horse Cart	0	0
Total Motorized Vehicles (Number)	11565	-
Total Non Motorized Vehicles (Number)	436	-
Total Vehicles (Number)per day	12001	-
Total Motorized Vehicles (PCU)	-	13263
Total Non Motorized Vehicles (PCU)	-	234
Total PCU per day	-	13497
Total Commercial Vehicle per day	2717	-

For Homogeneous Section – IV

Table -7.18(e): Estimates of AADT as observed on Lankeswar (Ch. 214.000 Km)

Vehicle Type	Lankeswar (Ch. 214.000 Km)	
	In Number	In PCU
Two Wheeler	11433	5717
Car/Jeep/Van/Taxi/Auto	20166	20166
Mini Bus	37	56
Standard Bus	874	2622
LCV	1434	2151
2-Axle Truck	1376	4128
3-Axle Truck	342	1026
Multi-Axle	191	860
Tractor With Trailer	4	18
Tractor Without Trailer	8	12
Cycle	203	102
Cycle Rickshaw	24	48
Hand Cart	2	6
Bullock Cart	0	0
Horse Cart	0	0
Total Motorized Vehicles (Number)	35865	-
Total Non Motorized Vehicles (Number)	229	-
Total Vehicles (Number)per day	36094	-
Total Motorized Vehicles (PCU)	-	36755
Total Non Motorized Vehicles (PCU)	-	156
Total PCU per day	-	36910
Total Commercial Vehicle per day	4258	-

7.4.6 PEAK SEASON AADT

The Peak Seasonal factor for petrol and diesel driven vehicle, describe in previous section have been applied to ADT to derive Peak Season AADT. The Peak Season AADT is used for the capacity assessment. The Peak Season AADT, thus derived is given in **Table 7.19(a)** to **Table 7.19(e)**.

For Homogeneous Section – I

Table- 7.19(a): Estimates of Peak Season AADT as observed on Bahalpur (Ch. 31.000 Km)

Vehicle Type	Bahalpur (Ch. 31.000 km)	
	In Number	In PCU
Two Wheeler	2573	1286
Car/Jeep/Van/Taxi/Auto	3140	2834
Mini Bus	8	11
Standard Bus	303	910
LCV	598	897
2-Axle Truck	417	1251
3-Axle Truck	311	932
Multi-Axle	179	805
Tractor With Trailer	7	32
Tractor Without Trailer	13	20
Cycle	859	429
Cycle Rickshaw	17	34
Hand Cart	12	37
Bullock Cart	1	9
Horse Cart	0	0
Total Motorized Vehicles (Number)	7549	-
Total Non Motorized Vehicles (Number)	889	-
Total Vehicles (Number)per day	8438	-
Total Motorized Vehicles (PCU)	-	8979
Total Non Motorized Vehicles (PCU)	-	509
Total PCU per day	-	9488
Total Commercial Vehicle per day	1823	-

Table- 7.19(b): Estimates of Peak Season AADT as observed on Fofanga (Ch. 91.000 Km)

Vehicle Type	Fofanga (Ch. 91.000 Km)	
	In Number	In PCU
Two Wheeler	3013	1507
Car/Jeep/Van/Taxi/Auto	4378	3951
Mini Bus	76	115
Standard Bus	411	1233
LCV	761	1141
2-Axle Truck	184	552
3-Axle Truck	98	295
Multi-Axle	36	161
Tractor With Trailer	14	62
Tractor Without Trailer	43	65
Cycle	483	242
Cycle Rickshaw	10	20
Hand Cart	6	19
Bullock Cart	0	1
Horse Cart	8	31
Total Motorized Vehicles (Number)	9014	-
Total Non Motorized Vehicles (Number)	508	-
Total Vehicles (Number)per day	9522	
Total Motorized Vehicles (PCU)	-	9081
Total Non Motorized Vehicles (PCU)	-	312
Total PCU per day	-	9394
Total Commercial Vehicle per day	1580	-

For Homogeneous Section – II

Table- 7.19(c): Estimates of Peak Season AADT as observed on Dhupdhara (Ch. 141.000 Km)

Vehicle Type	Dhupdhara (Ch. 141.000 Km)	
	In Number	In PCU
Two Wheeler	3711	1856
Car/Jeep/Van/Taxi/Auto	3205	2892
Mini Bus	89	134
Standard Bus	365	1096
LCV	554	831
2-Axle Truck	263	790
3-Axle Truck	67	202
Multi-Axle	53	237
Tractor With Trailer	2	11
Tractor Without Trailer	10	15
Cycle	2455	1227
Cycle Rickshaw	129	259
Hand Cart	44	132
Bullock Cart	0	0
Horse Cart	0	0
Total Motorized Vehicles (Number)	8321	-
Total Non Motorized Vehicles (Number)	2628	-
Total Vehicles (Number)per day	10949	-
Total Motorized Vehicles (PCU)	-	8065
Total Non Motorized Vehicles (PCU)	-	1619
Total PCU per day		9683
Total Commercial Vehicle per day	1394	-

For Homogeneous Section – III

Table- 7.19(d): Estimates of Peak Season AADT as observed on Kukurmara (Ch. 186.000 Km)

Vehicle Type	Near Kukurmara (Ch. 186.000 Km)	
	In Number	In PCU
Two Wheeler	5109	2555
Car/Jeep/Van/Taxi/Auto	5236	4726
Mini Bus	29	43
Standard Bus	558	1675
LCV	1117	1675
2-Axle Truck	811	2433
3-Axle Truck	155	465
Multi-Axle	79	356
Tractor With Trailer	8	36
Tractor Without Trailer	9	13
Cycle	426	213
Cycle Rickshaw	9	17
Hand Cart	1	3
Bullock Cart	0	0
Horse Cart	0	0
Total Motorized Vehicles (Number)	13110	-
Total Non Motorized Vehicles (Number)	435	-
Total Vehicles (Number)per day	13545	
Total Motorized Vehicles (PCU)	-	13975
Total Non Motorized Vehicles (PCU)	-	233
Total PCU per day	-	14208
Total Commercial Vehicle per day	2756	-

For Homogeneous Section – IV

Table- 7.19(e): Estimates of Peak Season AADT as observed on Lankeswar (Ch. 214.000 Km)

Vehicle Type	Lankeswar (Ch. 214.000 Km)	
	In Number	In PCU
Two Wheeler	13385	6693
Car/Jeep/Van/Taxi/Auto	23901	21573
Mini Bus	37	56
Standard Bus	885	2656
LCV	1468	2203
2-Axle Truck	1407	4220
3-Axle Truck	348	1044
Multi-Axle	197	887
Tractor With Trailer	4	18
Tractor Without Trailer	8	12
Cycle	203	102
Cycle Rickshaw	24	48
Hand Cart	2	7
Bullock Cart	0	0
Horse Cart	0	0
Total Motorized Vehicles (Number)	41641	-
Total Non Motorized Vehicles (Number)	229	-
Total Vehicles (Number)per day	41871	
Total Motorized Vehicles (PCU)	-	39361
Total Non Motorized Vehicles (PCU)	-	156
Total PCU per day	-	39517
Total Commercial Vehicle per day	4347	-

7.4.7 TRAFFIC PROJECTION

Traffic Projection of Project Road for Homogeneous section-I (from Km 0.000 to Km 99.450)

From traffic projection Table 7.20(a) and Table 7.20(b), it is found that present traffic in the project road is 8982 PCU and considering 5.0% traffic growth rate and 20 years design life, the projected traffic calculated in the year 2041 is 27589 PCU which is less than 40000 PCU. Therefore, implementation of 4 lane with paved shoulder is adequate to maintain the required level of service B (LOS B)

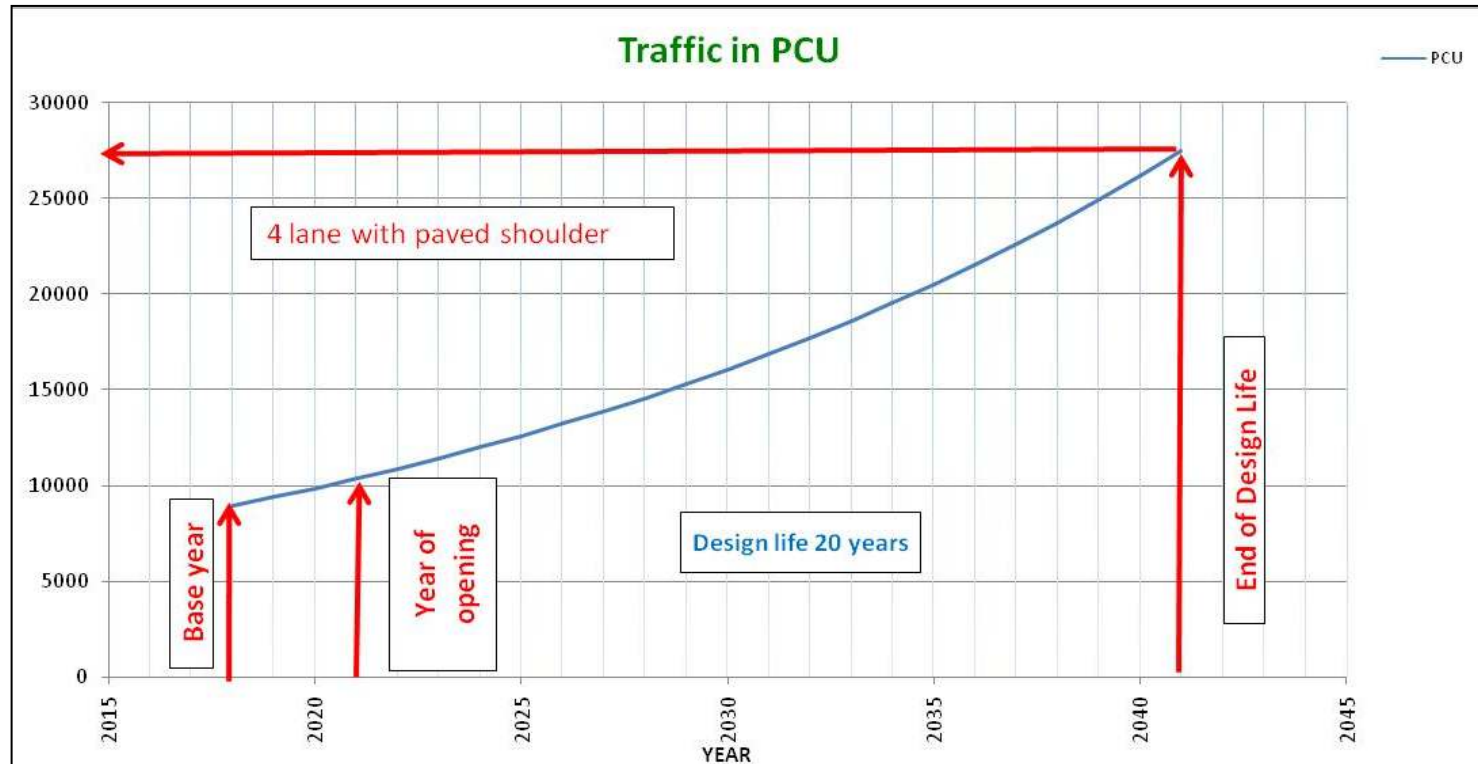


Fig 7.18(a): Traffic Projection in Number & PCU near Bahalpur (Ch. 31.000 km)

Table- 7.20 (a): Traffic Projection in Number & PCU near Bahalpur(near Ch. 31.000 km)

Year	Growth rate	Two Wheeler	Car/Jeep/ Van/Taxi/ Auto	Mini / RTVs Bus	Stand. Bus	LCV	2- Axle	3 - Axle	Multi- Axle	Agri. Tract. With Trailor	Agri. Tract. Without Trailor	Cycle	Cycle Rickshaw	Hand Cart	Bullock Cart	Horse Cart	Total in no	Total in PCU
2019	5.0%	2198	2639	7	294	580	404	301	174	7	13	859	17	12	1	0	7506	8957
2020	5.0%	2307	2771	8	309	609	424	316	182	7	14	902	18	13	2	0	7881	9405
2021	5.0%	2423	2910	8	324	639	446	332	191	8	14	947	19	14	2	0	8276	9875
2022	5.0%	2544	3055	9	340	671	468	349	201	8	15	994	20	14	2	0	8689	10369
2023	5.0%	2671	3208	9	357	705	491	366	211	8	16	1044	21	15	2	0	9124	10888
2024	5.0%	2805	3369	9	375	740	516	384	221	9	16	1096	22	16	2	0	9580	11432
2025	5.0%	2945	3537	10	394	777	542	404	233	9	17	1151	23	17	2	0	10059	12003
2026	5.0%	3092	3714	10	414	816	569	424	244	10	18	1208	24	17	2	0	10562	12604
2027	5.0%	3247	3900	11	435	857	597	445	256	10	19	1269	25	18	2	0	11090	13234
2028	5.0%	3409	4095	11	456	899	627	467	269	11	20	1332	26	19	2	0	11645	13896
2029	5.0%	3580	4299	12	479	944	658	491	283	11	21	1399	28	20	2	0	12227	14590
2030	5.0%	3759	4514	13	503	992	691	515	297	12	22	1468	29	21	2	0	12838	15320
2031	5.0%	3946	4740	13	528	1041	726	541	312	12	23	1542	31	22	3	0	13480	16086
2032	5.0%	4144	4977	14	555	1093	762	568	327	13	24	1619	32	23	3	0	14154	16890
2033	5.0%	4351	5226	15	582	1148	800	596	344	13	25	1700	34	25	3	0	14862	17735
2034	5.0%	4568	5487	15	611	1205	840	626	361	14	27	1785	35	26	3	0	15605	18621
2035	5.0%	4797	5761	16	642	1266	882	657	379	15	28	1874	37	27	3	0	16385	19552
2036	5.0%	5037	6050	17	674	1329	926	690	398	16	29	1968	39	28	3	0	17204	20530
2037	5.0%	5289	6352	18	708	1395	973	725	418	16	31	2066	41	30	3	0	18064	21557
2038	5.0%	5553	6670	19	743	1465	102	761	438	17	33	2170	43	31	4	0	18968	22634
2039	5.0%	5831	7003	20	780	1538	107	799	460	18	34	2278	45	33	4	0	19916	23766
2040	5.0%	6122	7353	21	819	1615	112	839	483	19	36	2392	47	35	4	0	20912	24954
2041	5.0%	6428	7721	22	860	1696	118	881	508	20	38	2512	50	36	4	0	21957	26202
2042	5.0%	6750	8107	23	903	1781	124	925	533	21	40	2637	52	38	4	0	23055	27512
2043	5.0%	7087	8512	24	948	1870	130	971	560	22	42	2769	55	40	5	0	24208	28888

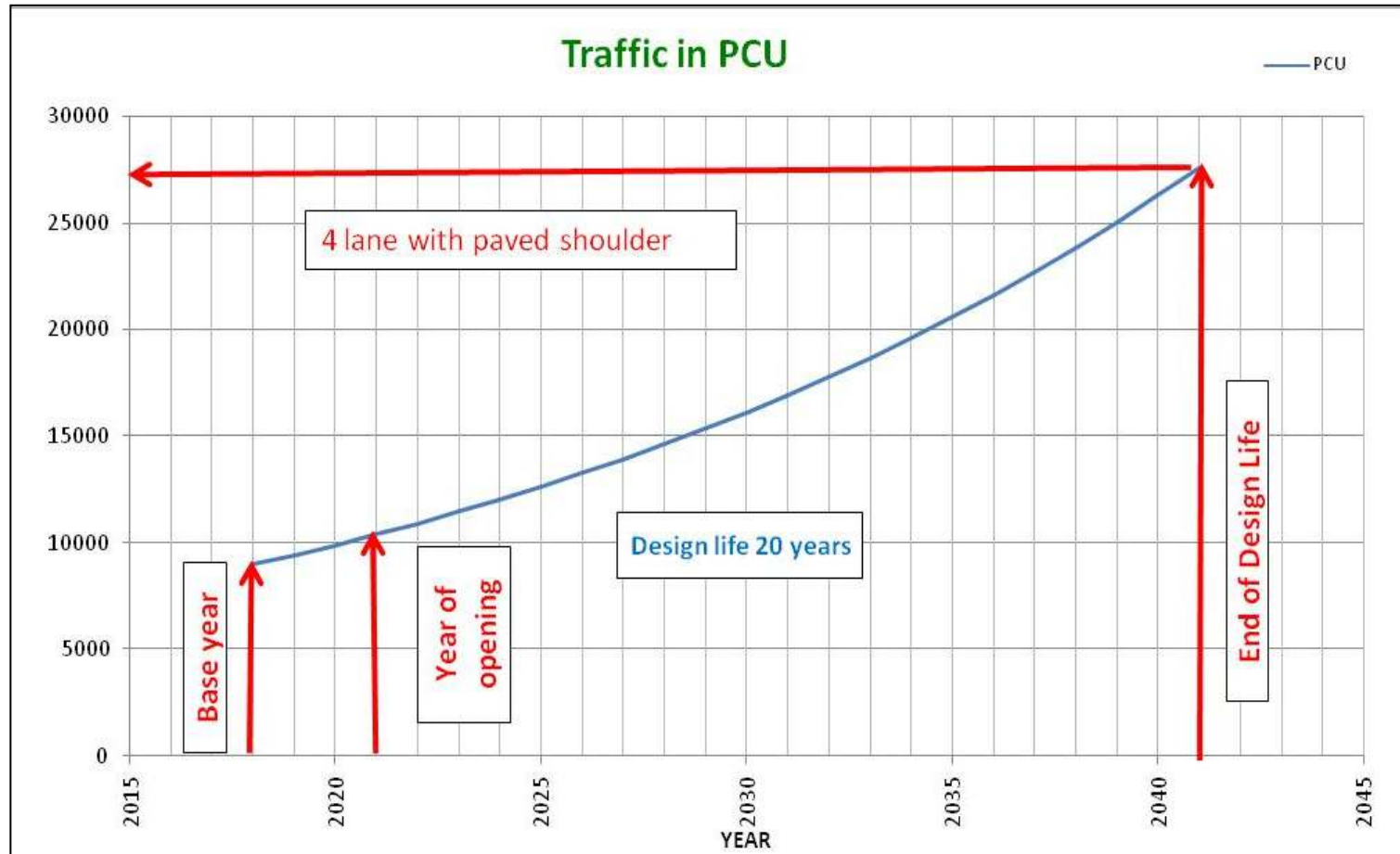


Fig 7.18(b): Traffic Projection in Number & PCU near Fofanga(Ch. 91.000 km)

Table- 7.20(b): Traffic Projection in Number & PCU near Fofanga (Ch. 91.000 km)

Year	Growth rate	Two Wheeler	Car/Jeep/ Van/Taxi/ Auto	Mini / RTVs Bus	Stand. Bus	LCV	2- Axle	3 - Axle	Multi- Axle	Agri. Tract. With Trailor	Agri. Tract. Without Trailor	Cycle	Cycle Rickshaw	Hand Cart	Bullock Cart	Horse Cart	Total in no	Total in PCU
2019	5.0 %	2574	3756	75	414	748	190	100	35	13	42	483	10	6	0	8	8455	8982
2020	5.0%	2703	3944	79	435	786	200	105	37	14	44	508	11	7	0	8	8878	9431
2021	5.0%	2838	4141	83	456	825	210	110	38	15	46	533	11	7	0	9	9322	9903
2022	5.0%	2980	4348	87	479	866	220	116	40	15	48	560	12	7	0	9	9788	10398
2023	5.0%	3129	4566	91	503	909	231	122	42	16	51	588	12	8	0	9	10277	10918
2024	5.0%	3285	4794	96	528	955	243	128	44	17	53	617	13	8	0	10	10791	11464
2025	5.0%	3449	5034	101	555	1003	255	134	47	18	56	648	13	8	0	10	11331	12037
2026	5.0%	3622	5285	106	583	1053	268	141	49	19	59	680	14	9	0	11	11897	12639
2027	5.0%	3803	5550	111	612	1105	281	148	51	20	62	714	15	9	0	11	12492	13271
2028	5.0%	3993	5827	117	642	1161	295	155	54	21	65	750	16	10	0	12	13117	13935
2029	5.0%	4193	6119	123	674	1219	310	163	57	22	68	787	16	10	0	13	13773	14631
2030	5.0%	4402	6424	129	708	1280	325	171	59	23	72	827	17	11	0	13	14461	15363
2031	5.0%	4622	6746	135	743	1344	342	180	62	24	75	868	18	11	0	14	15184	16131
2032	5.0%	4853	7083	142	781	1411	359	189	66	25	79	912	19	12	0	15	15944	16938
2033	5.0%	5096	7437	149	820	1481	377	198	69	26	83	957	20	12	0	15	16741	17784
2034	5.0%	5351	7809	156	861	1555	395	208	72	28	87	1005	21	13	0	16	17578	18674
2035	5.0%	5619	8199	164	904	1633	415	218	76	29	91	1055	22	14	0	17	18457	19607
2036	5.0%	5899	8609	172	949	1715	436	229	80	31	96	1108	23	14	0	18	19380	20588
2037	5.0%	6194	9040	181	996	1801	458	241	84	32	101	1163	24	15	0	19	20349	21617
2038	5.0%	6504	9492	190	1046	1891	481	253	88	34	106	1222	25	16	0	19	21366	22698
2039	5.0%	6829	9966	200	1098	1985	505	265	92	35	111	1283	27	17	0	20	22434	23833
2040	5.0%	7171	10465	210	1153	2084	530	279	97	37	117	1347	28	18	0	21	23556	25024
2041	5.0%	7529	10988	220	1211	2189	556	293	102	39	122	1414	29	18	0	23	24734	26276
2042	5.0%	7906	11537	231	1272	2298	584	307	107	41	129	1485	31	19	0	24	25971	27589

Traffic Projection of Project Road for Homogeneous section-II (from Km 99.450 to Km 160.400)

From traffic projection Table 7.20(c), it is found that present traffic in the project road is 9303 PCU and considering 5.0% traffic growth rate and 20 years design life, the projected traffic calculated in the year 2041 is 28575 PCU which less than 40000 PCU. Therefore, implementation of 4 lane with paved shoulder is adequate to maintain the required level of service B (LOS B)

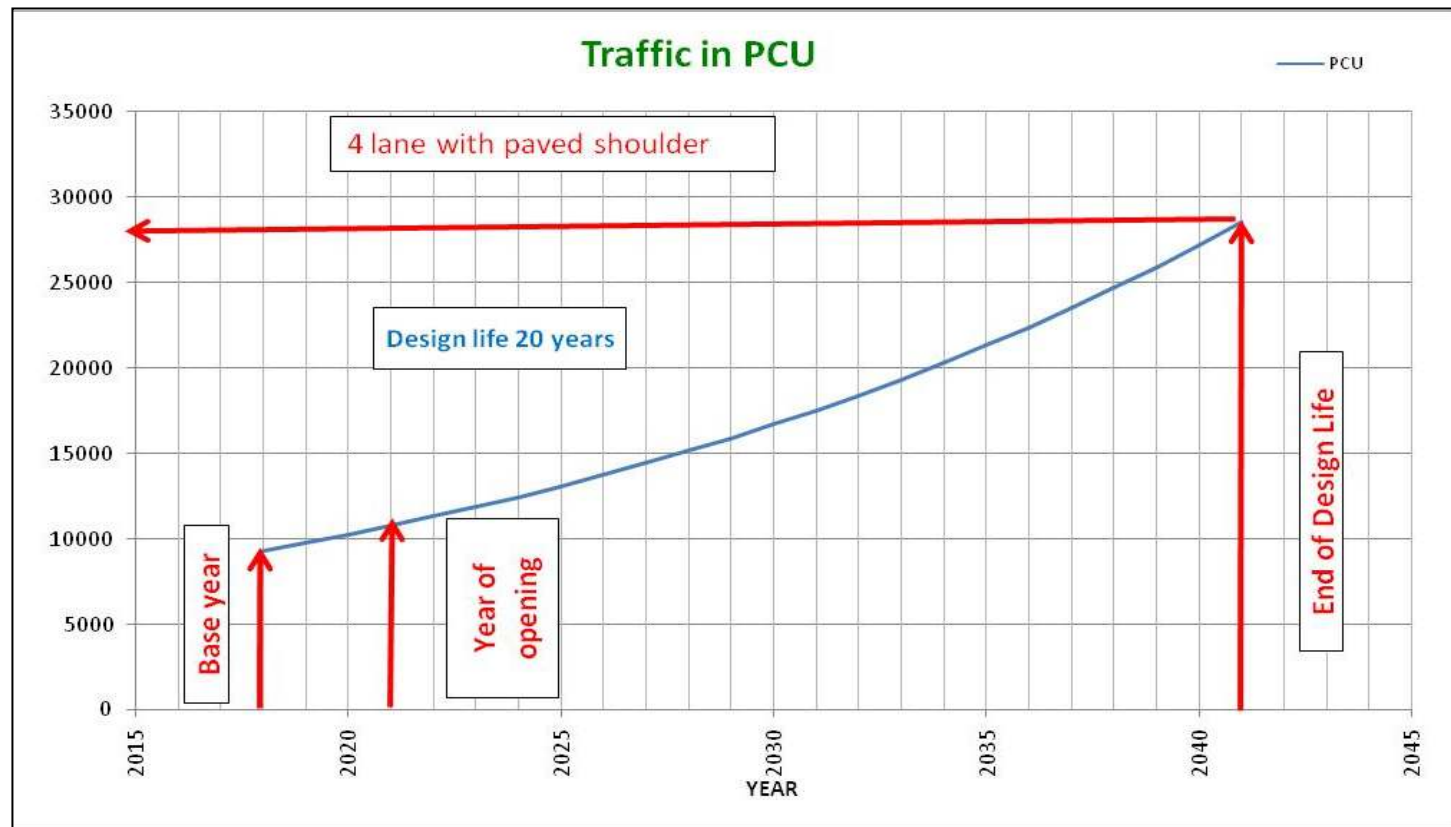


Fig 7.18(c): Traffic Projection in Number & PCU near Dhupdhara (Ch. 141.000 km)

Table- 7.20(c): Traffic Projection in Number & PCU near Dhupdhara (Ch. 141.000 km)

Year	Growth rate	Two Wheeler	Car/Jeep/ Van/Taxi/ Auto	Mini / RTVs Bus	Stand. Bus	LCV	2- Axle	3 - Axle	Multi- Axle	Agri. Tract. With Trailor	Agri. Tract. Without Trailor	Cycle	Cycle Rickshaw	Hand Cart	Bullock Cart	Horse Cart	Total in no	Total in PCU
2019	5.0 %	3170	2770	88	370	547	267	70	51	2	10	2455	129	44	0	0	9974	9303
2020	5.0%	3329	2909	92	388	575	281	73	54	2	10	2577	136	46	0	0	10473	9768
2021	5.0%	3495	3054	97	408	604	295	77	56	3	11	2706	143	49	0	0	10997	10257
2022	5.0%	3670	3207	101	428	634	309	81	59	3	11	2842	150	51	0	0	11546	10770
2023	5.0%	3853	3367	107	450	665	325	85	62	3	12	2984	157	54	0	0	12124	11308
2024	5.0%	4046	3536	112	472	699	341	89	65	3	13	3133	165	56	0	0	12730	11874
2025	5.0%	4248	3712	117	496	734	358	94	68	3	13	3290	173	59	0	0	13366	12467
2026	5.0%	4461	3898	123	520	770	376	98	72	3	14	3454	182	62	0	0	14035	13091
2027	5.0%	4684	4093	130	547	809	395	103	75	3	15	3627	191	65	0	0	14737	13745
2028	5.0%	4918	4298	136	574	849	415	109	79	4	15	3808	201	68	0	0	15473	14432
2029	5.0%	5164	4512	143	603	892	435	114	83	4	16	3998	211	72	0	0	16247	15154
2030	5.0%	5422	4738	150	633	936	457	120	87	4	17	4198	221	75	0	0	17059	15912
2031	5.0%	5693	4975	157	664	983	480	126	92	4	18	4408	232	79	0	0	17912	16707
2032	5.0%	5978	5224	165	698	1032	504	132	96	4	19	4629	244	83	0	0	18808	17543
2033	5.0%	6277	5485	174	732	1084	529	139	101	5	20	4860	256	87	0	0	19748	18420
2034	5.0%	6591	5759	182	769	1138	556	145	106	5	21	5103	269	92	0	0	20736	19341
2035	5.0%	6920	6047	191	807	1195	583	153	111	5	22	5358	283	96	0	0	21773	20308
2036	5.0%	7266	6349	201	848	1255	613	160	117	5	23	5626	297	101	0	0	22861	21323
2037	5.0%	7629	6667	211	890	1317	643	168	123	6	24	5908	311	106	0	0	24004	22389
2038	5.0%	8011	7000	222	935	1383	675	177	129	6	25	6203	327	112	0	0	25205	23509
2039	5.0%	8411	7350	233	981	1452	709	186	135	6	26	6513	343	117	0	0	26465	24684
2040	5.0%	8832	7718	244	1031	1525	745	195	142	7	28	6839	361	123	0	0	27788	25919
2041	5.0%	9274	8104	256	1082	1601	782	205	149	7	29	7181	379	129	0	0	29177	27214
2042	5.0%	9737	8509	269	1136	1681	821	215	157	7	30	7540	398	136	0	0	30636	28575

Traffic Projection of Project Road for Homogeneous section-III (from Km 160.400 to Km 205.000)

From traffic projection Table 7.20(d), it is found that present traffic in the project road is 13497 PCU. The present traffic is 20 years considering 5 % traffic growth rate. From the projection Table 7.20 (d), it is found that the projected traffic crosses 40000 PCU in the year of 2041 (end year of design life). Therefore, implementation of 4-lane with paved shoulder is adequate to maintain the required level of service, LOS B throughout the design life.

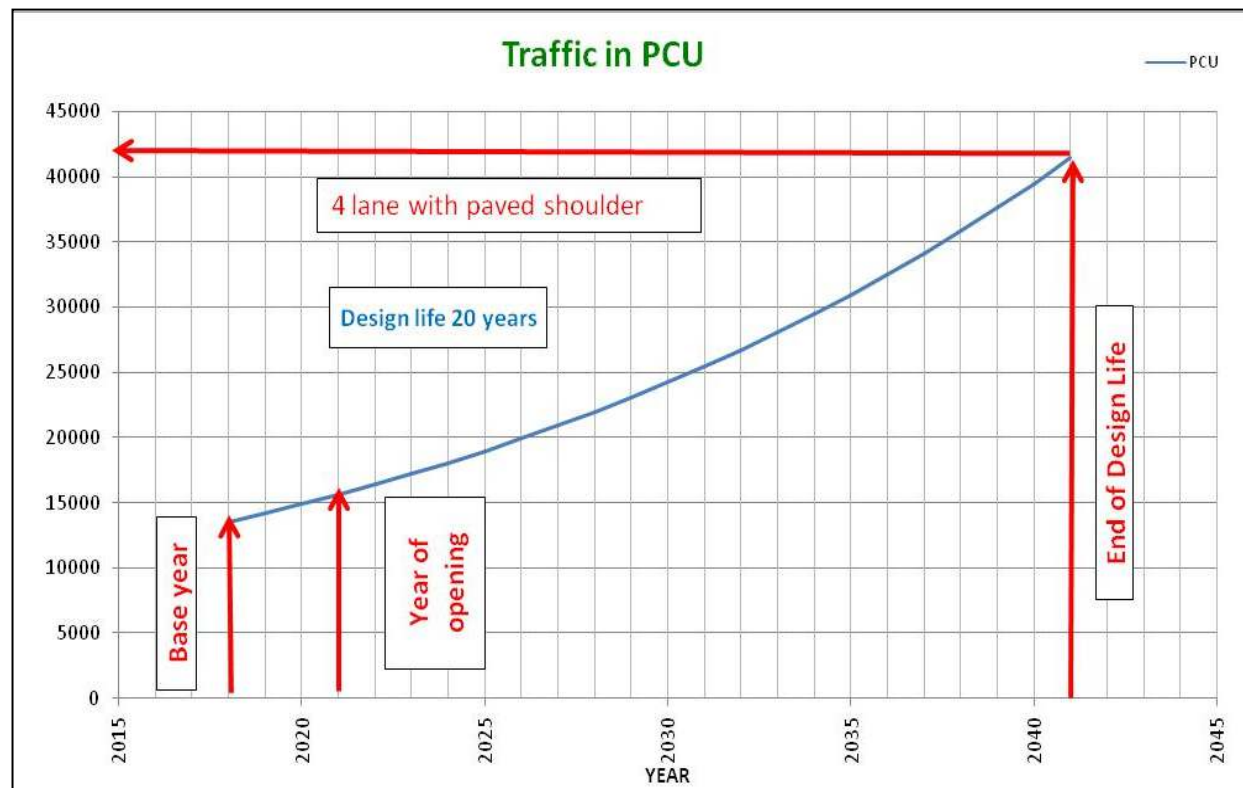


Fig 7.18(d): Traffic Projection in Number & PCU near Kukurmara (Ch. 186.000 km)

Table- 7.20(d): Traffic Projection in Number & PCU near Kukurmara(Ch. 186.000 km)

Year	Growth rate	Two Wheeler	Car/Jeep/ Van/Taxi/ Auto	Mini / RTVs Bus	Stand. Bus	LCV	2- Axle	3 - Axle	Multi- Axle	Agri. Tract. With Trailor	Agri. Tract. Without Trailor	Cycle	Cycle Rickshaw	Hand Cart	Bullock Cart	Horse Cart	Total in no	Total in PCU
2019	5.0%	4364	4477	29	557	1093	798	155	77	8	8	426	9	1	0	0	12001	13497
2020	5.0%	4583	4701	30	585	1148	838	163	80	8	9	447	9	1	0	0	12601	14172
2021	5.0%	4812	4936	32	614	1205	880	171	84	8	9	469	9	1	0	0	13231	14880
2022	5.0%	5052	5183	33	645	1265	924	179	89	9	10	493	10	1	0	0	13893	15624
2023	5.0%	5305	5442	35	677	1329	970	188	93	9	10	517	10	1	0	0	14588	16405
2024	5.0%	5570	5714	37	711	1395	101	198	98	10	11	543	11	1	0	0	15317	17226
2025	5.0%	5849	6000	39	746	1465	106	208	103	10	11	570	11	1	0	0	16083	18087
2026	5.0%	6141	6300	41	784	1538	112	218	108	11	12	599	12	1	0	0	16887	18991
2027	5.0%	6448	6615	43	823	1615	117	229	113	11	12	629	13	1	0	0	17731	19941
2028	5.0%	6770	6946	45	864	1696	123	240	119	12	13	660	13	2	0	0	18618	20938
2029	5.0%	7109	7293	47	907	1780	130	252	125	13	13	693	14	2	0	0	19549	21985
2030	5.0%	7464	7658	49	952	1869	136	265	131	13	14	728	15	2	0	0	20526	23084
2031	5.0%	7838	8041	52	1000	1963	143	278	138	14	15	765	15	2	0	0	21553	24238
2032	5.0%	8230	8443	54	1050	2061	150	292	144	15	16	803	16	2	0	0	22630	25450
2033	5.0%	8641	8865	57	1103	2164	158	307	152	15	16	843	17	2	0	0	23762	26723
2034	5.0%	9073	9308	60	1158	2272	165	322	159	16	17	885	18	2	0	0	24950	28059
2035	5.0%	9527	9774	63	1216	2386	174	338	167	17	18	929	19	2	0	0	26197	29462
2036	5.0%	10003	10262	66	1276	2505	182	355	176	18	19	976	20	2	0	0	27507	30935
2037	5.0%	10503	10776	69	1340	2630	192	373	184	19	20	1025	21	2	0	0	28883	32481
2038	5.0%	11028	11314	73	1407	2762	201	391	194	19	21	1076	22	3	0	0	30327	34106
2039	5.0%	11580	11880	76	1478	2900	211	411	203	20	22	1130	23	3	0	0	31843	35811
2040	5.0%	12159	12474	80	1551	3045	222	431	213	21	23	1186	24	3	0	0	33435	37601
2041	5.0%	12767	13098	84	1629	3197	233	453	224	23	24	1245	25	3	0	0	35107	39481
2042	5.0%	13405	13753	88	1711	3357	245	476	235	24	25	1308	26	3	0	0	36862	41456

Traffic Projection of Project Road for Homogeneous section-IV (from Km 205.000 to Km 215.745)

From AADT table it is found that the present traffic for this homogeneous section is 36910 PCU and the existing road stretch is already of 4 lane configuration which presently caters the above traffic. However considering the same traffic growth rate considered the other section, this section immediately demands for 6-lane configurations. But to match with the previous sections, present 4 lane road has been kept as it is with provision of both side 2 lane(7.5m) service road has been provided all along to segregate the local traffic from through traffic.

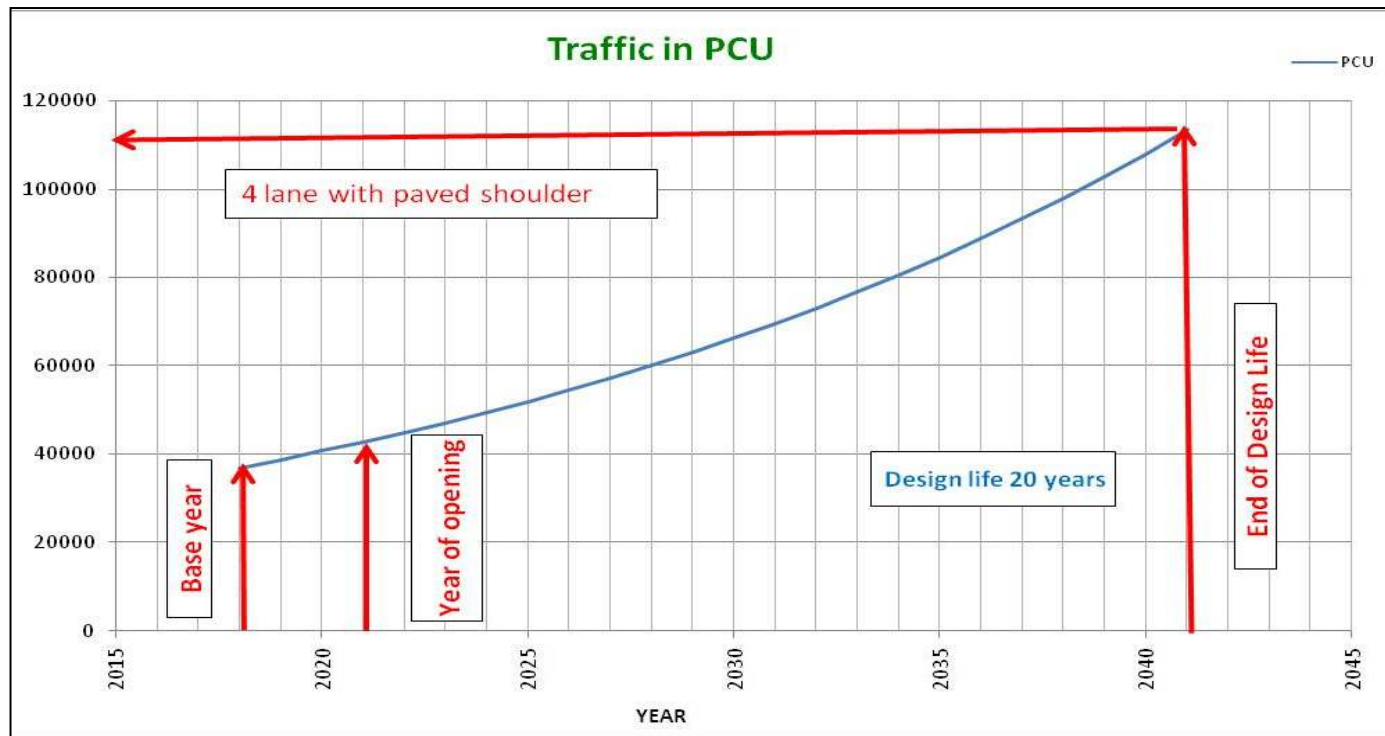


Fig 7.18(e): Traffic Projection in Number & PCU near Lankeswar (Ch. 214.000 km)

Table- 7.20(e): Traffic Projection in Number & PCU near Lankeswar (Ch. 214.000 km)

Year	Growth rate	Two Wheeler	Car/Jeep/ Van/Taxi/ Auto	Mini / RTVs Bus	Stand. Bus	LCV	2- Axle	3 - Axle	Multi- Axle	Agri. Tract. With Trailor	Agri. Tract. Without Trailor	Cycle	Cycle Rickshaw	Hand Cart	Bullock Cart	Horse Cart	Total in no	Total in PCU
2019	5.0 %	11433	20166	37	874	1434	137	342	191	4	8	203	24	2	0	0	36094	36910
2020	5.0%	12005	21174	39	918	1506	144	359	201	4	8	213	25	2	0	0	37899	38756
2021	5.0%	12605	22233	41	963	1581	151	377	211	4	8	224	26	3	0	0	39794	40693
2022	5.0%	13236	23345	43	1012	1660	159	396	221	4	9	235	28	3	0	0	41784	42728
2023	5.0%	13897	24512	45	1062	1743	167	416	232	5	9	247	29	3	0	0	43873	44864
2024	5.0%	14592	25737	48	1115	1830	175	437	244	5	10	259	30	3	0	0	46067	47108
2025	5.0%	15322	27024	50	1171	1922	184	458	256	5	10	272	32	3	0	0	48370	49463
2026	5.0%	16088	28375	53	1230	2018	193	481	269	5	11	286	34	3	0	0	50789	51936
2027	5.0%	16892	29794	55	1291	2119	203	505	282	6	11	300	35	3	0	0	53328	54533
2028	5.0%	17737	31284	58	1356	2225	213	531	297	6	12	315	37	4	0	0	55994	57260
2029	5.0%	18624	32848	61	1424	2336	224	557	311	6	13	331	39	4	0	0	58794	60123
2030	5.0%	19555	34491	64	1495	2453	235	585	327	7	13	347	41	4	0	0	61734	63129
2031	5.0%	20533	36215	67	1569	2576	247	614	343	7	14	365	43	4	0	0	64820	66285
2032	5.0%	21559	38026	70	1648	2704	259	645	360	7	15	383	45	4	0	0	68061	69599
2033	5.0%	22637	39927	74	1730	2840	272	677	378	8	15	402	47	5	0	0	71465	73079
2034	5.0%	23769	41923	78	1817	2981	286	711	397	8	16	422	50	5	0	0	75038	76733
2035	5.0%	24958	44020	82	1908	3131	300	747	417	8	17	443	52	5	0	0	78790	80570
2036	5.0%	26205	46221	86	2003	3287	315	784	438	9	18	466	55	5	0	0	82729	84598
2037	5.0%	27516	48532	90	2103	3451	331	823	460	9	19	489	57	6	0	0	86866	88828
2038	5.0%	28892	50958	94	2208	3624	347	864	483	10	19	513	60	6	0	0	91209	93270
2039	5.0%	30336	53506	99	2319	3805	365	907	507	10	20	539	63	6	0	0	95769	97933
2040	5.0%	31853	56181	104	2435	3995	383	953	532	11	21	566	66	6	0	0	100558	102830
2041	5.0%	33446	58991	109	2556	4195	402	100	559	11	23	594	70	7	0	0	105586	107971
2042	5.0%	35118	61940	115	2684	4405	422	105	587	12	24	624	73	7	0	0	110865	113370

7.5 AXLE LOAD SURVEYS AND VEHICLE DAMAGE FACTORS

For the purpose of preliminary pavement design required for the project, axle load survey has been carried out on the project road for 2 days x 24 hours at the following locations

- **Axle-1: Ch. 66.000 km near Jogighopa Station**
- **Axle-2: Ch. 186.000 km near Kukurmara**



The axle load spectrum observed on the project road, along with the derivation of vehicle damage factors (VDFs) as per the relevant IRC Codes are given in **Table 7.21(a)** and **Table 7.21(b)** which summarizes the VDF observed on the Project Road. Details of VDF Calculation are produced in a separate volume field investigation report **Appendix-7.3**

For Homogeneous Section – I& II

Table- 7.21(a): VDF at Ch. 66.000 km near Jogighopa Station

TYPE OF VEHICLES	VDF							
	UP				DOWN			
	EMPTY		LOADED		EMPTY		LOADED	
	VDF	Frequency	VDF	Frequency	VDF	Frequency	VDF	Frequency
4 Axle	0.2357	3	3.0311	7	0.0000	0	3.4108	7
3 Axle	0.2538	10	2.5992	29	0.2513	13	0.0000	26
2 Axle truck	0.2101	38	4.2678	31	0.2304	52	5.3568	81
LCV	0.0004	59	0.2488	40	0.0006	76	0.0070	61
Bus	0.9761	1	1.0145	28	0.0000	0	0.8577	44
TOTAL		111		135		141		219
WEIGHTED VDF IN EACH DIRECTION	1.14				1.42			
Max. WEIGHTED VDF	1.42							
WEIGHTED VDF OF COMMERCIAL VEHICLE	1.42							

For Homogeneous Section – III & IV

Table- 7.21(b): VDF at Ch. 186.000 km near Kukurmara

TYPE OF VEHICLES	VDF							
	UP				DOWN			
	EMPTY		LOADED		EMPTY		LOADED	
	VDF	Frequency	VDF	Frequency	VDF	Frequency	VDF	Frequency
4 Axle	0.0000	0	3.9142	6	0.2704	8	3.5902	7
3 Axle	0.2440	3	2.4055	18	0.2469	24	4.8743	8
2 Axle truck	0.2118	10	3.9650	35	1.8996	109	4.8684	112
LCV	0.0004	10	0.0048	54	0.0031	85	0.0054	174
Bus	0.0000	0	0.9866	46	0.0000	0	0.9866	120
TOTAL		23		159		226		421
WEIGHTED VDF IN EACH DIRECTION	1.40				1.46			
Max. WEIGHTED VDF	1.46							
WEIGHTED VDF OF COMMERCIAL VEHICLE	1.46							

7.6 ESTIMATION OF DESIGN ESA

(a) **Traffic growth rate (Both direction):** As per IRC: 37-2018, 5% growth of traffic is considered for homogeneous sections

(b) **Lane Factor (D):** 0.75 for four lane dual carriageway (Clause 4.5.1.5, Page – 17, IRC : 37-2018)

(i) **Homogeneous Section-I (Km 0.000 to Km 99.450):**

➤ **ESA Computation as per VDF obtained from Axle Load Survey**

N: Cumulative number of standard axle to be created for in the design in terms of msa

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day=1251

D: Lane distribution factor (Refer IRC:37-2018 , Clause 4.5.1.5 , page-17)= 0.75

F: Vehicle Damage Factor =1.42

n: Design life in years =20 (After completion of road construction)

r: Annual growth rate of commercial vehicles =5 %

$$N = (365 * [(1+r)^n - 1] * A * D * F) / r = 16 \text{ msa}$$

➤ **ESA Computation as per VDF obtained from IRC:37-2018,[Clause 4.4.6 , page-16]**

N: Cumulative number of standard axle to be created for in the design in terms of msa

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day= 1251

D: Lane distribution factor (Refer IRC:37-2018 , Clause 4.5.1.5 , page-17)= 0.75

F: Vehicle Damage Factor (Refer IRC:37-2018 , Clause 4.4.6 , page-16) =3.9

n: Design life in years =20 (After completion of road construction)

r: Annual growth rate of commercial vehicles =5 %

$$N = (365 * [(1+r)^n - 1] * A * D * F) / r = 44 \text{ msa}$$

Also from Clause 4.3.1 of IRC 37-2018 (page no-14), flexible pavement shall be designed for minimum design period of 20 years, subject to the condition that design traffic shall not be less than 20 msa.

Therefore considering the above design traffic value, 44 msa has been adopted for flexible pavement design.

(ii) Homogeneous Section-II (Km 99.450 to Km 160.400):

➤ **ESA Computation as per VDF obtained from Axle Load Survey**

N: Cumulative number of standard axle to be created for in the design in terms of msa

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day= 954

D: Lane distribution factor (Refer IRC:37-2018 , Clause 4.5.1.5 , page-17)= 0.75

F: Vehicle Damage Factor =1.42

n: Design life in years =20 (After completion of road construction)

r: Annual growth rate of commercial vehicles =5 %

$$N = (365 * [(1+r)^n - 1] * A * D * F) / r = 12 \text{ msa}$$

➤ **ESA Computation as per VDF obtained from IRC:37-2018,[Clause 4.4.6 , page-16]**

N: Cumulative number of standard axle to be created for in the design in terms of msa

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day= 954

D: Lane distribution factor (Refer IRC:37-2018 , Clause 4.5.1.5 , page-17)= 0.75

F: Vehicle Damage Factor (Refer IRC:37-2018 , Clause 4.4.6 , page-16) =3.9

n: Design life in years =20 (After completion of road construction)

r: Annual growth rate of commercial vehicles =5 %

$$N = (365 * [(1+r)^n - 1] * A * D * F) / r = 34 \text{ msa}$$

Also from Clause 4.3.1 of IRC 37-2018 (page no-14), flexible pavement shall be designed for minimum design period of 20 years, subject to the condition that design traffic shall not be less than 20 msa.

Therefore considering the above design traffic value, 34 msa has been adopted for flexible pavement design.

(iii) Homogeneous Section-III (Km 160.400 to 205.000 Km):

➤ **ESA Computation as per VDF obtained from Axle Load Survey**

N: Cumulative number of standard axle to be created for in the design in terms of msa

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day=1856

D: Lane distribution factor (Refer IRC:37-2018 , Clause 4.5.1.5 , page-17)= 0.75

F: Vehicle Damage Factor =1.46

n: Design life in years =20 (After completion of road construction)

r: Annual growth rate of commercial vehicles =5 %

$$N = (365 * [(1+r)^n - 1] * A * D * F) / r = 25 \text{ msa}$$

➤ **ESA Computation as per VDF obtained from IRC:37-2018,[Clause 4.4.6 , page-16]**

N: Cumulative number of standard axle to be created for in the design in terms of msa

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day=1856

D: Lane distribution factor (Refer IRC:37-2018 , Clause 4.5.1.5 , page-17)= 0.75

F: Vehicle Damage Factor (Refer IRC:37-2018 , Clause 4.4.6 , page-16) =5

n: Design life in years =20 (After completion of road construction)

r: Annual growth rate of commercial vehicles =5 %

$$N = (365 * [(1+r)^n - 1] * A * D * F) / r = 84 \text{ msa}$$

Also from Clause 4.3.1 of IRC 37-2018 (page no-14), flexible pavement shall be designed for minimum design period of 20 years, subject to the condition that design traffic shall not be less than 20 msa.

Therefore considering the above design traffic value 84 msa has been adopted for flexible pavement design.

(iv) Homogeneous Section-IV (Km 205.000 to 215.787 Km):

➤ **ESA Computation as per VDF obtained from Axle Load Survey**

N: Cumulative number of standard axle to be created for in the design in terms of msa

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day=2910

D: Lane distribution factor (Refer IRC:37-2018 , Clause 4.5.1.5 , page-17)= 0.75

F: Vehicle Damage Factor =1.46

n: Design life in years =20 (After completion of road construction)

r: Annual growth rate of commercial vehicles =5 %

$$N = (365 * [(1+r)^n - 1] * A * D * F) / r = 38 \text{ msa}$$

➤ **ESA Computation as per VDF obtained from IRC:37-2018,[Clause 4.4.6 , page-16]**

N: Cumulative number of standard axle to be created for in the design in terms of msa

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day=2910

D: Lane distribution factor (Refer IRC:37-2018 , Clause 4.5.1.5 , page-17)= 0.75

F: Vehicle Damage Factor (Refer IRC:37-2018 , Clause 4.4.6 , page-16) =5

n: Design life in years =15 (After completion of road construction)

r: Annual growth rate of commercial vehicles =5 %

$$N = (365 * [(1+r)^n - 1] * A * D * F) / r = 132 \text{ msa}$$

Also from Clause 4.3.1 of IRC 37-2018 (page no-14), flexible pavement shall be designed for minimum design period of 20 years, subject to the condition that design traffic shall not be less than 20 msa.

Therefore considering the above design traffic value, 132 msa has been adopted for flexible pavement design.

7.7 INTERSECTION TURNING MOVEMENT COUNTS

Intersection turning movement count survey has been conducted at the following intersections on the project road:

- **TMC-1 : Ch. 0.000 km near Bilasipura Junction(4 legged)**
- **TMC-2 : Ch. 50.700 Km near North Salmara (3 legged)**
- **TMC-3 : Ch. 52.555 Km at Tulungia (3 legged)** [Intersection Volume count for this junction has been carried out for **Hapachara-Tulungia Stretch**]
- **TMC-4 : Ch. 80.000 km near Makri Bazar (4 legged)**
- **TMC-5 : Ch. 99.450 Km near Paikan Junction (3 legged)**
- **TMC-6 : Ch. 114.900 Km near Dudhnoi Junction (4 legged)**
- **TMC-7 : Ch. 160.400 Km near Boko Junction (3 legged)**
- **TMC-8 : Ch. 196.900 Km near Mirza Junction (4 legged)**
- **TMC-9 : Ch. 205.100 Km near Airport Junction (4 legged)**
- **TMC-10 : Ch. 222.200 Km near Jalukbari Junction (3 legged)**

Detail analysis of turning movement count survey is given in **Appendix-7.4**

The peak hour flows (in vehicles and PCUs) have been presented in **Figures 7.19 (a) to 7.27(b)**

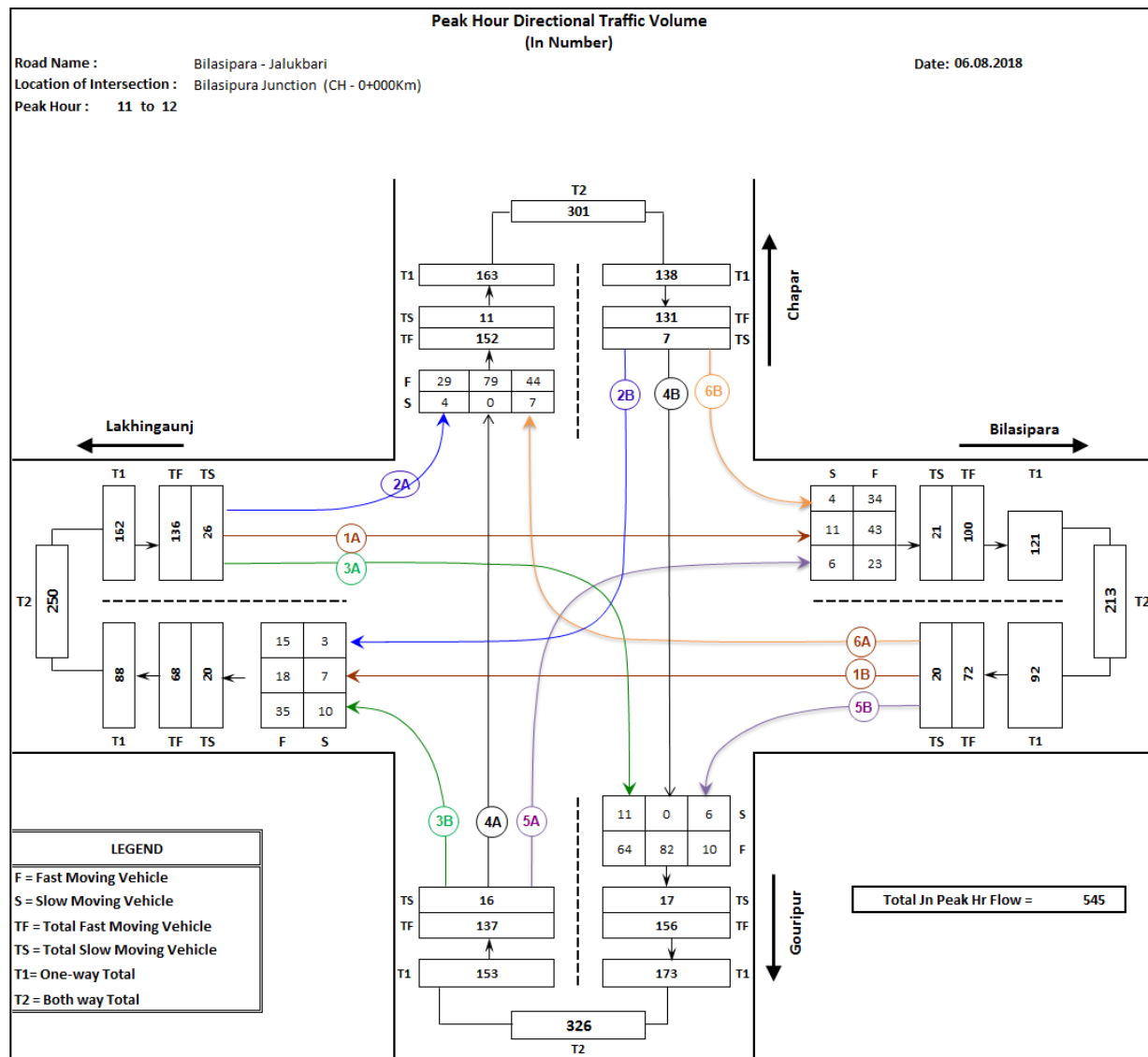


Fig- 7.19(a): Peak hour traffic in Number at Ch. 0.000 km near Bilasipura Junction (4 legged)

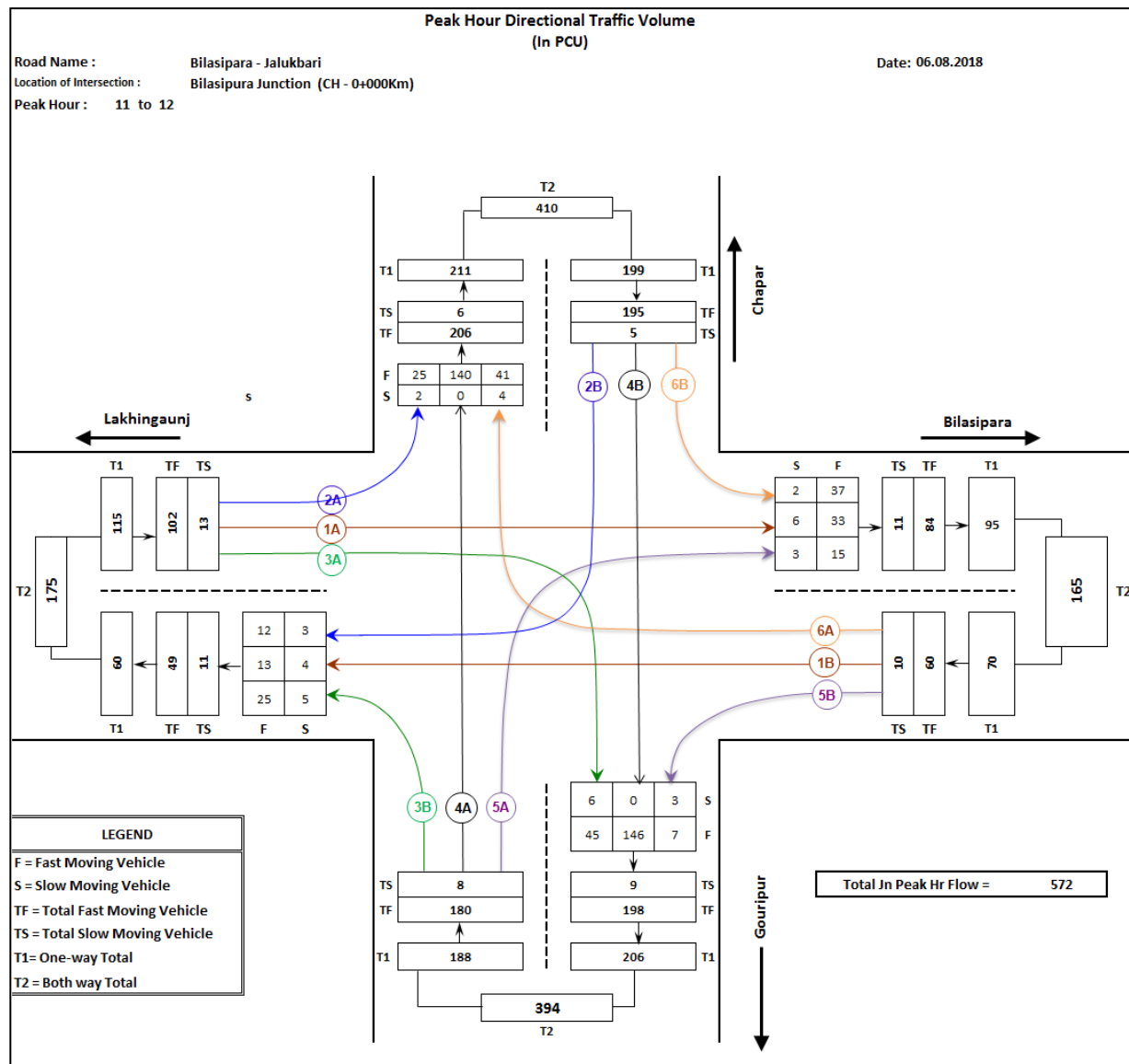


Fig- 7.19(b): Peak hour traffic in PCU at Ch.0.000 km near Bilasipura Junction (4 legged)

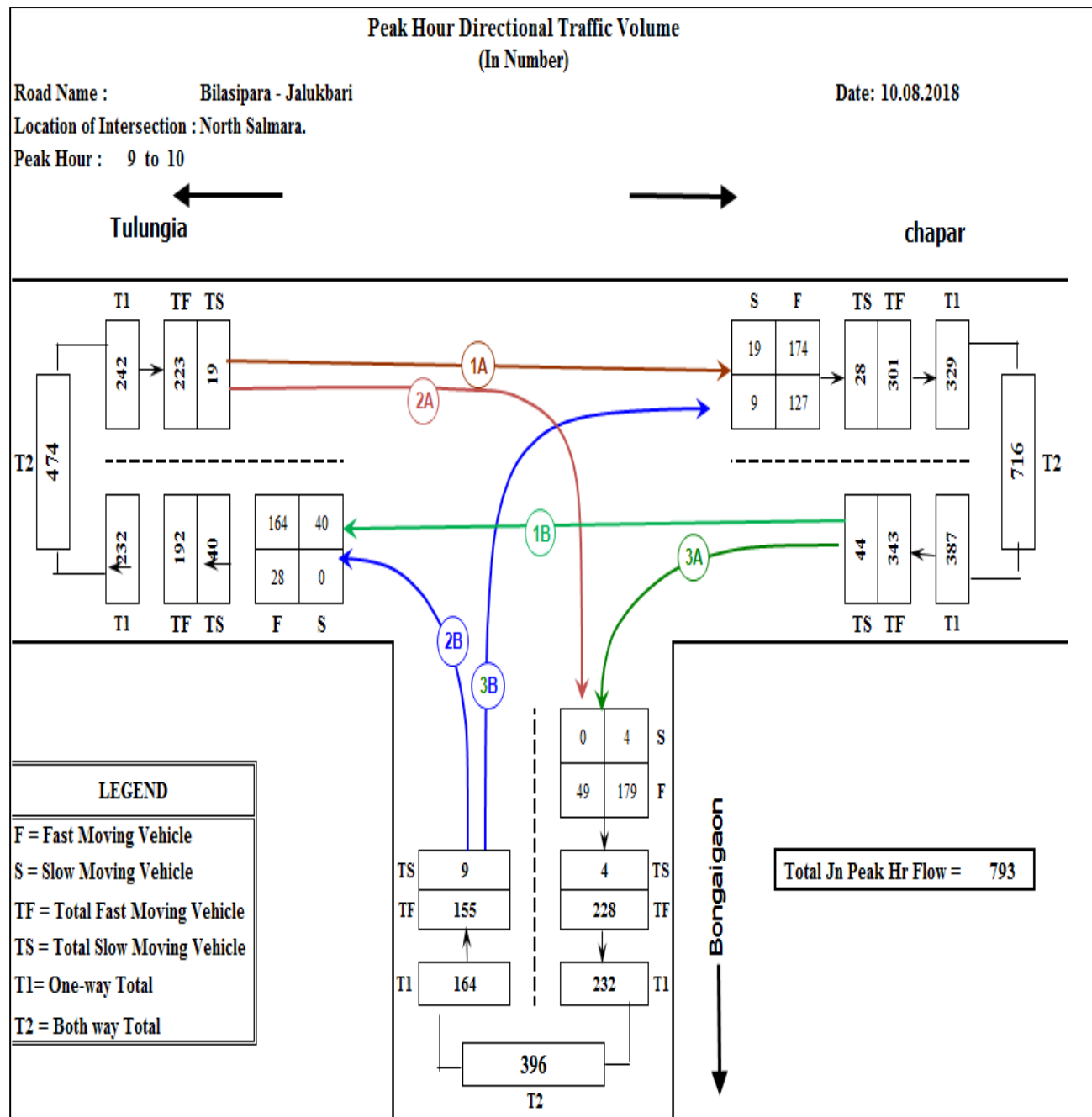


Fig -7.20(a): Peak hour traffic in Number at Ch. 50.700 Km near North Salmara (3 legged)

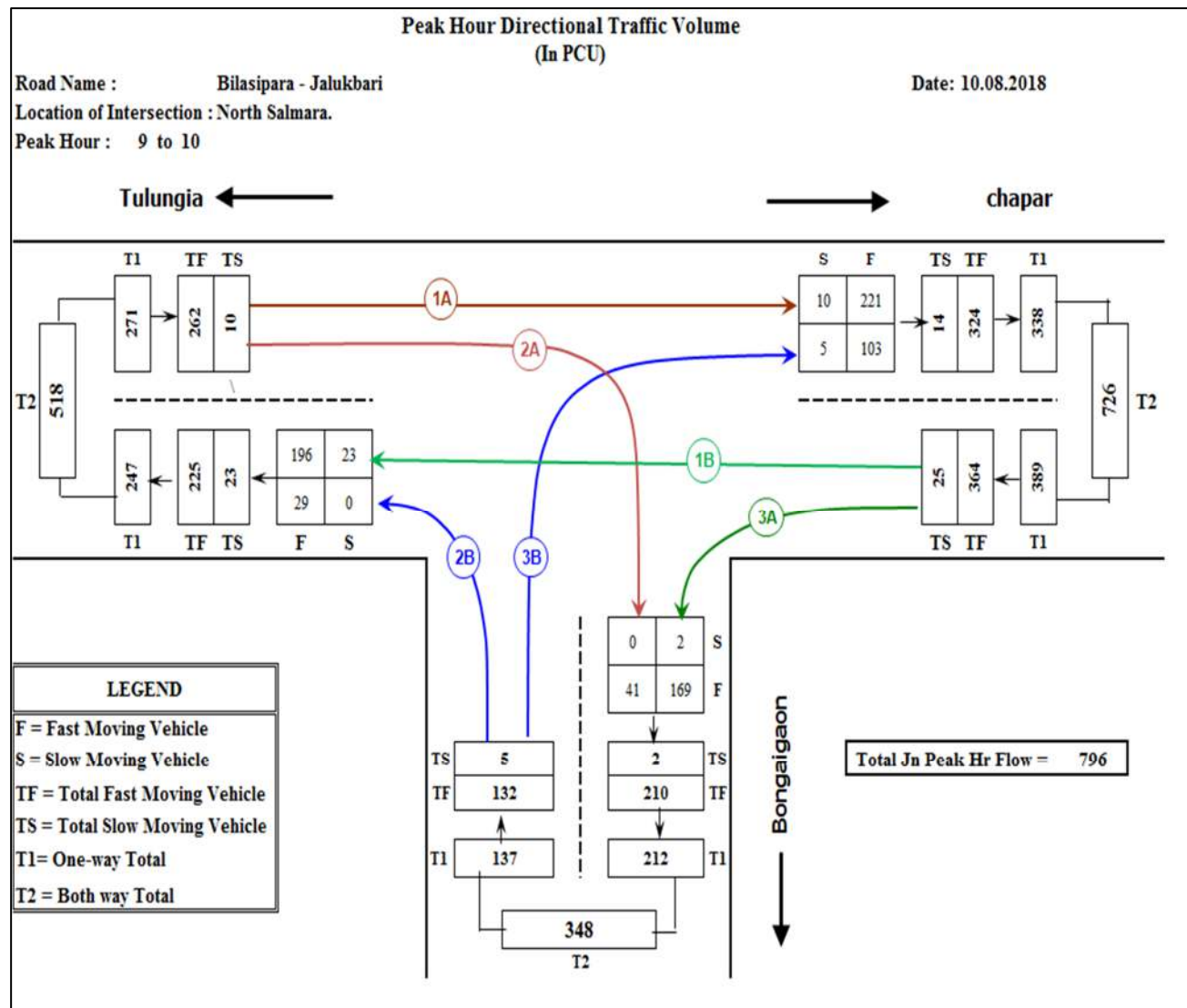


Fig -7.20(b): Peak hour traffic in PCU at Ch. 50.700 Km near North Salmara (3 legged)

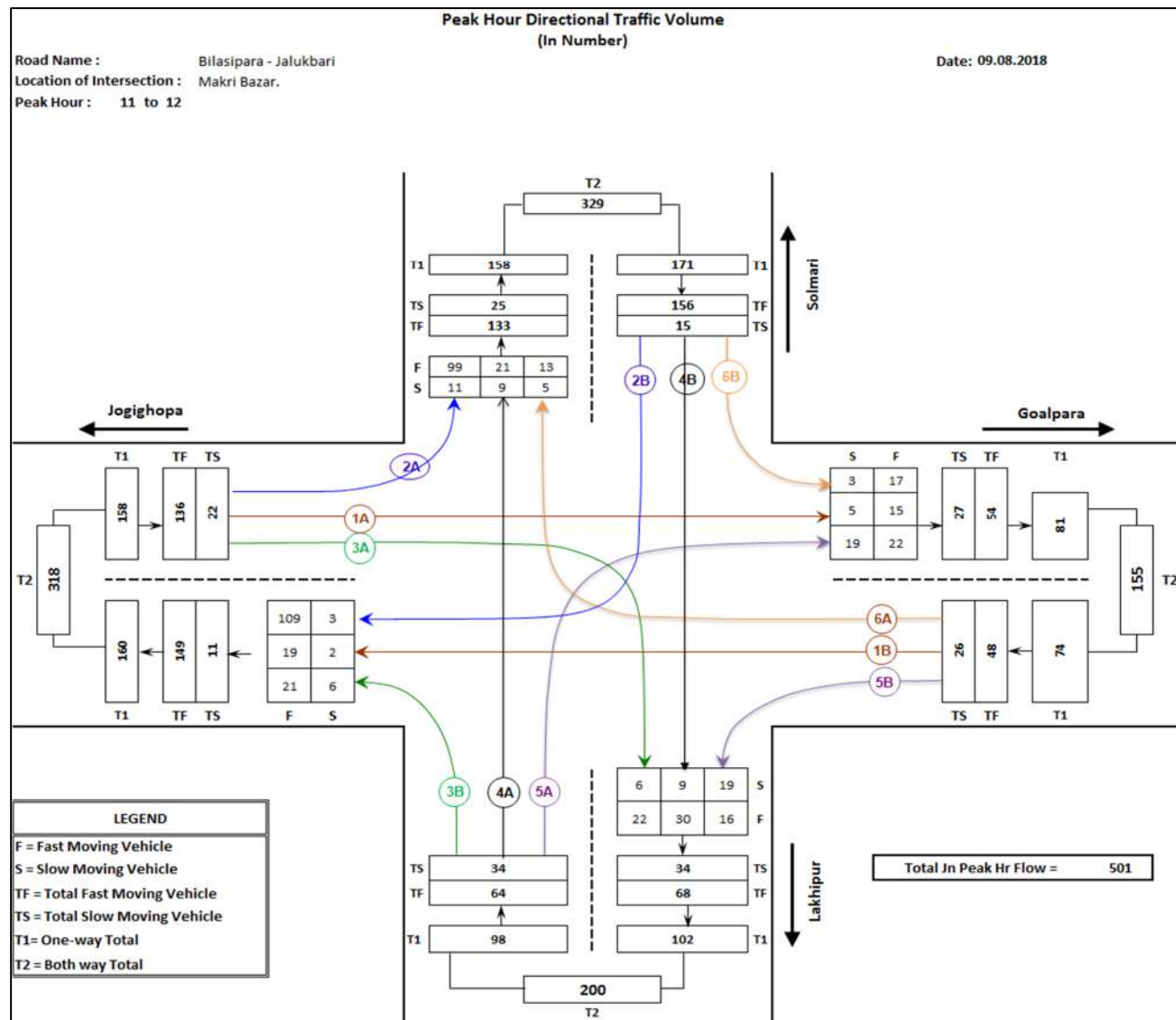


Fig -7.21(a): Peak hour traffic in Number at Ch. 80.000 km near Makri Bazar (4 legged)

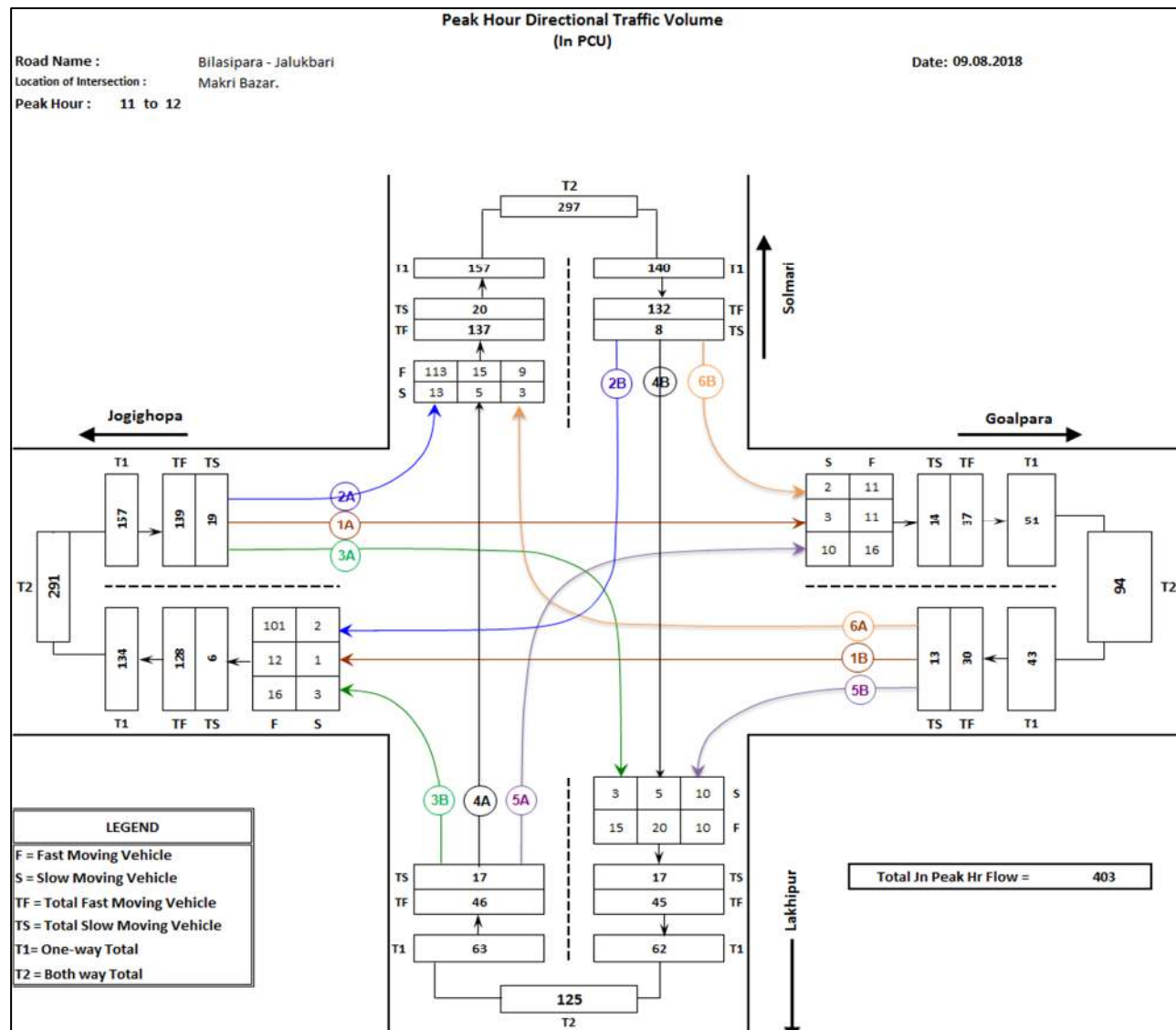


Fig -7.21(b): Peak hour traffic in PCU at Ch. 80.000 km near Makri Bazar (4 legged)

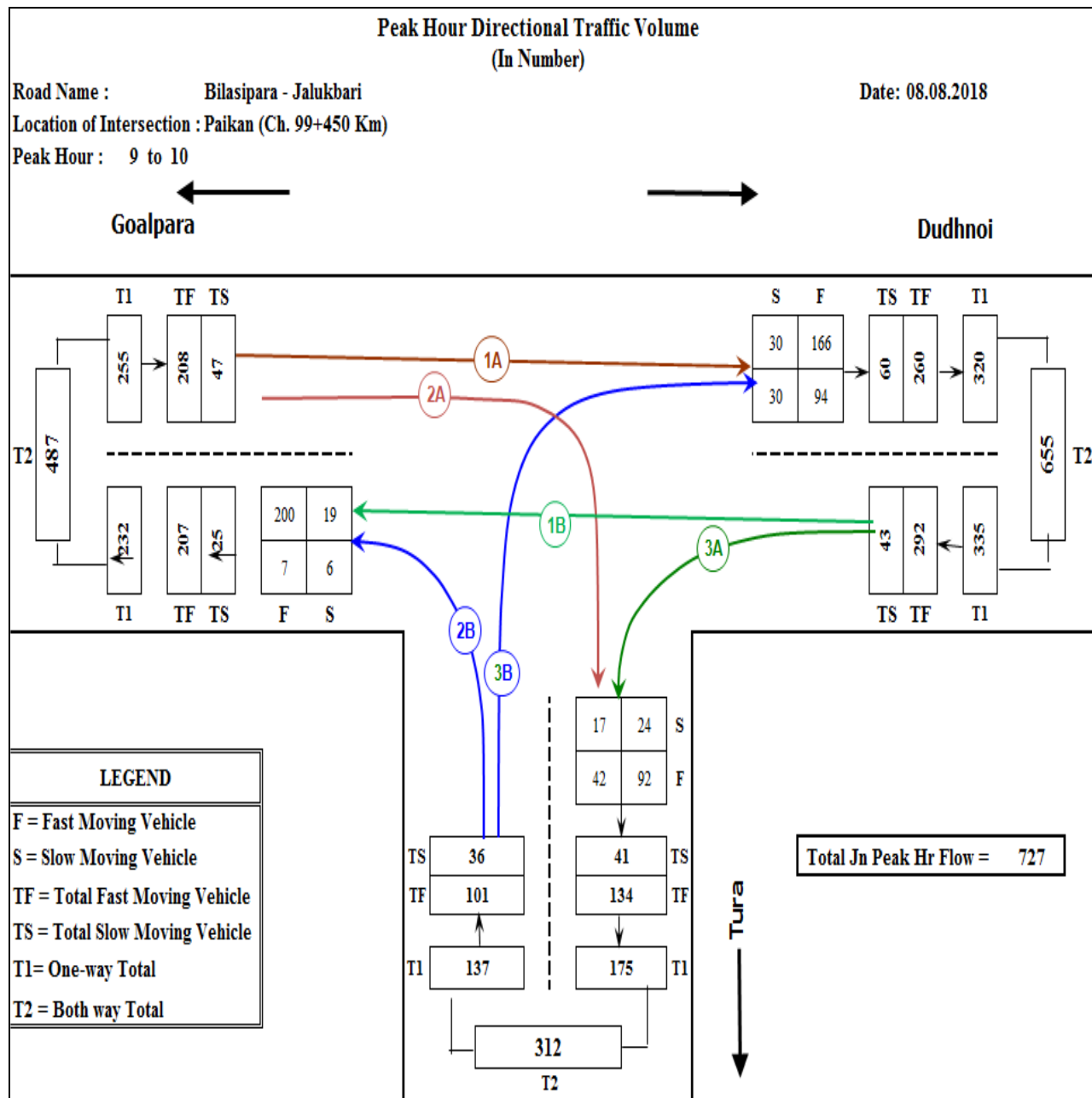


Fig -7.22(a): Peak hour traffic in Number atCh. 99.450 Km near Paikan Junction (3 legged)

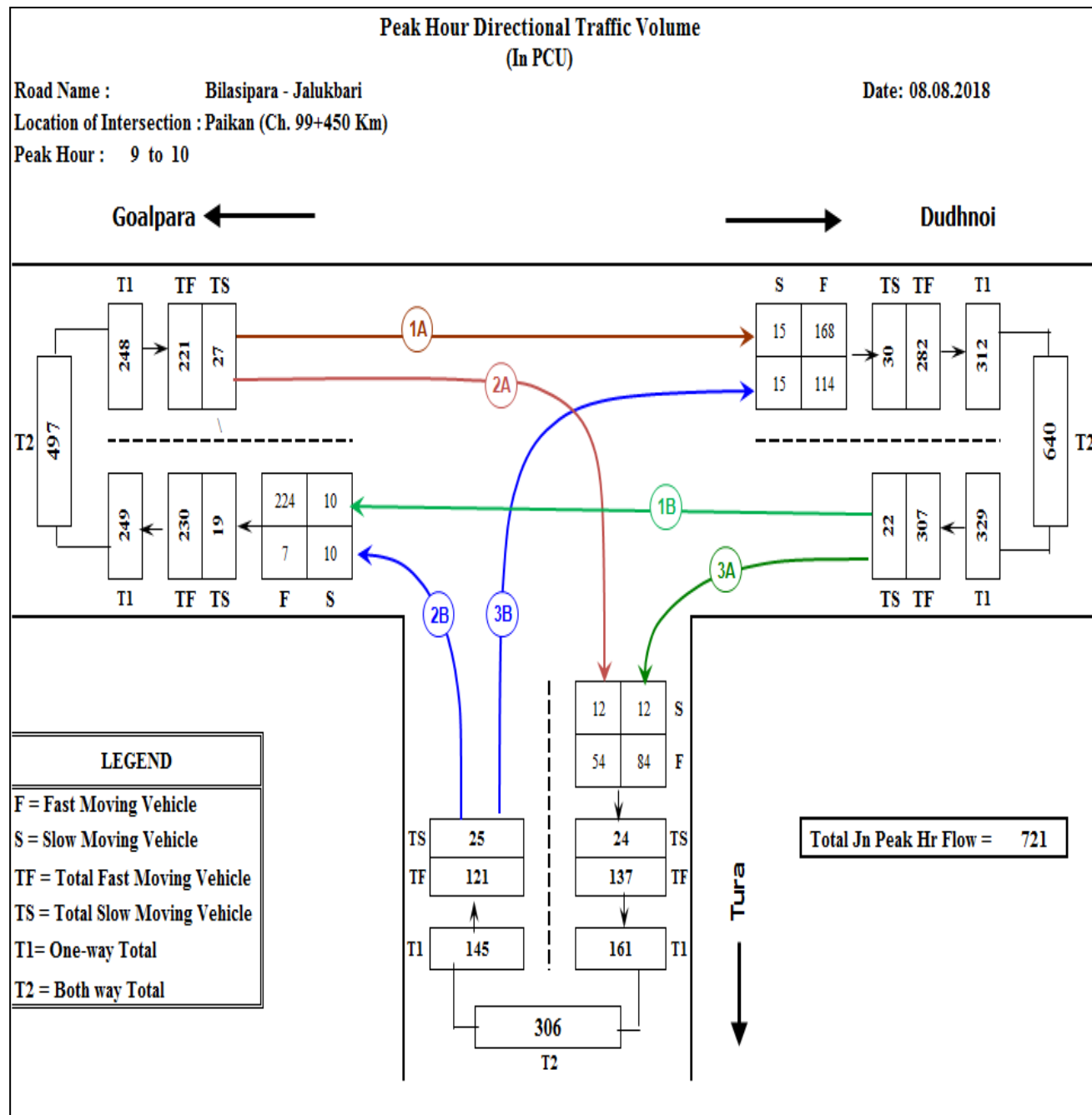


**Fig -7.22(b): Peak hour traffic in PCU at Ch. 99.450 Km near Paikan Junction
(3 legged)**

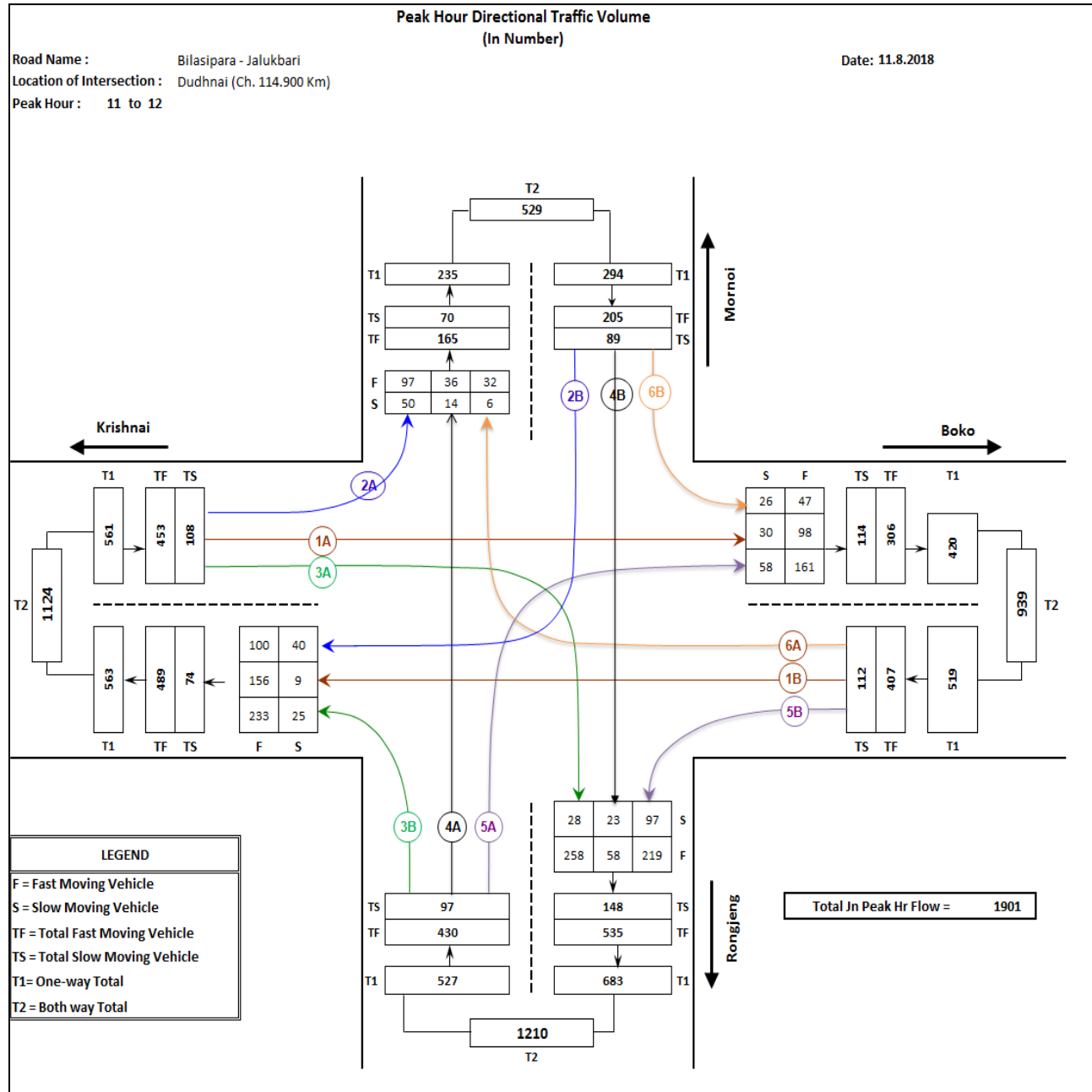


**Fig -7.23(a): Peak hour traffic in Number at Ch. 114.900 Km near Dudhnoi Junction
(4 legged)**

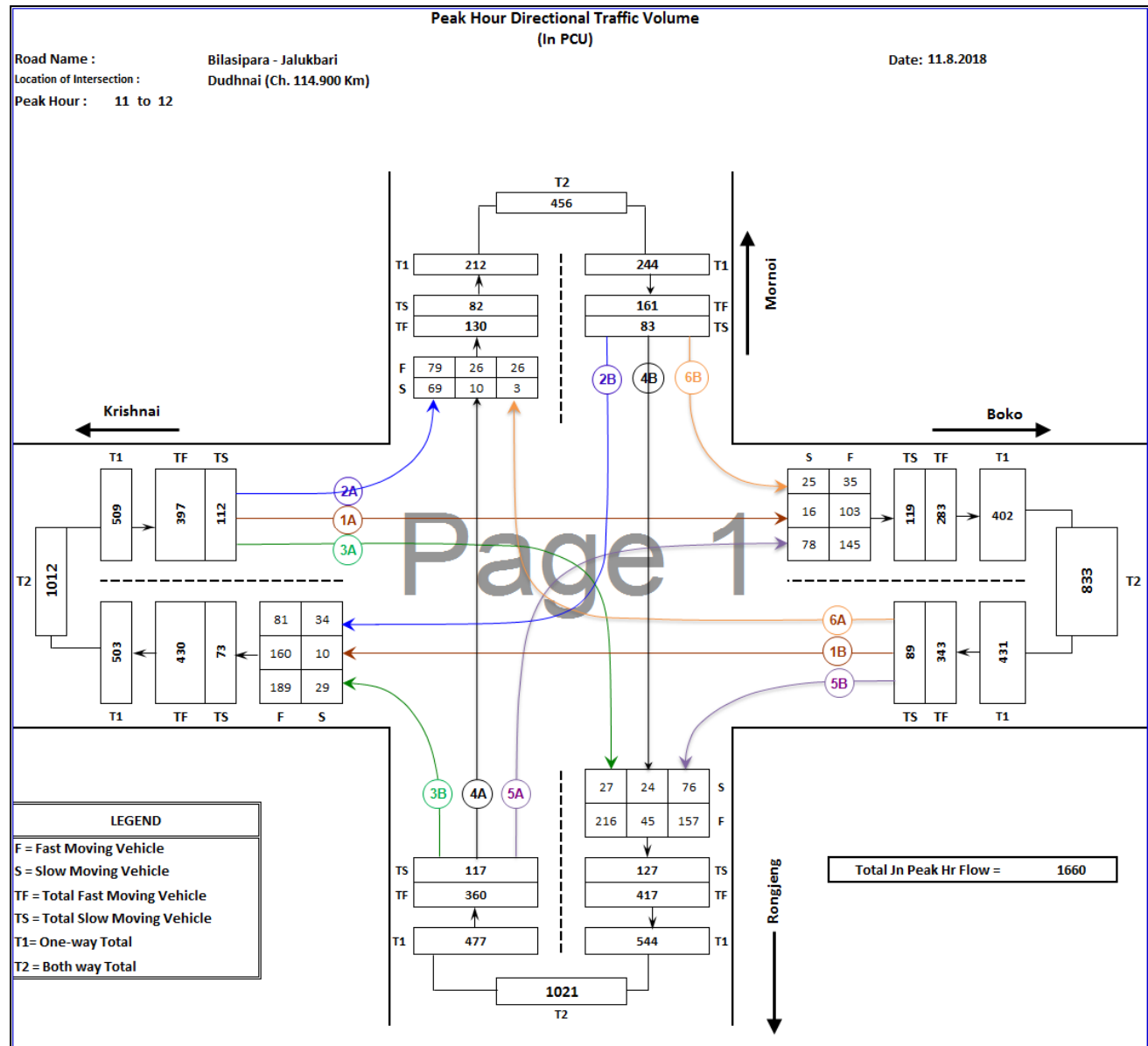


Fig -7.23(b): Peak hour traffic in PCU at Ch. 114.900 Km near Dudhnoi Junction (4 legged)

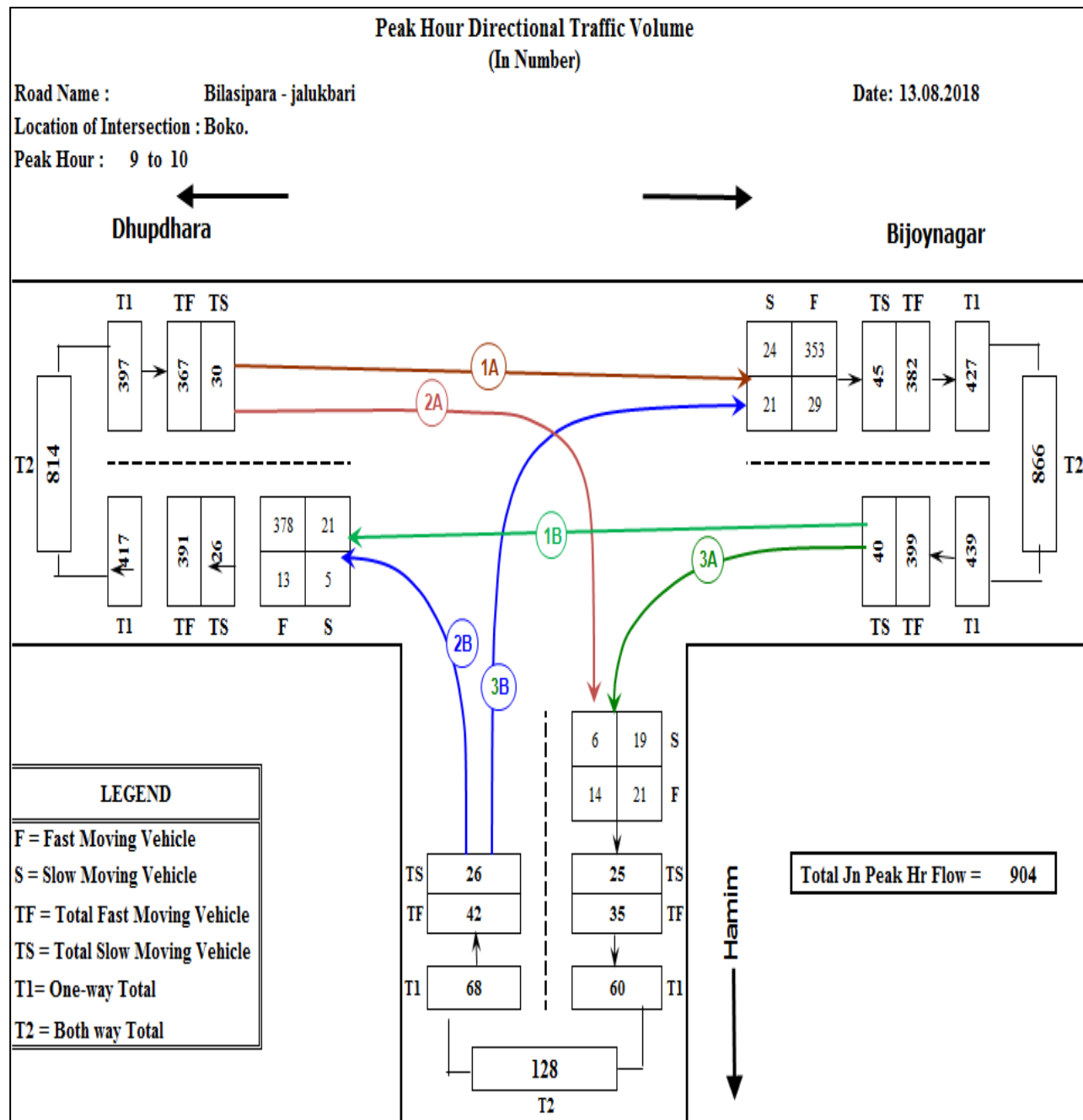


Fig -7.24(a): Peak hour traffic in Number at Ch. 160.400 Km nearBoko Junction (3 legged)

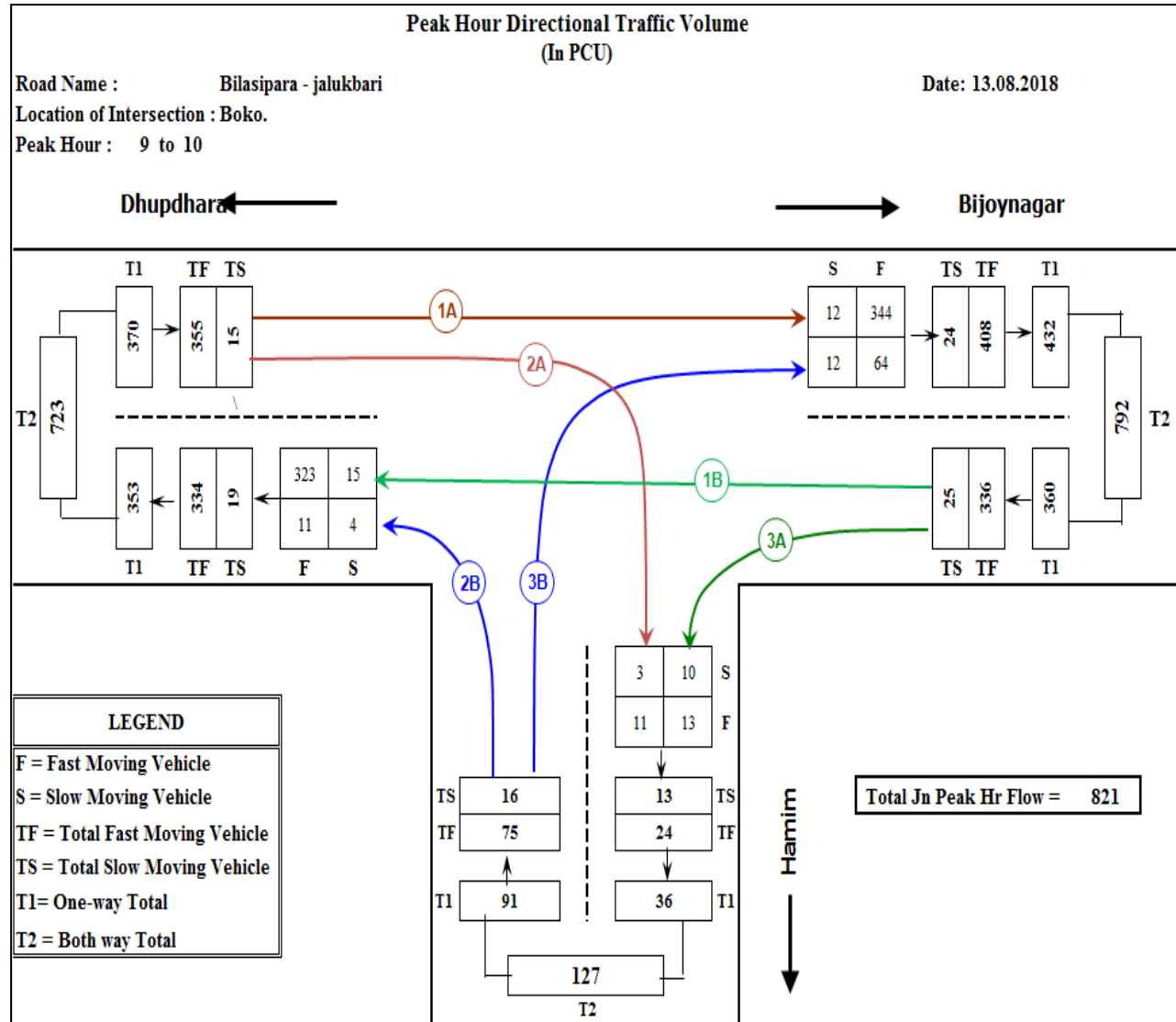


**Fig -7.24(b): Peak hour traffic in PCU at Ch. 160.400 Km near Boko Junction
(3 legged)**

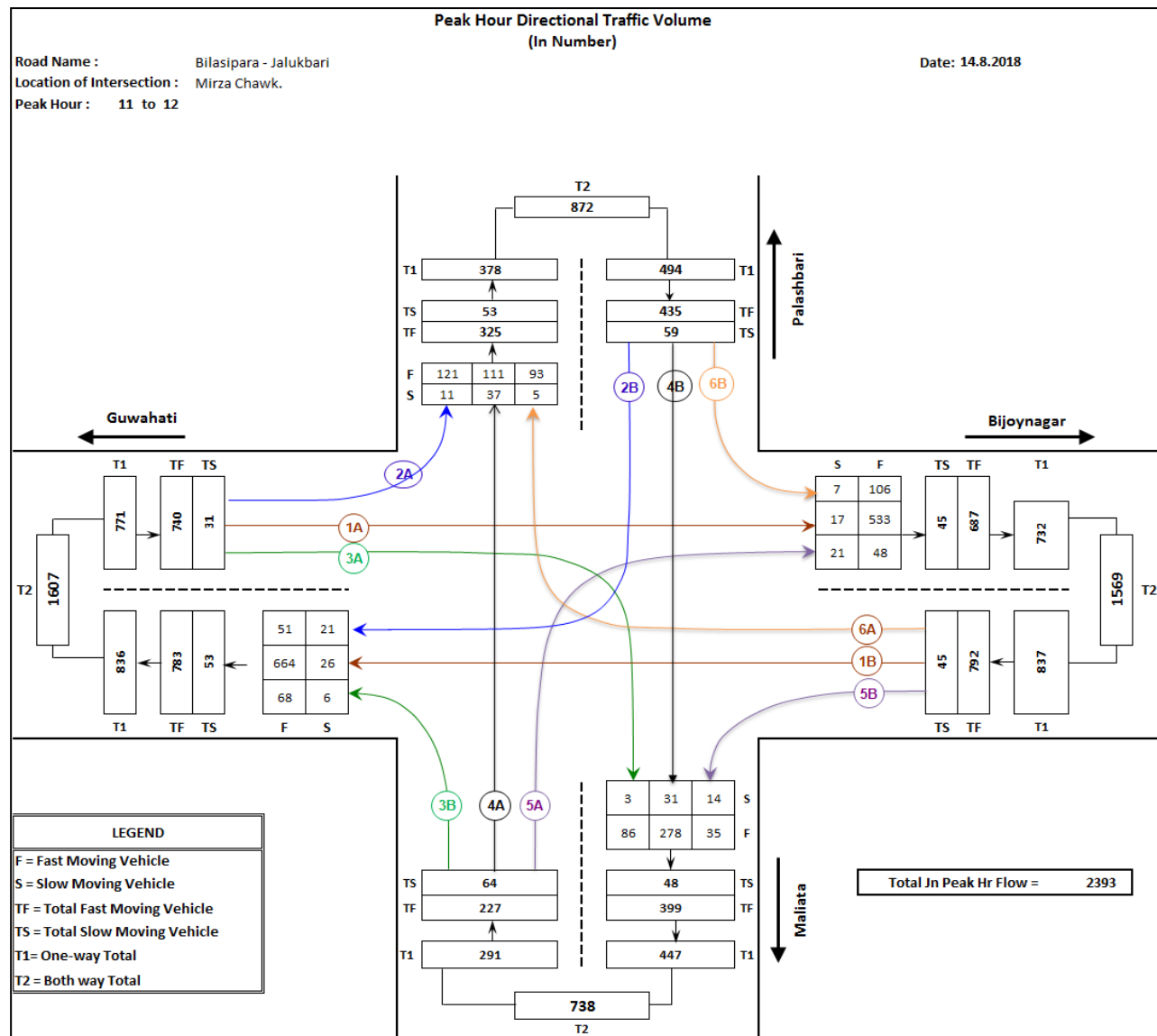


Fig -7.25(a): Peak hour traffic in Number at Ch. 196.900 Km near Mirza Junction (4 legged)

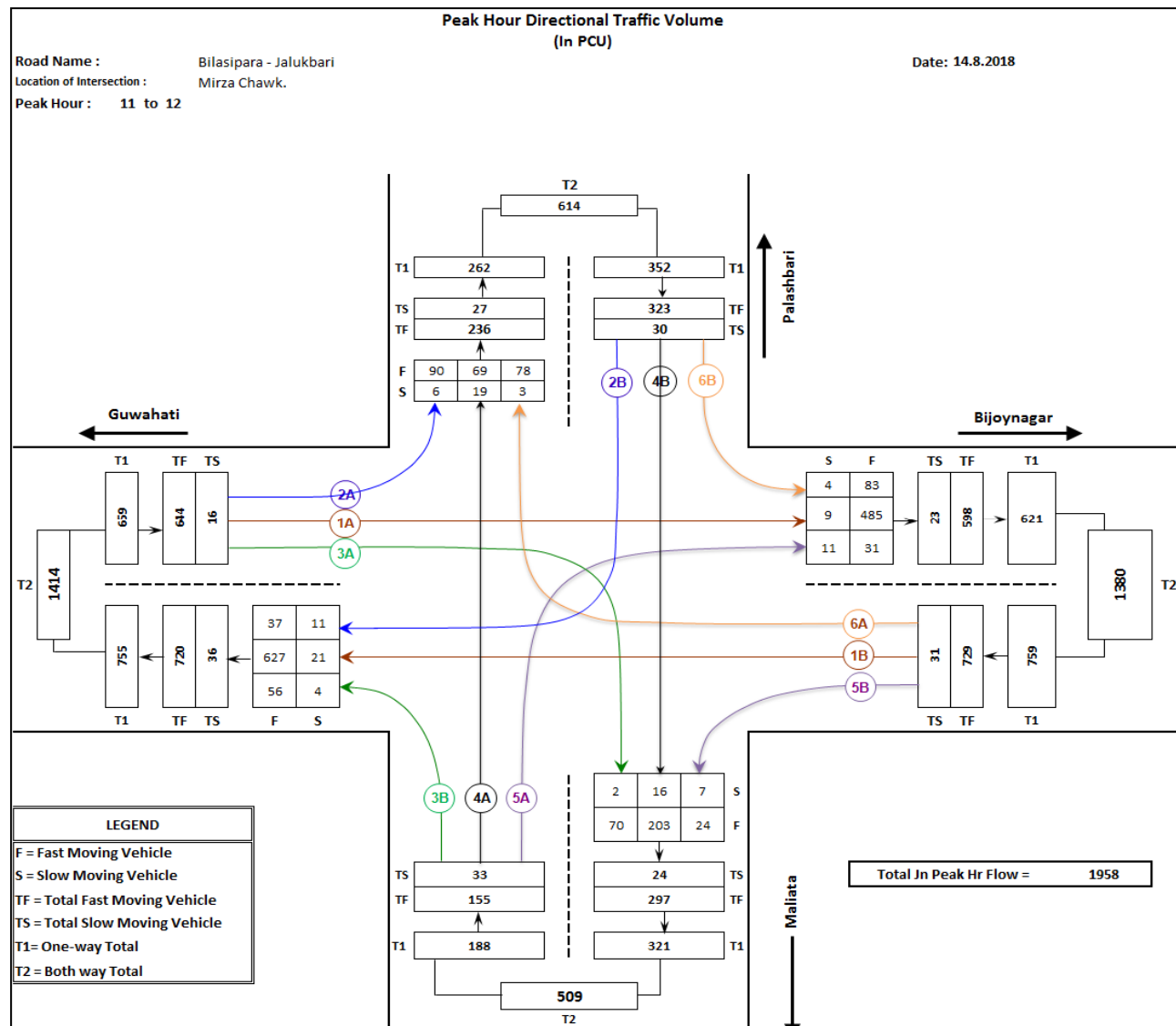


Fig -7.25(b): Peak hour traffic in PCU at Ch. 196.900 Km near Mirza Junction (4 legged)

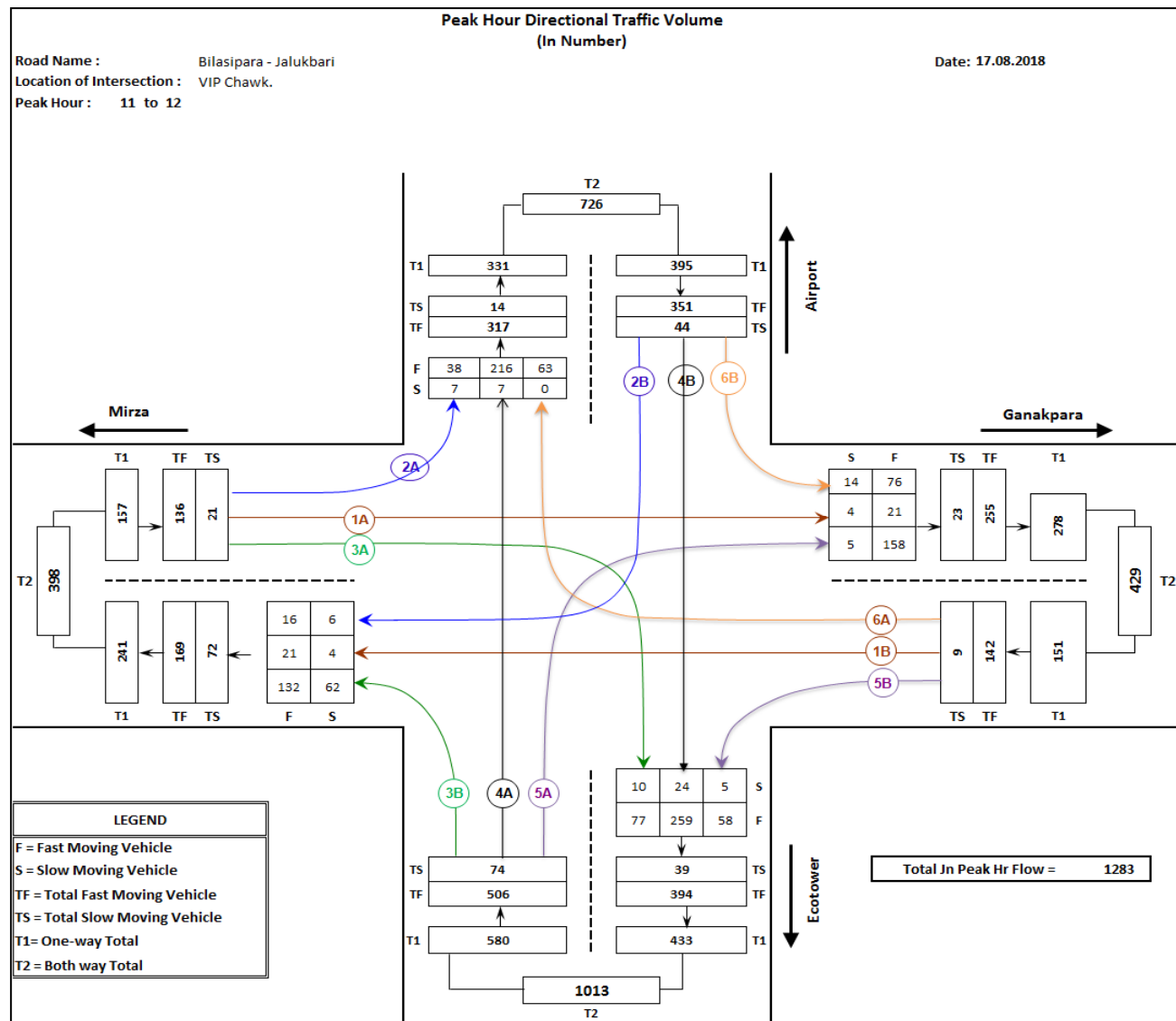


**Fig -7.26(a): Peak hour traffic in Number at Ch. 205.100 Km near Airport Junction
(4 legged)**

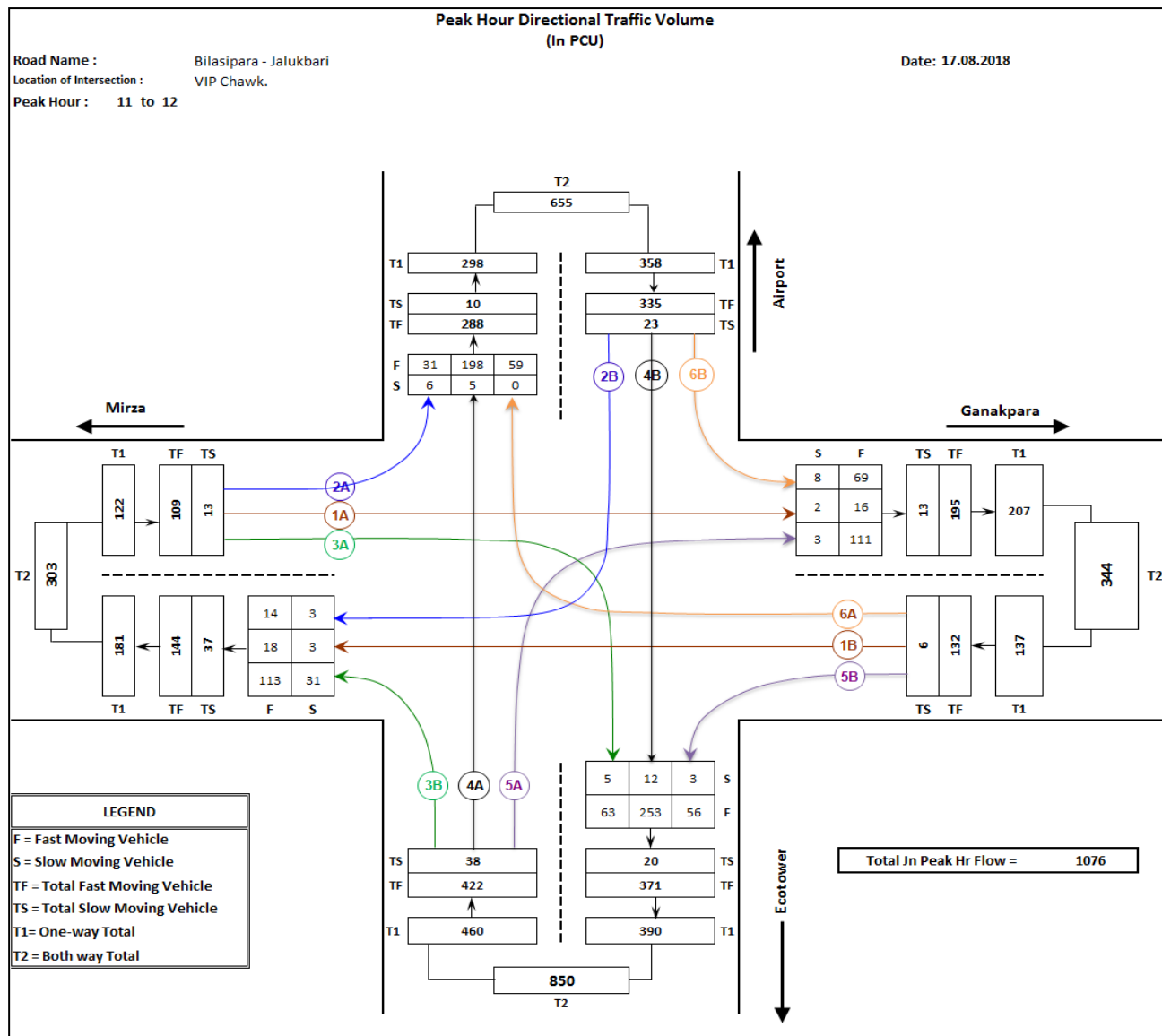


Fig -7.26(b): Peak hour traffic in PCU at Ch. 205.100 Km near Airport Junction (4 legged)

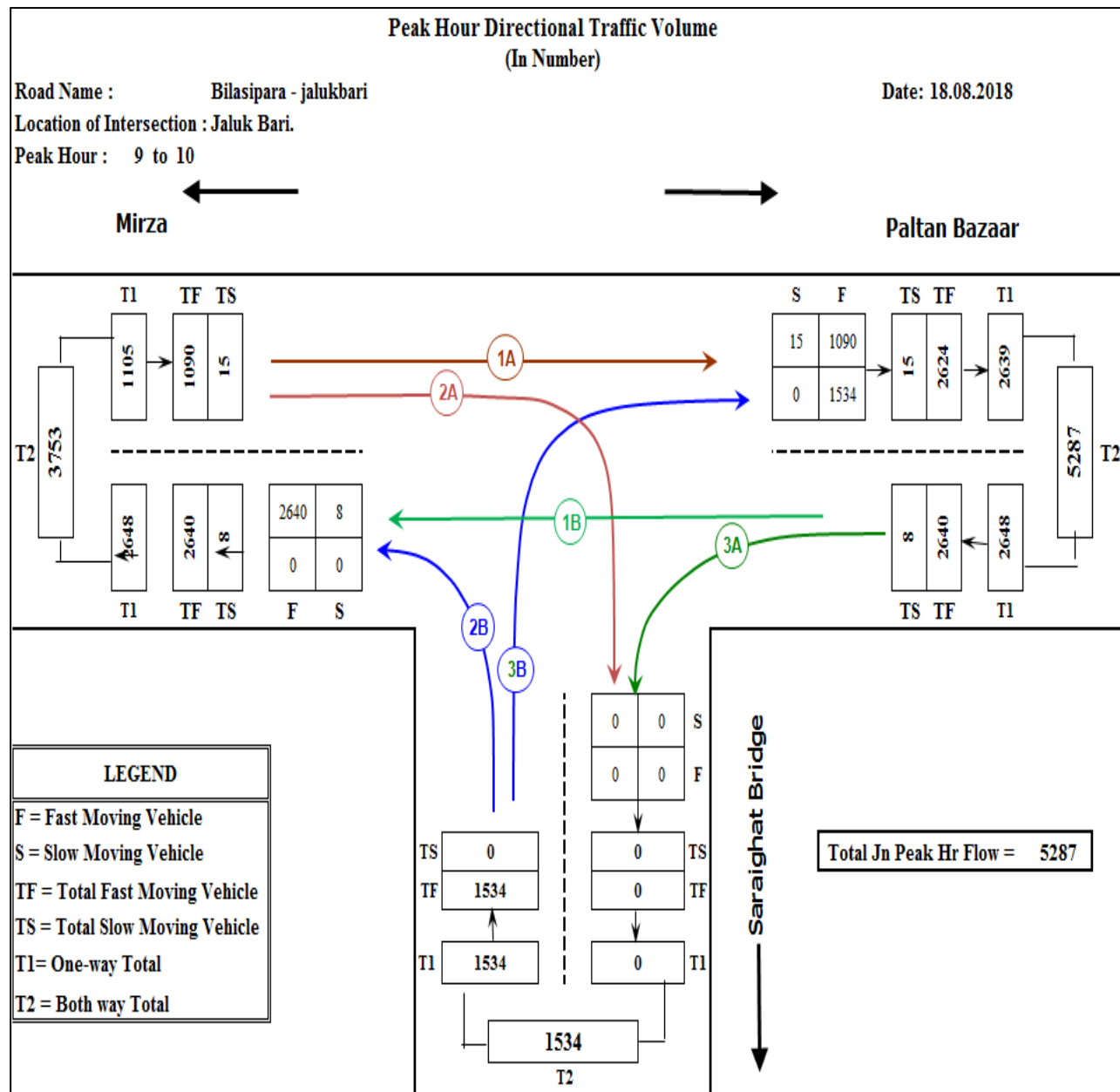


Fig -7.27(a): Peak hour traffic in Number at Ch. 222.200 Km near Jalukbari Junction (3-legged)

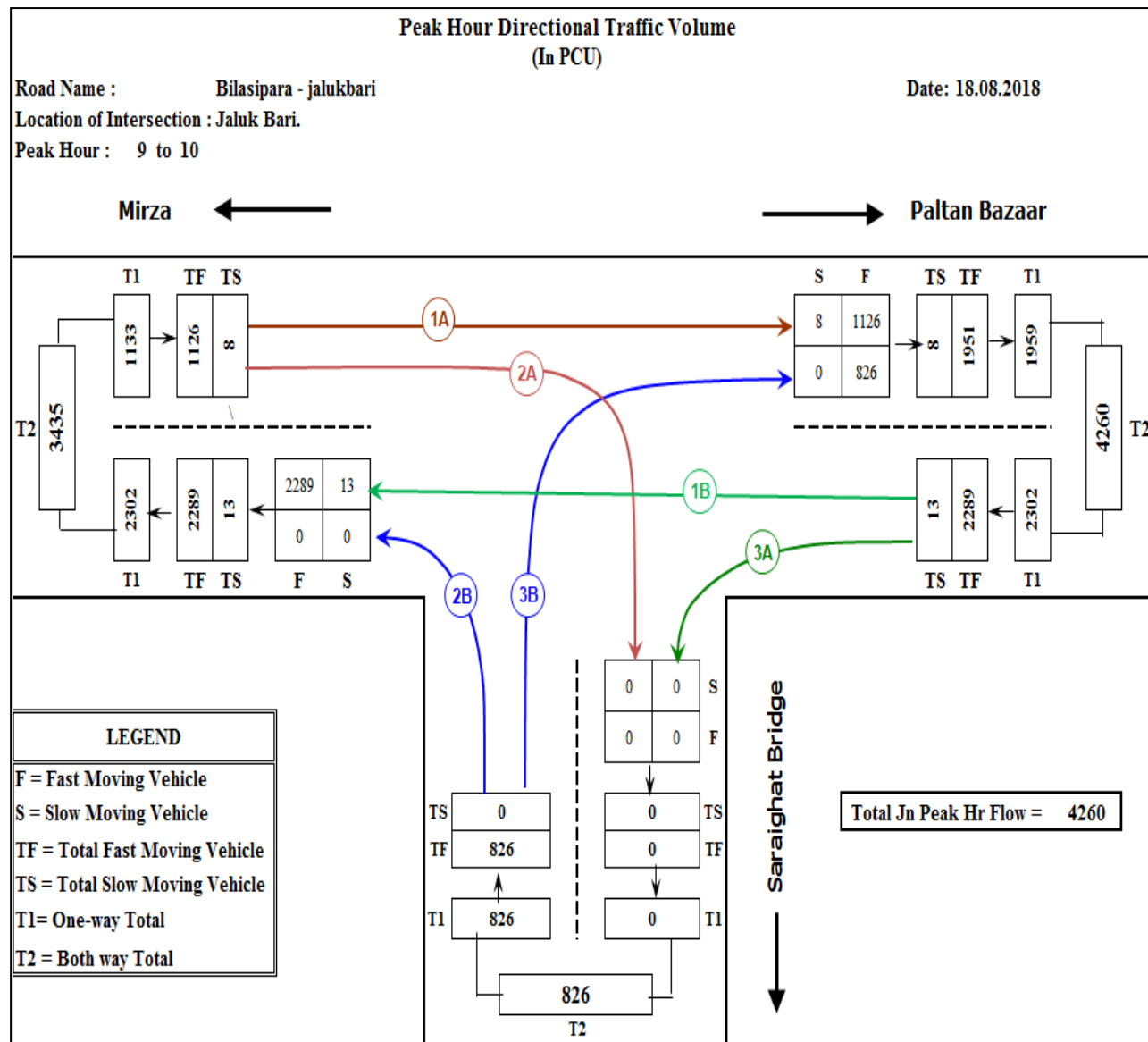


Fig -7.27(b): Peak hour traffic in PCU at Ch. 222.200 Km near Jalukbari Junction (3-legged)

7.7.1 Forecasts of Intersection Turning Movements

Intersection turning movement survey was carried out at the identified major intersection locations on the project road for 1 day x 12 hours. The peak hour turning movement at these major intersections have been calculated. These forecasts consider the likely growth in the traffic at intersection. As per IRC 62-1976, Grade Separator should be provided at intersection of divided rural highway if ADT (fast vehicles) at the cross roads within the next 5 years exceeding 5000 nos. The details on the turning movement counts are given in **Appendix 7.4**. The location wise ADT from turning movement surveys is given Table 7.22(a):

Table -7.22(a): Forecast of Intersection Flow

Sl.No	Name of Intersection	Type	As per IRC 62-1976, Grade Separator should be provided at intersection of divided rural highway if ADT (fast vehicles) at the cross roads within the next 5 years exceeding 5000 nos.						Requirement of proposed improvement
			ADT crossing the through traffic						
			2018	2019	2020	2021	2022	2023	
1	Bilasipura Junction	4-Legged	576	605	635	667	700	735	Not Required
2	North Salmara	3-Legged	383	402	422	443	466	489	Not Required
3	Makri Bazar	4-Legged	421	442	464	487	512	537	Not Required
4	Paikan Junction	3-Legged	235	247	259	272	286	300	Not Required
5	Dudhnoi Junction	4-Legged	1335	1402	1472	1545	1623	1704	Not Required
6	Boko Junction	3-Legged	77	81	85	89	94	98	Not Required
7	Mirza Junction	4-Legged	1386	1455	1528	1604	1685	1769	Not Required
8	Airport Junction	4-Legged	702	737	774	813	853	896	Not Required
9	Jalukbari Junction	3-Legged	3730	3917	4112	4318	4534	4761	Not Required

7.8 PEDESTRIAN COUNT SURVEY

Pedestrian count survey was conducted for 1 day x 12 hours at the following locations on the Project road.

- **PED-1: Ch.0.000 km at Bilasipura Junction(4 legged)**
- **PED-2: Ch.50.700 Km at North Salmara (3 legged)**
- **PED-3: Ch.80.000 km at Makri Bazar (4 legged)**
- **PED-4: Ch.99.450 Km at Paikan Junction (3 legged)**
- **PED-5: Ch.114.900 Km at Dudhnoi Junction (4 legged)**
- **PED-6: Ch.160.400 Km Near Boko Junction (3 legged)**
- **PED-7: Ch.196.900 Km at Mirza Junction (4 legged)**
- **PED-8: Ch.205.100 Km at Airport Junction (4 legged)**
- **PED-9: Ch.222.200 Km at Jalukbari Junction (3 legged)**

Analysis of Pedestrian count survey data is presented below in **Fig 7.28** to **Fig 7.36**.

The details of Pedestrian Count Survey is given in **Appendix-7.5**.

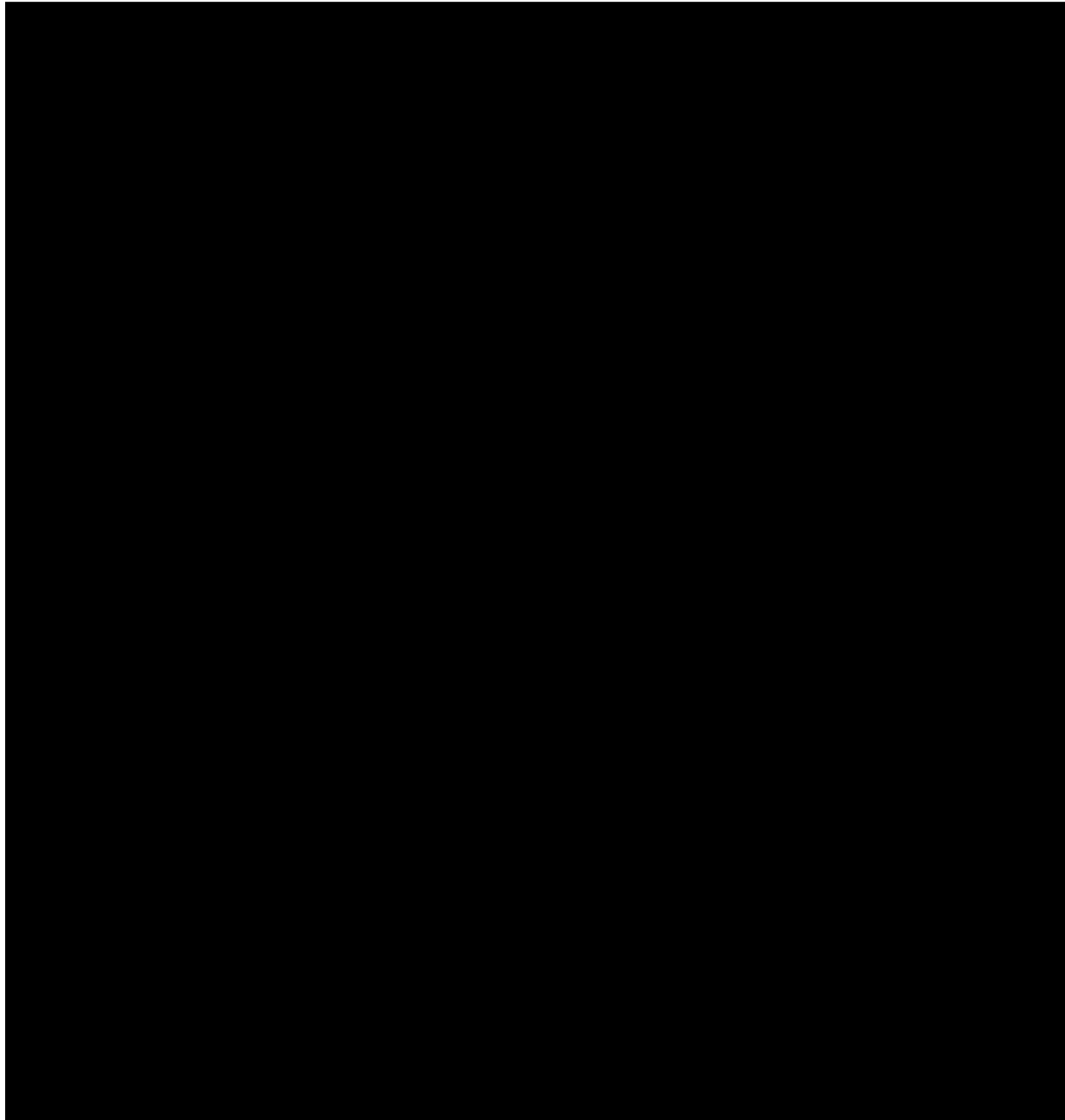


Fig- 7.28: Pedestrian Count Survey at Ch.0.000 km near Bilasipura Junction(4 legged)

PEDESTRIAN COUNT SURVEY										
LOCATION OF SURVEY STATION : North Salmara (Ch. 50+700 Km)										
DATE & DAY OF SURVEY : 10.08.2018										
ROAD NAME- Bilasipara - Jalukbari										
PLACE	COUNT HOURS			Side of Carriageway		Across the Carriageway		Total		Total (in all direction)
				1	2	1A	2A	1+2	1A+2A	
North Salmara	8:00	to	9:00	42	41	24	22	83	46	129
	9:00	to	10:00	47	25	27	19	72	46	118
	10:00	to	11:00	55	49	49	44	104	93	197
	11:00	to	12:00	44	47	19	43	91	62	153
	12:00	to	13:00	57	59	29	40	116	69	185
	13:00	to	14:00	32	64	14	22	96	36	132
	14:00	to	15:00	31	36	49	18	67	67	134
	15:00	to	16:00	41	37	21	37	78	58	136
	16:00	to	17:00	33	47	17	47	80	64	144
	17:00	to	18:00	47	51	49	39	98	88	186
	18:00	to	19:00	49	17	39	40	66	79	145
	19:00	to	20:00	30	28	27	23	58	50	108
TOTAL				508	501	364	394	1009	758	1767
HOURLY AVERAGE PEDESTRIAN				42	42	30	33	84	63	147
PEAK HOURLY PEDESTRIAN	10:00	to	11:00	104		93		197		197

1A, 2A = Across the Carriageway

1, 2 = Side of Carriageway

Fig -7.29: Pedestrian Count Survey at Ch.50.700 Km near North Salmara (3 legged)

***Final Detailed Project Report
Traffic Studies And Demand Forecasts Design***

Fig- 7.30: Pedestrian Count Survey at Ch.80.000 km near Makri Bazar (4 legged)



PEDESTRIAN COUNT SURVEY										
LOCATION OF SURVEY STATION : Paikan (Ch. 99+450Km)										
DATE & DAY OF SURVEY : 08.08.2018										
ROAD NAME- Bilasipara - Jalukbari										
PLACE	COUNT HOURS			Side of Carriageway		Across the Carriageway		Total		Total (in all direction)
				1	2	1A	2A	1+2	1A+2A	
Paikan	8:00	to	9:00	16	20	7	10	36	17	53
	9:00	to	10:00	20	20	10	6	40	16	56
	10:00	to	11:00	30	31	7	9	61	16	77
	11:00	to	12:00	21	42	5	10	63	15	78
	12:00	to	13:00	12	35	11	5	47	16	63
	13:00	to	14:00	17	13	9	7	30	16	46
	14:00	to	15:00	19	11	8	8	30	16	46
	15:00	to	16:00	25	12	6	12	37	18	55
	16:00	to	17:00	16	17	12	10	33	22	55
	17:00	to	18:00	21	20	5	11	41	16	57
	18:00	to	19:00	11	15	9	8	26	17	43
	19:00	to	20:00	9	10	3	2	19	5	24
TOTAL				217	246	92	98	463	190	653
HOURLY AVERAGE PEDESTRIAN				18	21	8	8	39	16	54
PEAK HOURLY PEDESTRIAN	10:00	to	11:00	63		15		78		78
2 ↑ 2A ← Solmari 1 ↓ 1A → Krishnai 1,2 = Side of Carriageway 1A, 2A = Across the Carriageway										

Fig- 7.31: Pedestrian Count Survey at Ch.99.450 Km near Paikan Junction (3 legged)

PEDESTRIAN COUNT SURVEY										
LOCATION OF SURVEY STATION : Dudhnoi (Ch. 114+900 Km)										
DATE & DAY OF SURVEY : 11.08.2018										
ROAD NAME- Bilasipara - Jalukbari										
PLACE	COUNT HOURS			Side of Carriageway		Across the Carriageway		Total		Total (in all direction)
				1	2	1A	2A	1+2	1A+2A	
Dudhnoi	8:00	to	9:00	67	62	15	17	129	32	161
	9:00	to	10:00	74	78	18	15	152	33	185
	10:00	to	11:00	82	82	10	23	164	33	197
	11:00	to	12:00	60	58	19	15	118	34	152
	12:00	to	13:00	86	62	11	21	148	32	180
	13:00	to	14:00	62	86	10	18	148	28	176
	14:00	to	15:00	74	64	12	21	138	33	171
	15:00	to	16:00	70	64	23	11	134	34	168
	16:00	to	17:00	46	32	6	14	78	20	98
	17:00	to	18:00	29	28	11	7	57	18	75
	18:00	to	19:00	22	20	13	13	42	26	68
	19:00	to	20:00	19	15	8	5	34	13	47
TOTAL				691	651	156	180	1342	336	1678
HOURLY AVERAGE PEDESTRIAN				58	54	13	15	112	28	140
PEAK HOURLY PEDESTRIAN	10:00	to	11:00	164		33		197		197
1A, 2A = Across the Carriageway 1,2 = Side of Carriageway										

Fig- 7.32: Pedestrian Count Survey at Ch. 114.900 Km near Dudhnoi Junction (4 legged)

PEDESTRIAN COUNT SURVEY										
LOCATION OF SURVEY STATION : Boko (Ch. 160+400Km)										
DATE & DAY OF SURVEY : 13.08.2018										
ROAD NAME- Bilasipura Jalukbari										
PLACE	COUNT HOURS			Side of Carriageway		Across the Carriageway		Total		Total (in all direction)
				1	2	1A	2A	1+2	1A+2A	
Boko	8:00	to	9:00	19	15	8	9	34	17	51
	9:00	to	10:00	29	25	12	12	54	24	78
	10:00	to	11:00	38	29	9	10	67	19	86
	11:00	to	12:00	24	32	11	9	56	20	76
	12:00	to	13:00	30	27	24	17	57	41	98
	13:00	to	14:00	29	19	9	18	48	27	75
	14:00	to	15:00	21	23	10	12	44	22	66
	15:00	to	16:00	27	35	26	8	62	34	96
	16:00	to	17:00	28	20	17	17	48	34	82
	17:00	to	18:00	23	18	9	16	41	25	66
	18:00	to	19:00	15	16	10	4	31	14	45
	19:00	to	20:00	9	8	6	3	17	9	26
TOTAL				292	267	151	135	559	286	845
HOURLY AVERAGE PEDESTRIAN				24	22	13	11	47	24	70
PEAK HOURLY PEDESTRIAN	12:00	to	13:00	57		41		98		98

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Fig- 7.33: Pedestrian Count Survey at Ch. 160.400 Km near Boko Junction (3 legged)

PEDESTRIAN COUNT SURVEY										
LOCATION OF SURVEY STATION : Mirza Chowk										
DATE & DAY OF SURVEY : 14.08.2018										
ROAD NAME- Bilasipara - Jalukbari										
PLACE	COUNT HOURS			Side of Carriageway		Across the Carriageway		Total		Total (in all direction)
				1	2	1A	2A	1+2	1A+2A	
Mirza Chowk	8:00	to	9:00	66	69	11	19	135	30	165
	9:00	to	10:00	83	79	16	14	162	30	192
	10:00	to	11:00	90	80	10	22	170	32	202
	11:00	to	12:00	88	56	17	18	144	35	179
	12:00	to	13:00	87	63	10	16	150	26	176
	13:00	to	14:00	61	87	14	20	148	34	182
	14:00	to	15:00	70	89	9	18	159	27	186
	15:00	to	16:00	72	65	23	11	137	34	171
	16:00	to	17:00	49	34	15	11	83	26	109
	17:00	to	18:00	33	37	10	7	70	17	87
	18:00	to	19:00	16	29	7	11	45	18	63
	19:00	to	20:00	12	18	5	5	30	10	40
TOTAL				727	706	147	172	1433	319	1752
HOURLY AVERAGE PEDESTRIAN				61	59	12	14	119	27	146
PEAK HOURLY PEDESTRIAN	10:00	to	11:00	170		32		202		202

1A, 2A = Across the Carriageway

1, 2 = Side of Carriageway

Fig- 7.34: Pedestrian Count Survey at Ch. 196.900 Km near Mirza Junction (4 legged)

PEDESTRIAN COUNT SURVEY										
LOCATION OF SURVEY STATION : VIP Chowk										
DATE & DAY OF SURVEY : 17.08.2018										
ROAD NAME- Bilasipara - Jalukbari										
PLACE	COUNT HOURS			Side of Carriageway		Across the Carriageway		Total		Total (in all direction)
				1	2	1A	2A	1+2	1A+2A	
VIP Chowk	8:00	to	9:00	39	44	18	11	83	29	112
	9:00	to	10:00	49	59	21	16	108	37	145
	10:00	to	11:00	55	70	17	19	125	36	161
	11:00	to	12:00	64	59	14	15	123	29	152
	12:00	to	13:00	41	47	21	10	88	31	119
	13:00	to	14:00	50	59	10	13	109	23	132
	14:00	to	15:00	62	46	16	19	108	35	143
	15:00	to	16:00	37	59	19	12	96	31	127
	16:00	to	17:00	34	47	11	10	81	21	102
	17:00	to	18:00	29	34	5	13	63	18	81
	18:00	to	19:00	31	29	10	9	60	19	79
19:00	to	20:00	12	16	8	6	28	14	42	
TOTAL				503	569	170	153	1072	323	1395
HOURLY AVERAGE PEDESTRIAN				42	47	14	13	89	27	116
PEAK HOURLY PEDESTRIAN	10:00	to	11:00	125		36		161		161

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Fig- 7.35: Pedestrian Count Survey at Ch. 205.100 Km near Airport Junction (4 legged)

PEDESTRIAN COUNT SURVEY										
LOCATION OF SURVEY STATION : Jalukbari (Ch. 222+200 Km)										
DATE & DAY OF SURVEY : 18.08.2018										
ROAD NAME- Bilasipara - Jalukbari										
PLACE	COUNT HOURS			Side of Carriageway		Across the Carriageway		Total		Total (in all direction)
				1	2	1A	2A	1+2	1A+2A	
Jalukbari	8:00	to	9:00	8	5	5	5	13	10	23
	9:00	to	10:00	15	10	8	9	25	17	42
	10:00	to	11:00	25	16	8	12	41	20	61
	11:00	to	12:00	16	20	5	10	36	15	51
	12:00	to	13:00	20	18	9	7	38	16	54
	13:00	to	14:00	17	25	7	6	42	13	55
	14:00	to	15:00	24	18	9	4	42	13	55
	15:00	to	16:00	20	12	5	7	32	12	44
	16:00	to	17:00	24	16	8	5	40	13	53
	17:00	to	18:00	16	10	5	5	26	10	36
	18:00	to	19:00	11	13	2	4	24	6	30
	19:00	to	20:00	8	5	1	2	13	3	16
TOTAL				204	168	72	76	372	148	520
HOURLY AVERAGE PEDESTRIAN				17	14	6	6	31	12	43
PEAK HOURLY PEDESTRIAN	10:00	to	11:00	41		20		61		61

1A, 2A = Across the Carriageway

2A ← Sivasagar

1A → Kakotibari

1,2 = Side of Carriageway

Fig- 7.36: Pedestrian Count Survey at Ch. 222.200 Km near Jalukbari Junction (3 legged)

Table-7.23(a): Total Cross Pedestrian at project road

SI No	Location	Total Cross Pedestrian (TCP)	Peak Hr. Pedestrian (P)	Total Motorized Traffic during Pedestrian Peak Hour (V)	P.V ²	Limiting value of P.V ²
1	Bilasipura Junction	372	48	492	0.1162	1X10 ⁸
2	North Salmara	758	93	492	0.2251	1X10 ⁸
3	Makri Bazar	414	55	537	0.1586	1X10 ⁸
4	Paikan	190	22	654	0.09409	1X10 ⁸
5	Dudhnoi	336	34	551	0.10334	1X10 ⁸
6	Boko	286	41	819	0.2750	1X10 ⁸
7	Mirza Chowk	319	35	559	0.1094	1X10 ⁸
8	Airport Junction	323	37	2254	1.8797	More than 1X10 ⁸
9	Jalukbari	148	20	2985	1.7820	More than 1X10 ⁸

From table 7.23(a), it is observed that P.V² value of seven locations are within the limiting value as mentioned in IRC:103-1998. Therefore, there is no need of providing any pedestrian underpass at those seven locations. However, proper traffic safety measurement will be recommended at these locations.

PV² value of two locations (VIP Chowk & Jalukbari) are exceeding the limiting value as mentioned in IRC:103-1998. Therefore, requirement of Grade Separator is prevailed in the above said two locations.

Finally, following improvement proposal have been suggested for the said nine locations in Table 7.23(b):

7.9 SPEED DELAY SURVEY

Speed delay survey has been carried out throughout the project stretch; summary of this survey is prescribed in **Table 7.23(a)** and **Table 7.23(b)**

Table- 7.23(a): Average Journey Speed of Project Stretch

Project : Consultancy Services for Preparation of DPR for development of Economic corridors, Inter corridors and Feeder Routes to improve the Efficiency of Freight movement in India under Bharatmala Pariyojana (Lot-1/Package-1A) in the state of Assam														
Section : One		From : Bilasipara				To : Dudhnoi								
Direction	Journey Time		Stopped Delay		No. of Vehicles			Overtaking (-) Overtaken (ny)	Average journey Time in min. (tw)	Average Journey Time from opp. Stream (ta)	Average Volume $q = (na + ny) / (ta + tw)$	Average Journey Time $t = tw - (ny/q)$	Length of Travel in km (L)	Average Journey Speed = $L/t \times 60$ (km/hr)
	Min	Sec	Min	Sec	Over-taking	Over-taken	From opp. Direction (na)							
BI-DU	135	25	1	30	16	9	352	4.64	138.06	142.25	1.33	134.56	114.80	51.19
	146	48	1	23	11	6	369							
	132	58	3	15	10	8	381							
	Total	414	11	6	37	23	1102							
Mean	138	3.66	2	2.66	12.3	7.66	367.3							
DU-BI	142	55	1	35	7	12	386	-1	142.25	138.06	1.29	143.03	114.80	48.16
	138	50	1	40	13	15	349							
	145	0	1	20	9	5	351							
	Total	426	45	4	35	29	1086							
Mean	142	15	1.33	11.66	9.6	10.6	362							

Table- 7.23(b): Average Journey Speed of Project Stretch

SPEED DELAY SURVEY FOR DETERMINING AVERAGE TRAVEL & JOURNEY SPEED														
Project :		Consultancy Services for Preparation of DPR for development of Economic corridors, Inter corridors and Feeder Routes to improve the Efficiency of Freight movement in India under Bharatmala Pariyojana (Lot-1/Package-1A) in the state of Assam												
Section : One		From : Dudhnoi			To : Jalukbari									
Direction	Journey Time		Stopped Delay		No. of Vehicles			Overtaking (-) Overtaken (ny)	Average Journey Time in min. (tw)	Average Journey Time from opp. Stream (ta)	Average Volume $q = (na + ny) / (ta + tw)$	Average Journey Time $t = tw - (ny/q)$	Length of Travel in km (L)	Average Journey Speed = $L/t \times 60$ (km/hr)
	Min	Sec	Min	Sec	Over-taking	Over-taken	From opp. Direction (na)							
DU - JA	130	42	4	45	12	8	790	-1.67	135.52	128.17	3.13	136.05	99.50	43.88
	135	0	2	25	18	24	881							
	140	55	5	0	9	12	809							
	Total	406	37	12	39	44	2480							
Mean	135	32.33	4	3.33	13	14.67	826.67							
DU - JA	129	46	2	20	15	10	672	1.33	128.17	135.52	2.77	127.69	99.50	46.75
	125	55	0	35	10	15	792							
	128	51	1	20	15	11	726							
	Total	384	32	4	40	36	2190							
Mean	128	10.66	1	25	13.33	12	730							

CHAPTER – 8

SOCIAL IMPACT ASSESSMENT

8.0 INTRODUCTION AND BACKGROUND

The Project Road starts near Chirakuta and ends at Jalukbari interchange in Guwahati. The total length of the existing road stretch is 209.998km(As per Topographic survey). The project road comes under Dhubri districts of Assam

The project road connects important market/Town Bilasipura, Chapar, Tulungia, Jogighopa, Krishnai, Dudhnoi, Dhupdhara, Boko, Chayagaon, Bijoynagar, Mirza & Guwahati. The project road also connects the proposed MMLP at Jogighopa.

The Package-1 of the project road starts near Chirakuta and ends Near Mowatari, before Chapar Bypass (Ex.Ch.5.580km to Ex.Ch.25.633km). The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain.

J. Moulvi



Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A (**Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam**)

**Final Detailed Project Report
Social Impact Assessment**

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Figure 1: Location Map of the Project Road



Assam

Assam is located south of the eastern Himalayas situated between 8905/-960 1/ East Longitude and 2403/-27058/ North Latitude. It can be divided into three principal geographical regions: the Brahmaputra Valley in the north; the Barak Valley in the south; and the Karbi Anglong and Cachar Hills that divide the two regions with a total area of 30,285 square miles (78,440 km²). Assam is surrounded by six of the other Seven Sister States: Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, and Meghalaya. Assam is the sentinel of north-east India and gateway to the North-Eastern States. Assam also shares international borders with Bhutan and Bangladesh.

The state is the rich, green land of rolling plains and dense forests is the gateway to the north eastern part of India. The mighty Brahmaputra river that has its origins in Tibet charts its majestic course through this state. This mystic land of eternal blue hills and beautiful rivers is renowned for its tea, rich flora and fauna, the world famous one horned rhinoceros and other rare species of wildlife on the verge of extinction. Barring Africa, there is perhaps no part of the world where such a variety of wildlife exists.

Assam is well connected by a network of national highways and other roads to important places within the state and other major cities in the country. Assam comprises of approximately 40342 km of road network including 2841 km of national highway.

Guwahati, the capital of Assam has good quality roads that are accessible and connected with major cities and towns in India. The National Highway Number 31, 37, 38, 40 and 52 links the state of Assam with other states and cities.

TABLE-1: SOCIO-ECONOMIC PROFILE OF ASSAM

Sl.	Description	Assam 2011
1	Population size	31205576
2	Population size (Males)	15939443
3	Population size (Females)	15266133
4	Population size (Rural)	26807034
5	Population size (Urban)	4398542
6	Population density (Total, Persons per sqkm)	398
7	Sex ratio (Females per 1000males)	958
8	Population size, 0 - 6 yrs	4638130
9	Sex ratio, 0 - 6 yrs (Females per 1000 males)	962
10	Literacy rate, 7+ yrs (Persons, Per cent)	72.19
11	Literacy rate, 7+ yrs (Males, Per cent)	77.85
12	Literacy rate, 7+ yrs (Females, Per cent)	66.27

8.1 SCOPE OF LAND ACQUISITION

The existing road is two lane with earthen shoulder on both side. The road is 2 lane configuration. The existing ROW along the project road varies from 11m to 50m. The proposed road is planned for improvement of existing two lane road to 4 lane road.

J. Moulvi



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Proposed ROW is required 35m-50m for the project road. Hence land have to be acquired to provide PROW as required in open areas, bypass area and in built-up area.

New pavement has been designed for widening/New Construction as well as reconstruction portion as per the latest guidelines of IRC applicable for flexible options.

The summary of acquisition of land is given below.

Summary of Land details for PKG-1		
Sl.	Description	Area (Ha)
1	Total Land to be acquired	44.1687
2	Forest Land to be acquired	4.0842
3	Revenue Land to be acquired	40.0845
4	Revenue Land to be acquired (Pvt)	22.0087
5	Revenue Land to be acquired (Govt.)	18.0758

8.2 METHODOLOGY FOR IMPACT ASSESSMENT

The Joint Measurement Survey was carried out by a Joint Team involving officials from Revenue Dept., PWD (Building), Forest, Fisheries, Agriculture and NHIDCL & Consultant etc. The objectives of the Joint Measurement Survey are to assess the affected building/structures & Zirat (Agriculture, Horticulture & Fishery). The survey includes the following:-

- Physical measurements of the affected building/structures
- Physical measurements of the affected asset/Zirat

Compensation amount Determination

- Land – Private Land Owners (Market Rate x Multiplying Factor + Solatium)
- Structure & Zirat
 - On Private Land (Estimate / Valuation + Solatium)
 - On Govt. Land (Estimate / Valuation)

8.3 ENTITLEMENTS, ASSISTANCE AND BENEFITS

Compensation for the lost assets will be evaluated by Competent Authority of Land Acquisition (CALA). An Entitlement Matrix has been formulated, which recognizes and lists various types of losses resulting out of the project and specific compensation.

Sl.	Type of Loss	Unit of	Entitlement	Entitlement Details
LOSS OF LAND				
1.	Loss of Agricultural/ Commercial land	Titleholder / Owner	Applicable	Compensation as per NH Act 1956 & RFCTLARR ACT 2013 & Related Notifications.
LOSS OF STRUCTURE (RESIDENTIAL/COMMERCIAL/OTHER)				
3.	Loss of residential /	Titleholder /	Applicable	Compensation as per NH



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl.	Type of Loss	Unit of	Entitlement	Entitlement Details
	commercial structures	Owner		Act 1956 & RFCTLARR ACT 2013 & Related Notifications.
LOSS OF TREES AND CROPS				
4.	Loss of Trees	Titleholder / Owner	Applicable	Compensation as per NH Act 1956 & RFCTLARR ACT 2013 & Related Notifications.
5.	Loss of Crops, Ponds & Other Assets	Titleholder / Owner	Applicable	Compensation as per NH Act 1956 & RFCTLARR ACT 2013 & Related Notifications.
LOSS OF COMMUNITY INFRASTRUCTURE/COMMON PROPERTY RESOURCES				
6.	Loss of Common Property Resources	Community	Applicable	Compensation as per NH Act 1956 & RFCTLARR ACT 2013 & Related Notifications.

The compensation amount will be awarded by CALA, DC Office to NHIDCL as per Joint Measurement Survey

8.4 CONCLUSIONS

The widening of PKG-1 (Near Chirakuta to Near Mowatari, before Chapar Bypass) of the project road gives an immense scope of development of the region in regards of easy accessibility to all the places of the North Eastern region with comfort and helps in immense development of the Commerce both National and International. Other than the development of the commerce sector there would be easy accessibility of the agricultural surplus of the region and the finished industrial products with the rest the country.

The public consultation on the stakeholders gave the opportunity to address issues, which were already resolved after making appropriate changes in design and alternative finalization. The stakeholders become aware of the development schemes and at the same time influence and share to control over these initiatives, decisions and resources. Community consultations also help to avoid opposition to the project, which is otherwise likely to occur.

[Signature]



CHAPTER – 9 Environmental Impact Assessment

EXECUTIVE SUMMARY

A. Project Background

National Highways and Infrastructure Development Corporation Ltd. (NHIDCL) has been entrusted with the assignment of consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana, for widening to 4-lane with paved shoulder from "Chirakuta to Jalukabari" in the state of Assam.

The Project Road starts near Chirakuta and ends at Jalukbari in Guwahati. The total length of the existing road stretch is 209.998km(As per Topographic survey).The entire road comes under Dhubri, Bongaigaon, Goalpara, Kamrup Rural & Kamrup Metropolitan districts of Assam.

B. Introduction

Roads developmental activities will have an adverse effect on the neighboring Environment of the proposed project. Hence, these activities required to be wellplanned and should consider the environmental impacts.The *Environmental Impact Assessment (EIA)* for the proposed project has been carried out as part of project preparation and in compliance with Environmental Assessment. The project road is located in Assam State of India. The report also briefly describes the *existing environmental conditions in the project area, anticipated environmental impacts and corresponding mitigation measures, process etc.*

C. Project description

The Project Road starts near Chirakuta and ends at Jalukbari in Guwahati. The total length of the existing road stretch is 209.998km (based on Topographic Survey). The entire road comes under Dhubri, Bongaigaon, Goalpara, Kamrup Rural & Kamrup Metropolitan districts of Assam

The PKG-1 of the project road starts near Chirakuta and ends near Mowatari, before Chapar bypass)(Ex.Ch.5.580km to Ex.Ch.25.633km). The Design length of the package-1 is 17.737km (Design Ch. 0.000km to Ch. 17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain. The proposed road is planned for improvement of existing 2 lane road to 4 lane road.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Salient Features of Proposed Road Project for PKG-1

1	Name of the Project	:	Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana (Lot-1) Package 1A, from Ex. Ch.5.580km to Ex. Ch.25.633km (Design Ch.0.000km to Ch.17.737km) near Chirakuta to near Mowatari, before Chapar Bypass (Package-1) of Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road in the State of Assam		
2	Location of the proposed project	:	State		District
			Assam		Dhubri
3	Number of village along the project road	:	10 Numbers		
4	Total Length of the project road	:	20.053 KM (based on Topographic Survey)		
5	Terrain	:	Plain		
6	Seismic Zone	:	Zone-V		
7	Geographical Location	:		Starting point	End point
			Latitude	26°13'58.99"N	26°15'55.12"N
			Longitude	90°16'47.91"E	90°26'12.64"E
8	Bridges		Proposed Bridges		
			Major Bridges- Nil.		Minor Bridges-10Nos.
9	Proposed Culverts		54Nos.		
10	Proposed Junction		Nil		
11	Overpasses, Underpasses/Flyover/Viaduct/ROB		VUP-2 Nos., SVUP-5 Nos., VOP-1Nos., ROB - 1 No, Flyover - 1 no & Viaduct -3 nos		
12	Right of Way (m)		35m-50m (Proposed)		
13	Design Speed		80-100kmph		
14	Toll Plazas		1No.		
15	Carriageway		4 lane divided carriageway with paved shoulder		
16	Land Use		Mainly agricultural land and some settlement area have been observed.		
17	Forest Stretch		Theaffected length of forest stretch=2.169Km		
18	Number of trees affected		Total 4392(Approx) numbers of trees		

D. Need of the Project

The project Road will provide better connectivity as it reduces the travel time. Improvement of existing road from two lane to 4 lane configurations will provide better, fast, safe and smooth connectivity to neighboring state. Smooth and fast-moving traffic will cause only lower emissions thereby reducing pollution levels. This economic corridor also provides connectivity to Upper Assam and Lower Assam (via NH27) with the neighboring states. The project road also connects important town Bilasipura, Tulungia, Jogighopa, Gendra, Paikan, Dudhnoi, Boko & Mirza, Guwahati.

S. Mulya



E. Limitation of the Project

As defined in the scope of works baseline data on various physical, biological and social-economic aspects have been collected, analyzed and compiled in order to get the true picture of the existing environment condition in the project influence area. Impact on noise and air in operation stage will be updated after complication of baseline monitoring.

F. Policies, Legal and Administrative Framework

F.1. Institutional Setting

The project has been initiated and is being carried out by the Bharatmala Pariyojana. The primary responsibility of the project rests with the NHIDCL providing encumbrance free ROW to the concessionaire who will implement the project.

F.2. Clearances

EIA notification was issued by Ministry of Environment, Forests and Climate Change (MoEF&CC) in 2006. The project road is a national highway, passing through few habitation areas, forest area and length of the project road is 209.998km (As per Topographic Survey). Under the MoEF EIA Notification 2006 and Subsequent amendments, **Environment Clearance** is not required

- Package Length is 20.053Km.
- Even if we consider total existing length of 209.998km (Chirakuta to Guwahati), the additional Land Acquisition is (i) less than 40m on existing and (ii) less than 60m on bypass.
- Also, the road is not a new National Highway Project.

As part of the project preparations, the Project Proponent shall take the following clearances and NOCs:

- Tree felling permission has to be taken from the respective **Divisional Forest Officer**. For road projects, 10 trees are planted for each tree felled.

Apart from the clearances required to be obtained by the Project Proponent, the concessionaire and contractor shall also obtain following clearances, NOCs and licenses prior to the commencement of construction. These are:

- NOC and Consents under **Air, Water, EP Acts & Noise rules of SPCB** for establishing and operating hot-mix plants, batching from SPCB.
- NOC under **Hazardous Waste (Management and Handling) Rules, 1989** from SPCB
- PUC certificate for use of vehicles (including JCB, tractors, etc.)for construction from Department of Transport
- Quarry lease deeds and license and Explosive license from **Dept. of Geology and Mines & Chief controller of explosives**
- NOC for water extraction for construction and allied works from **Ground Water Authority**

Apart from the above clearances, the concessionaire also has to comply with the following:

- Clearance of Engineer for location and layout of Worker's Camp, Equipment yard and Storage yard.
- Clearance of Engineer for **Traffic Management Plan** for each section of the route after it has been handed over for construction.
- An **Emergency Action Plan** should be prepared by the contractor and approved by the Engineer for accidents involving **fuel & a lubricant before the construction starts**

- Submit a **Quarry Management Plan** to the Engineer along with the Quarry lease deeds.

G. Baseline Environmental Profile

For base-line data collection, an area covering 500 m radius from the proposed alignment as the centre has been considered as per EIA guidelines published by the MoEF&CC, Govt. of India. Baseline data of prominent environmental attributes like ambient air, water quality, soil, geology, noise, meteorology, socio-economic features, land use etc. will be collected.

G.1. Meteorology

The project road comes under Dhubri, Bongaigaon, Goalpara, Kamrup Rural & Kamrup Metro districts of Assam. The Package-1 is comes under Dhubri District of Assam. The climate of the all project district is almost same.

The climate of the project districts is warm and temperate. The summers are much rainier than the winters in the projects. The cold season starts in the district from the end of November when both the day and night temperature begin to fall sharply. The temperature generally goes down to the minimum points in the months of December, January and February.

G.2. Air Environment

Ambient air quality in the state is quite pure compared to other neighbouring states. Ambient air quality for particulate matters (PM10 and PM2.5), SO₂, NO_x & CO was monitoring at 9 locations along the project road. out of nine locations of air monitoring the PM10 and PM2.5 concentration at AAQM 2, AAQM 3 and AAQM 4 marginally exceeds permissible limits. While at other locations the PM10 and PM2.5 conc. is well within limits. Other parameters monitored i.e. NO_x, SO₂, CO were found within the permissible limits for all the locations. Overall, the air quality in the project area in not an issue.

G.3. Water Environment:

The development of any region is contingent on the availability of sufficient water resources, as developmental activities require water for irrigation, domestic and other purposes. The water resources in the area broadly fall into following categories

- Surface Water resources: River and Ponds.
- Ground Water resources: Hand pump

Surface Water & Ground Water: In order to represent the true profile of the project area, samples from major surface water source through which the project road runs were collected and analysed as per IS- 2488 (Part I-V). Ground water (drinking water) samples were analysed as per IS: 10500-1991. Results show that the pH of the sampled water in the region is well within permissible limits (6.5 – 7.5).

BOD level for all analysed water samples is higher than the permissible standards. Other parameters analysed like chloride, sulphate, fluorides are found well within standards. Overall the ground water quality in the project areas in good.

G.4. Noise Environment

It has been observed that noise levels are within the prescribed limits of CPCB, as normally observed in other National highways. Noise, though is a major area of concern, at locations of sensitive receptors (educational establishments like schools and colleges, hospitals) identified quite close to the road especially within the urban areas.

G.5. Soil Environment

The characteristics of soil of the project area (Bilasipura-Guwahati roadcorridor) vary from place to place due to topographical variations. The soil in general is loamy sand to silty clay loam with a depth of 30 cm to 100 cm and in some cases even more than 120 cm. It has less water holding capacity and is dry in nature.

G.6. Ecology

Ecological resources are among the most important resources impacted by the road projects. The detailed baseline study of the ecological resources is essential to estimate the magnitude of potential impacts and to avoid or mitigate any loss caused by the proposed project. In this section baseline details of the flora and fauna are presented. There are no endangered species of flora and fauna present within the project influence area.

G.7. Socio-Economic Environment

The prevailing status of socio-economic aspect comprises of demographic profile, Infrastructure, socioeconomic condition, literacy level and lifestyle, etc. The proposed project will definitely have some positive impact on the socio-economic environment of the people of surrounding villages experiencing development in the study area.

H. Public Interactions and Consultation

The main purposes of these consultations are to understand the community's reaction to the perceived impact of proposed project on the people at individual and settlement level. Both formal and informal modes of consultation were used in the public consultation process for the project. On-site discussion with project affected stakeholders, and reconnaissance visits have also been made to the project areas. The attempts were made to encourage participation in the consultation process of the Government officials from different departments that have relevance to the project.local people from different socio economic backgrounds in the villages as well as urban areas along the road alignment and at detours, residents near the existing road, women representatives, local commuters, and other concerned were also consulted.

I. Environment Impact Assessment

I.1. Construction Phase:

The impact during construction will be localized and short term with temporary changes in use of surrounding land as compared to the current conditions. Impact will be primarily related to the civil works and less intensive impact is expected during erection of the equipment and trial operation.

Identification of Activities & Probable Impacts (Construction)		
Construction Activities	Environment Attribute	Probable Impacts
Land Acquisition	Land	Change in Land Use Pattern Change in land use pattern in the vicinity
	Socio-economics	Rehabilitation & Resettlement issues
Site clearing and Leveling (cutting, stripping, excavation, earth	Air	Fugitive Dust Emissions Noise/ Air Emissions from machinery constructionequipment and machinery
	Water	Run-off from area
	Land	Loss of top soil Change in Drainage Pattern

Identification of Activities & Probable Impacts (Construction)		
Construction Activities	Environment Attribute	Probable Impacts
movement, compaction)	Ecology	Loss of vegetation/ habitat
Transportation and Storage of Construction Material / Equipment	Air	Noise and Air Emissions from Vehicles Fugitive Dust Emissions due to Traffic Movement
	Water	Run-off from Storage Areas of Construction Material
	Public Utilities	Increased flow of traffic
Civil Construction Activities	Air	Noise and Air Emissions from Construction Machinery Fugitive Dust Emissions
	Water	Run-off from Construction Areas
Mech. and Elec. Erection Activities	Air	Noise and Air Emissions from Machines/ activities
	Water	Run-off from Erection Areas containing Oils, Paints
Transportation and Disposal of Construction Debris	Air	Noise and Air Emissions from Transport Vehicles Fugitive Dust Emissions due to Movement of Traffic Spillage and fugitive emissions of debris materials
	Water	Run-off from Disposal Areas
	Soil	Conversion of land into waste land

1.2. Operation Phase:

Air: Potential impact on the air quality during the construction stage will be due to fugitive dust and the exhaust gas generated in and around the construction site.

Dust is major component of the air pollution, generated mainly from the following construction activity.

- Site clearance and use of heavy vehicle and machinery/ equipment etc. at construction site;
- Procurement and transport of construction materials such as sand, cement, etc. to the construction site.
- Other gaseous emission during construction results from the opening of construction vehicles, plant and equipments.

Prediction of Air Impacts

During construction, and at the micro-level only, air quality may be degraded by generation of dust (PM) and generation of polluting gases including SO₂, NO_x and HC for short periods from vehicular movements, site clearance, earth filling and material loading and unloading. The impacts are expected to be localised, temporary and confined to construction areas. Care should, however, be taken at sensitive urban locations so that harmful impacts can be minimised. The following actions should be implemented:

- regular check-up and maintenance of construction equipment,
- mixing plants i.e. asphalt, concrete, and bricks, should be operated within the permissible limits of CPCB and WB EHS, and be located away from settlements, the contractor should submit a dust suppression and control programme to the PMU,

- vehicles delivering loose and fine materials should be covered to reduce spills, controlled blasting should be carried out and only with the prior approval of the site Engineer and, if required, PIU,
- bitumen heaters should be used and the use of wood for fuel should be discouraged or prohibited.

Noise: The impact of noise levels from the proposed project on the neighbouring communities is addressed. It has been concluded that both day and nighttimes equivalent noise levels are within the permissible limits right from start of project life. Noise sensitive receptors have been identified along the project road.

Flora:

Impacts:

- Illegitimate felling of trees exists along the project road.
- Over cutting of trees due to negligence in level and lines in the widening process.
- Damage to flora due to unsystematic and unplanned excavation of reverse slope along the project road.

Mitigation Measures:

- Proper planning for additional cutting of trees.
- Afforestation should be carried with proper management and technical planning for successful afforestation programme.
- Existing plantation, along the ROW, should be protected from illegal felling of trees.
- Systematic planning prior to the excavation of reverse slope (if any) along the project road

Fauna

Impacts:

- Loss of shelter for avifauna.
- Aquatic fauna shall be affected due to contamination of Oil and Grease spillage in traffic accidents and release of toxic chemical into the water bodies.

Mitigation Measures:

- Plantations of trees along the highways.
- Contingency plan should be developed to minimize contaminations in traffic accidents.
- Water bodies and wetland should be developed along the highways

I.3. Impacts of green House gas (GHG)

In a constructions phase of the road project, GHG emission has taken place primarily due to: a) Transport emissions, b) Material emissions and c) Machines emissions. It is estimated that this project may result in emission of approximately 21975.05t CO₂ eq of GHG during construction phase.

J. Environmental Management Plan

Project specific environmental management plan has to be prepared for ensuring the implementation of the proposed measures during construction as well as operation phases of the project. The implementation and supervision responsibilities, sufficient allocation of funds, timeframes for anticipated activities etc. have been dealt with in this document, The EMP will eventually form a part of the Contract documents between the NHIDCL and the Concessionaire.

K. Conclusion

From the detailed analysis of the environmental impacts and the proposed preventive measures, it can be concluded that no significant deterioration in the eco-system is likely to occur due to measures to be taken up during construction and operation phase of the project. On the other hand the project is likely to have several benefits like improvement in employment generation and economic growth of the area, by way of improved infrastructure and better socio- economic condition. Hence, the implementation of the project will lead to overall sustainable development in the area.

List of Table

Table 1-1: Package-1 of the details of Project Road.....	1
Table 1-2: Details of the Project road.....	3
Table 1-3: Various environmental components for screening.....	5
Table 1-4: Primary and Secondary Information Sources.....	6
Table 2-1: Summary of existing pavement and carriageway.....	10
Table 4-1: Comparison “with” and “without” project scenario.....	26
Table 5-1: Districts of Package-1	31
Table 5-2: Location of Soil Sampling	35
Table 5-3: Soil Characteristics along the Project Road	35
Table 5-4: National Ambient Air Quality Standards	37
Table 5-5: Details of Ambient Air Quality Monitoring Locations.....	37
Table 5-6: Summary of AAQM Results	38
Table 5-7: Details of Surface Water Quality Monitoring Station	39
Table 5-8: Surface Water Quality Characteristics along the Project Road	40
Table 5-9: Details of Ground Water Quality Monitoring Station.....	42
Table 5-10: Ground Water Quality Characteristics along the Project Road	42
Table 5-11: National Ambient Noise Level Standards	43
Table 5-12: Ambient Noise Level in decibel (A) along the Project Road.....	45
Table 5-13: Forest Cover in the Project Districts (km ²)	46
Table 5-14: Package wise total Numbers of trees	46
Table 7-1: Activity-Impact Identification Matrix.....	52

List of Figure

Figure 1-1: Key map of the Project Road.....	2
Figure 1-2: Methodology of EIA	4
Figure 2-1: Existing Project Road Network.....	9
Figure 7-1: Typical rain water harvesting structure.....	68

List of Annexure

Annexure 1	:	Environmental Monitoring Data

List of Abbreviations

AAQ	: Ambient Air Quality
AAQMS	: Ambient Air Quality Monitoring Station
ASI	: Archeological Survey of India
BOD	: Biochemical Oxygen Demand
BOQ	: Bill of Quantities
CD	: Cross Drainage
CO	: Carbon Monoxide
Ch.	: Chainage
COD	: Chemical Oxygen Demand
CoI	: Corridor of Impact
CPCB	: Central Pollution Control Board
DFO	: Divisional Forest Officer
DLC	: District Level Committee
DPR	: Detailed Project Report
EAC	: Expert Appraisal Committee
EIA	: Environmental Impact Assessment
EMP	: Environmental Management Plan
GO	: Government Order
GoI	: Government of India
GWQMS	: Ground Water Quality Monitoring Station
HC	: Hydrocarbons
HD	: Highways Department
HQ	: Head Quarters
IAR	: Indian Archaeological / Historical / Religious Features
IMO	: Indian Meteorological Organization
IS	: Indian Standard
LHS	: Left Hand Side
MoEF	: Ministry of Environment and Forests
MoRT&H	: Ministry of Road Transport and Highways
NAAQS	: National Ambient Air Quality Standards
NGO	: Non Governmental Organisations
NH	: National Highway
NOC	: No-objection Certificate
NO _x	: Oxides of Nitrogen
PAF	: Project Affected Family

PAH	:	Project Affected Household
PAP	:	Project Affected Person
PAPUs	:	Project Affected Property Units
PD	:	Project Director
PF	:	Protected Forest
PCU	:	Passenger Car Unit
PIU	:	Project Implementation Unit
PPP	:	Public Private Partnership
PWD	:	Public Works Department
R&R	:	Resettlement and Rehabilitation
RAP	:	Resettlement Action Plan
RF	:	Reserved Forest
RHS	:	Right Hand Side
ROW	:	Right of Way
SO ₂	:	Sulphur Dioxide
SOS	:	Strategic Options Study
SPCB	:	State Pollution Control Board
PM	:	Particulate Matter
SWQMS	:	Surface Water Quality Monitoring Station
TDS	:	Total Dissolved Solids
VEC	:	Value Ecosystem Components

Symbols and Units

µg/Nm ³	:	Microgram per Normal Cubic Meter
mg/l	:	Milligram per Litre
dB(A)	:	A-weighted decibel
m	:	meter
PM _{2.5} or PM ₁₀	:	Particulate Matter of 2.5 micron or 10 micron size
ha	:	hectare
Leq	:	equivalent continuous noise level

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

1 INTRODUCTION

The National Highways and Infrastructure Development Corporation Ltd.(NHIDCL) has been entrusted with the assignment of consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana, for up-gradation Chirakuta-Jalukbari Road in the state of Assam.

NHIDCL will be the employer and executing agency for the consultancy services and the standards of output required from the appointed consultants are of international level both in terms of quality and adherence to the agreed time schedule. The consultancy firm will solely be responsible for submission of quality work in stipulated period.

After evaluation of Technical and Financial proposal National Highways & Infrastructure Development Corporation Limited (NHIDCL), MoRT&H, New Delhi has appointed C.E. Testing Company Pvt. Ltd. (CETEST) as consultant to prepare the Detailed Project Report for the below road stretches vide **Letter of Acceptance No. NHIDCL/Bharatmala/DPR/Phase-I/Lot-1/Package 1A/2017/60 dated 13.03.2018.**

1.1 Brief description of the Project

The Project Road starts near Chirakuta and ends at Jalukbari in Guwahati. The total length of the existing road stretch is 209.998km(As per Topographic survey).

The Package-1 of the of the project road starts near Chirakuta and ends near Mowatari, before Chapar Bypass) (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain.

Table 1-1: Package-1 of the details of Project Road

Package No	Design Chainage (km)			Survey Chainage(Km), Starting Chainage of Bilasipura KM 0.000			Package Start point	Package end point
	From	To	Length (km)	From	To	Length (km)		
PKG-1	0.000	17.737	17.737	5.580	25.633	20.053	Near Chirakuta	Near Mowatari, Before Chapar bypass

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)



Figure 1-1: Key map of the Project Road

1.2 Purpose of the project

The Package-1 of the project road starts near Chirakuta and ends Near Mowatari, before Chapar Bypass (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km).The salient proposal for up-gradation and improvement of 4 lane project road is classified into the following aspects.

Connectivity to West Bengal

- The project road connects to Alipurduwar via NH 117 (old NH 31C) and NH 27 (old NH 31C) and it also connects to Coach Behar via NH-17(old NH 31)

Connectivity to Meghalaya

- The project road connects to Turavia NH 17 (Old NH 37) and NH 217 (Old NH 31C) from Paikan, Dudhnoi
- It also connected to Selsela, Zikzak via NH 17 (Old NH 37), SH 12 (Assam), SH2 (Meghalaya) from Agia
- To Rongjeng and Nongstoin NH 17 (Old NH 37), SH 10 (Assam), SH1 (Meghalaya) from Boko
- To Shillong via NH 17 (Old NH 37), SH3 (Meghalaya) from Airport Junction Meghalaya

Connectivity to Nagaland

- To Dimapur via NH 27 (Old NH 37) and AH2 from Nagaon

Connectivity to Arunachal Pradesh

- To Itanagar via NH 27 (Old NH 37), NH15, NH415 from Gohpur

This economic corridor also provides connectivity to Upper Assam and Lower Assam (via NH27) with the neighboring states. The project road also connects important town Bilasipura, Tulungia, Jogighopa, Gendra, Paikan, Dudhnoi, Boko & Mirza, Guwahati. A multimodal logistic hub is also proposed at Jogighopa. Development of this stretch would give relief to the people of Assam due to inconvenience caused during frequent disruptions in neighboring states.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

1.3 Project name and Size

Project name and size of the project road is given in

Table 1-2: Details of the Project road

Name of the Project	Project length (KM)	Project Districts
Details of PKG-1		
Name of the Project	Package length (KM)	Project District
Widening/Improvement to 4 (Four) Lane with Paved Shoulder from Ch.5.580km to Ch.25.633km (Design Ch.0.000km to Ch.17.737km)(Existing Km901.100 to Km 921.145 of old NH-31) for Package-1 of Bilasipura-Guwahati road(NH-17) (Section: Near Chirakuta to Near Mowatari, before Chapar Bypass) in the state of Assam.	20.053	Dhubri

1.4 Objective and Scope of the Study

The objective of this EIA study is to identify potential environmental impacts of the proposed road improvement work and formulate strategies to avoid / mitigate the same. The scope of work to accomplish the above objective, comprise the following.

- Understanding the baseline environmental conditions of the project area, identifying the potential environmental impacts of the project proposal recommending appropriate mitigation measures to avoid / minimise the environmental impacts and preparing an environmental management plan for implementation
- Environmental assessment of project from the environmental point of view and preparation of environmental budget for implementation of mitigation measures.
- The environmental studies have been confined to the situation around the deemed areas of direct influence caused by constructional and operational facilities along the proposed road section.
- The following sections of the report, discusses the methodology adopted by the consultants in conducting the EIA study and presents the results of the same.
- Development of the road alignment in such a way that the environment and the settlement areas are affected the least.
- Presentation of public view on various aspects of environment and the project.

1.5 Proposed Improvements

The project road stretches passes through Plain terrain. The topography is mostly rural in nature but there exists some stretches which passes through built up area, along with that there exists some Proposed reserved forest stretches also the overall condition of the existing road surface is Poor - Fair pavement condition and Cross drainage structure are in poor condition and inadequate. The proposed improvements are given below.

- Develop a 4 lane road with a superior surface and good strength
- The proposed improvement aims at improving the road quality to improve journey speed and reduce congestion
- New cross-drainage structures would be provided.

1.6 Approach to EIA

Environmental Impact Assessment (EIA) is an assessment of the possible impact positive or negative-that a proposed project may have on the environment, together consisting of the natural, social and economic aspects. Its purpose is to identify, examine, assess and evaluate the likely and probable impacts of a

proposed project on the environment and, thereby, to work out remedial action plans to minimize adverse impact on the environment.

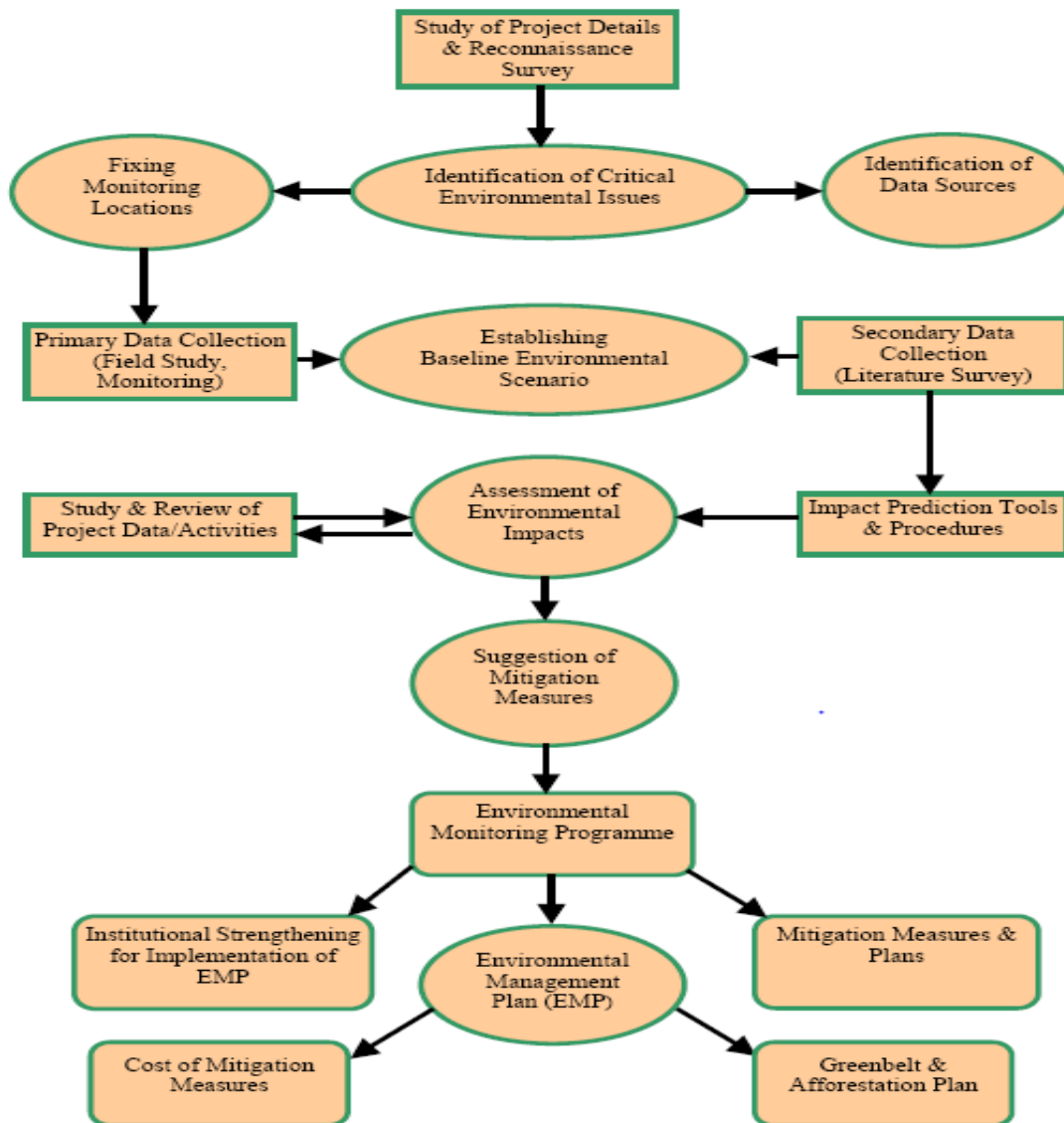


Figure 1-2: Methodology of EIA

The study methodology has been adopted in such a manner to ensure that environmental concerns are given adequate weightage in the selection of alignment and design of proposed road improvements. The study in this project employs an iterative approach in which potential environmental issues have been examined at successive levels in detail and specificity, at each step in the process.

The Environmental assessment is based on the information collected from secondary sources on various environmental attributes. Monitoring of air, water, noise and soil quality will be carried out within the ROW and significant issues were examined during field surveys to determine the magnitude of significant environmental impacts.

The major steps in the EIA process for the project were as follows:

1.6.1 Preliminary Environmental Screening

The environmental experts conducted the environmental screening to identify the hot spots along the project road. A Rapid Assessment Survey (RAS) was undertaken within the Corridor of Impact (COI) defined as 100m on either side of the proposed Centre line, to identify the Valued Ecosystem Components (VECs) during the feasibility stage and were categorized into various environmental components for screening and to assess their subsequent impacts due to the project as per the table below.

Table 1-3: Various environmental components for screening

Sl. No.	Environmental Attributes	Valued Ecosystem Components
1	Topography	Plain /rolling terrain
2	Land Use	Forest, Settlement, Agriculture (mostly Un-irrigated), no development zone, etc
3	Water resources	Water bodies like rivers and ponds – Crossings as well as water bodies within COI
4	Forests & Wild Life	Native, rare and endangered species
5	Road side Plantations	Strip Plantation
6	Settlements	Villages abutting the road corridor
7	Sensitive Receptors	Sensitive receptors such as educational and health facilities, Religious Structures within COI
8	Drinking water Source	Total number of drinking water source (wells, hand pumps, taps etc) within study area
9	Cultural	Number (total) of cultural properties (protected/ unprotected archaeological monuments) within 500m from the road
10	Market Places	Number (total) of weekly market places / haats; grain / fruit /vegetable / fish market; cattle market within COI
11	Common Property Resources	CPRs such as pastures / grazing lands; seating areas of the community; cremation/burial grounds etc. within / along the RoW (All CPRs other than religious structures, drinking water sources and bus stops) within COI
12	Other Features	Flood plains; soil erosion prone areas; stone quarries etc.

1.6.2 Review of Applicable Environmental Regulations

The Government of India has formulated various policy guidelines, acts and regulations aimed at protection and enhancement of environmental resources. The clearances/ permissions/ approvals under various acts, rules, and guidelines are required for proposed project during pre-construction and construction phases.

1.6.3 Assessment of Baseline Environmental Profile

In order to assess the situation in particular sections of the road during the screening and site visit of the area, different locations were identified for monitoring and analysis the noise level, ambient air and water quality.

The baseline conditions of the project area will study after 30th September, 2019. Data pertaining to all facets of environment which include physical, ecological, and socioeconomic environment both through secondary sources were collected. Key relevant information sources have been summarized in Table 1-4.

Ambient air & noise monitoring will be conducted as well as ground and surface water samples will be collected from various locations identified along the corridor. The monitoring and analysis for each component were carried out as per MoEF and CPCB guidelines. The results of the analysis were compared with the relevant national standards.

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As part of the baseline environmental profile, a detailed tree inventory along the RoW has been carried out based on their chainage, species, girth and distance from the carriageway. All trees with a girth size more than 30cm that are falling within the proposed ROW shall be marked on the ground. Based on the survey a tree schedule will be prepared for submission to the authorities.

Table 1-4: Primary and Secondary Information Sources

Sl. No.	Report Components	Information Sources
1	Project objectives, Technical information on existing road features	ToR, Design Report
2	Inventory of road features like water Bodies, Community structures, environmentally sensitive locations areas, congested locations etc.	Ground Physical surveys
3	Climatic Condition & Meteorological data	Envis and other websites, reports on studies conducted in this area, primary data collection
4	Geology, Seismicity, Soil and Topography	State of Environment report published by SPCB, government websites and primary data collection
5	Land Use/ Land cover	Survey of India (SoI) Toposheet, Satellite maps and Observation during surveys
6	Drainage Pattern	Survey of India Toposheet, District Groundwater Brochure of CGWB, field observation and local people
7	Status of forest area and Compensatory afforestation norms etc	Divisional Forest Office
8	Air Quality, Noise, Soil and water	Onsite monitoring and Analysis of Field samples
9	Borrow Areas, Quarries and other construction material source	Material Surveys and public consultations
10	River geo-morphology, hydrology, drainage, flood patterns	Engineering reports and information from local people, field observations
10	Socioeconomic Environment	Official websites maintained by state Govt., Census of India 2001 & 2011 and Public Consultation during the Field survey

1.6.4 Public Interaction

Public consultations meetings have been carried out to get perceptions of people about the project. Findings of consultation meetings have been incorporated in project road design.

Consultations with community members, PAPs Focus Group Discussions with women groups and others community were carried out. The feedback generated through these meetings has been incorporated as far as possible in the design and construction of the road. The consultation process shall continue even during the implementation stage to gauge the general opinion.

1.6.5 Analysis of Alternatives

Various project alternatives have been assessed for this project. The assessment of alternatives included realignments, widening options, requirement of noise barriers in sensitive areas etc.

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1.6.6 Anticipated Environmental Impacts and Mitigation Measures

The environmental assessment conducted in accordance with the requirement of the state government and Government of India. The collected primary and secondary data compiled and analyzed to establish a comprehensive database and assess the existing baseline environmental conditions.

Impact assessment has been carried out after establishing the baseline status of the study corridor and analysis of the project data/activities. At this stage, the data analysis and impact assessment would be performed. Wherever practicable, a quantitative analysis would be performed. Suitable computer models, if applicable, would be used; otherwise, the impact assessment would be quantified through mathematical computation. The project activities will be linked with the existing baseline environmental conditions in order to short list the affected environmental parameters and assess the likely impacts on such parameters. Compliance of the project with national standards will be duly checked. Following aspects will be given due importance during assessment of impacts and recommending remedial measures:

- Alignment of the project road and topographical changes
- Roadside drainage to avoid water logging, erosion & environmental degradation
- Loss of trees
- Noise level and dust concentration near construction sites
- Water requirement during construction and sources
- Nature, quantity and disposal of construction spoils
- Environmental hazards/damages associated with landslide
- Public health & sanitation, and occupational health & safety of construction workers
- Road safety features to avoid accidents
- Air & noise pollution in operation phase due to vehicular emissions & noise
- Population affected including weaker sections

1.6.7 Environmental Management Action Plans

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. The desired result from the environmental mitigation measures proposed in the project may not be obtained without a management plan to assure its proper implementation and function. The EMP envisages the plans for the proper implementation of mitigation measures to reduce the adverse impacts arising out of the project activities. The following issues will be addressed in the EMP:

- Preventive, mitigation, compensatory & enhancement measures for minimization & abatement of the undesirable impacts caused during the construction and operation stage.
- Details of management plans (compensatory plantation, solid waste management plan, borrow area management plan, occupational safety and health plan etc.) including their implementation schedule and supervision programme.
- Identified/recommended institutional set up for implementation of the EMP including institutional requirements, staffing and training
- Environmental monitoring programme during construction and operation phase including parameters, locations and frequency of monitoring, monitoring mechanisms, performance indicators, implementation programme and cost.
- Expenditures & budget for environmental protection measures and implementation of the EMP.

1.6.8 Environmental Monitoring Programme

Environmental monitoring plan for construction and post construction phases of the project road have been formulated to ensure effectiveness of implemented environmental mitigation measures. Cost of Environmental Monitoring Plan for construction and post construction phase of the project has been worked out.

1.7 Structure of Environmental Impact Assessment

The EIA report has been structured into the following chapters:

Chapter – 1: Introduction: This chapter gives the basic information about the project and project area. It also discusses the justification of the project and the purpose of the EIA study including the scope of the study.

Chapter – 2: Project Description describes the existing features and also discusses the various features and various proposed improvement programmes of the proposed highway project.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

2 PROJECT DESCRIPTION

This chapter describes the project road and discusses the various improvement measures proposed as part of the project. The project description includes details of existing condition of project road, existing and proposed traffic, pavement conditions, road inventory, safety and community facilities

2.1 Existing Road Features

2.1.1 Alignment

The Package-1 of the project road starts near Chirakuta and ends Near Mowatari, before Chapar Bypass) (Ex. Ch.5.580km to Ex.Ch. 25.633km). The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain. The topography is mostly rural in nature but there exists some stretches which passes through built up area.

- Existing Right of Way width along the project road stretche has been observed to be around 11m to 50m.
- The existing geometry of the road needs to be improved as per design criterion mentioned in the guideline of IRC. In general the existing carriageway width of the project road is 7.0m.
- The overall condition of the road is fair to Poor. Existence of all major types of road distresses cracks, potholes, Rutting and edge drop have been observed.

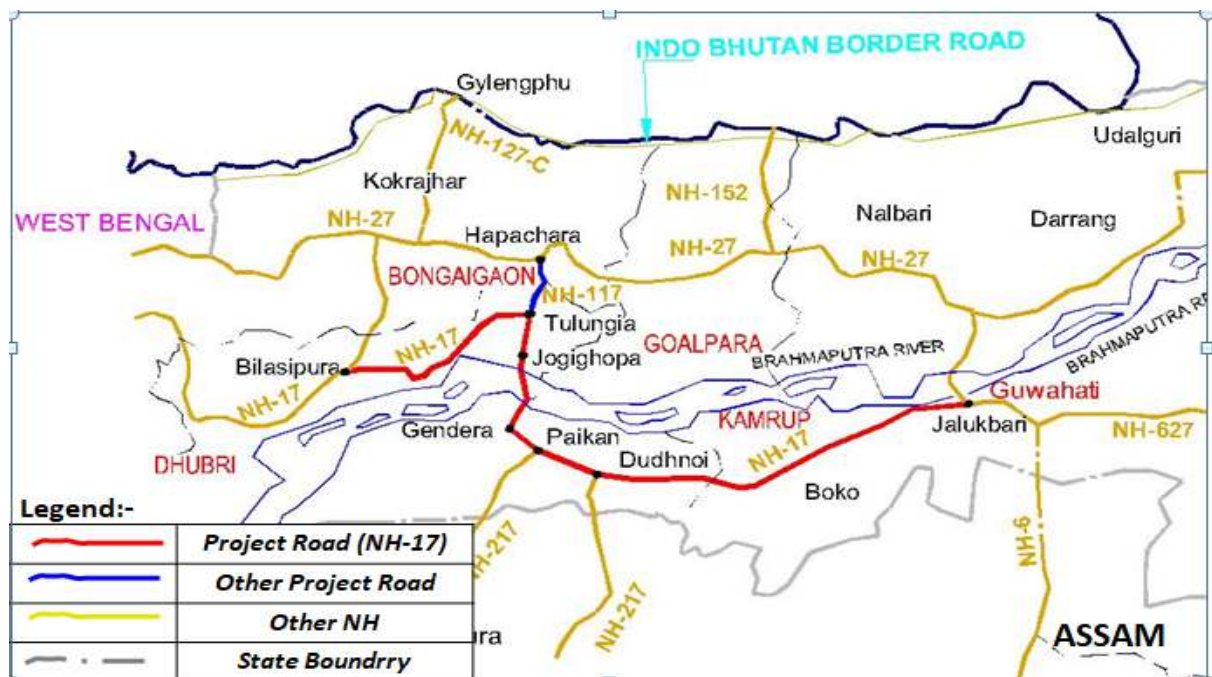


Figure 2-1: Existing Project Road Network

2.1.2 Right of way

The existing ROW along the project road varies from 11m to 50m. Development proposal of 4 lane divided carriageway with paved shoulder has been framed considering 35m/40m proposed right of way in rural area, 35m in Built up area, 35m/40m in forest location and 45m/50m in bypass location. Therefore, additional land will be required to accommodate the future proposal, geometric improvement and development of intersection with other project facilities.

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

2.1.3 Existing Carriageway

The existing road is two lane with earthen shoulder on both side. The carriageway width of the existing road is 7m. Width of shoulder varies from 1.0 – 1.5 meter on each side of the project road. Total formation width varies from 9 – 10 meter.

The existing pavement condition along the road is basically fair to poor. Various types of pavement distresses like Cracking, Potholes, Raveling, Edge drop, Rutting and Patching are observed. Summary of existing pavement and carriageway is given in Table 2-1.

Table 2-1: Summary of existing pavement and carriageway

SL. NO	Package	Survey Chainage (Km)		Length (Km)	Width of Carriageway (m)	Type of Pavement
		From	To			
1	1	5.580	25.633	20.053	7m	Bituminous

2.1.4 Road inventory

There are 39 numbers of minor intersections have been found along the project road stretch.

2.1.5 Existing Major Bridges

There are No major bridge have been observed along the project road stretch for PKG-1.

2.1.6 Existing Minor Bridges

There are 8 numbers of minor bridges along the project road stretch for PKG-1. List of the minor bridges are given below in Table 2-2

Table 2-2: List of the existing minor bridges

SI No	Survey Chainage (km)	Name of river/ stream	Type of bridge	Span arrangement (exp. joint to exp. joint)	Clear roadway width between kerbs	Total outer width of bridge (m)
1	6.244	Nallah	RCC Slab	1 x 6m	7.5	12.5
2	15.347	Sukhi river	RCC Slab	3 x 7.95m	7.5	8.0
3	15.994	Nallah	RCC Slab	1 x 6m	7.5	11.2
4	16.797	Nallah	RCC Slab	1 x 6m	7.5	11.5
5	19.347	Nallah	RCC Slab	1x9.3m+1x8.9 m	7.5	8.0
6	20.331	Dhirbil River	PSC Girder	1 x 40.7m	7.5	8.0
7	23.738	Nallah	RCC Slab	1 x 6.0m	7.5	12.8
8	25.452	Nallah	RCC Slab	5 x 7.5m	7.5	8.0

2.1.7 Existing Culverts

There are 8 numbers existing culverts have been observed along the project stretch for PKG-1 out of which 4 numbers of culverts are Slab culverts, 4 number of culvert is Pipe culverts.

2.1.8 Existing Flyover

No flyover has been observed along the project stretch for PKG-1

2.1.9 Traffic

The average daily traffic was counted in one location along the project road stretch for PKG-1 as given below. The AADT relates to traffic volume on the existing road for the year 2019.

Table 2-3: Average Daily Traffic(Yr,2019) on the project road

Sl. No.	Description	Ch. 31.000 km near Bahalpur
1	AADT in number	7506
2	AADT in PCU	8957

2.1.10 Existing Railway Crossing

No railway level crossing has been observed along the project stretch for PKG-1.

2.1.11 Existing ROB

No ROB has been observed along the project stretch for PKG-1

2.1.12 Existing RUB

No RUB has been observed along the project stretch for PKG-1.

2.1.13 Existing Forest Stretch

Forest stretch has been observed along the project stretch for PKG-1. Details of Forest stretches are given below in Table 2-4

Table 2-4: Details of Forest stretch along the project road for PKG-1

Survey Ch(km)		Design Ch(km)		Side	Length(km)	Remarks
From	To	From	To			
-	-	9.950	10.168	Both	0.436	Srigram RF
-	-	10.168	10.678	Left	0.510	Sarpamari RF
-	-	10.168	10.703	Right	0.535	Sarpamari RF
18.561	19.249	10.678	11.366	Left	0.688	Srigram RF
Total Length=					2.169	

2.2 Proposed Road Features

2.2.1 Alignment

- The Package-1 of the of the project road starts near Chirakuta and ends Near Mowatari, before Chapar Bypass) (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam.
- Proposed Road has been designed as per 4-Lane with Paved shoulder configuration

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

2.2.2 Cross Section Details

Based on the traffic estimates, capacity and the proposed Right of Way (ROW) various typical cross-sections (TCS) have been worked out for PKG-1 of the project road. These are described as given below:

Table 2-6: Types of proposed cross section

Sl. No.	Description	Length (m)
TCS 1D	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN RURAL AREA(RECONSTRUCTION OVER EXISTING PAVEMENT)	2227
TCS 2	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH	900
TCS 2A	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH WITH BOTH SIDE RETAINING WALL AND STONE PITCHING ALONG WITH BERM	2353
TCS 2C	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH WITH BOTH SIDE RETAINING WALL	609
TCS 4F	TYPICAL CROSS SECTION OF 4 LANE CARRIAGEWAY WITH BOTH SIDE SERVICE ROAD IN BUILT-UP AREA (RECONSTRUCTION OVER EXISTING PAVEMENT WITH FULL GRANULAR LAYER SCARIFICATION WITH NEW SUBGRADE)	2873
TCS 4F1	TYPICAL CROSS SECTION OF 4 LANE CARRIAGEWAY WITH BOTH SIDE SERVICE ROAD IN RURAL AREA (RECONSTRUCTION OVER EXISTING PAVEMENT)	969
TCS 4F2	TYPICAL CROSS SECTION OF 4 LANE CARRIAGEWAY WITH RIGHT SIDE SERVICE ROAD IN RURAL AREA(RECONSTRUCTION OVER EXISTING PAVEMENT)	180
TCS 5D	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN FOREST STRETCH WITH BOTH SIDE R.C.C RETAINING WALL	738
TCS 5E	TYPICAL CROSS SECTION OF 4 LANE CARRIAGEWAY WITH RIGHT SIDE SERVICE ROAD IN FOREST STRETCH (RECONSTRUCTION OVER EXISTING PAVEMENT WITH FULL GRANULAR LAYER SCARIFICATION WITH NEW SUBGRADE)	678
TCS 6B	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN VUP/SVUP APPROACHES WITH BOTH SIDE SERVICE ROAD	1215
TCS 6B1	TYPICAL CROSS SECTION OF 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN FLYOVER APPROACHES WITH BOTH SIDE SERVICE ROAD WITH DRAIN	343
	ROB+VIADUCT+VUP	1220
	TAPPERED PORTION	2700
	FLYOVER	455
	TOLL PLAZA	277
	Total Length=	17737

2.2.3 Major and Minor Bridges

10 nos. minor bridge (Reconstruction= 7 nos, Retain & additional 2 lane bridge=1 no. & New Construction=2nos) have been proposed in the project stretch.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

2.2.4 Proposed Culverts

54 nos. of RCC box culverts have been proposed in the project section. Out of which 8 nos. of culvert are to be reconstructed. 46 nos. additional new culvert has been proposed.

2.2.5 Roadside Ditches/Drains

RCC cover drain has been proposed in Built up area.

2.2.6 Service Roads and Footpath

Service road and RCC cover drain cum footpath has been proposed at Built-up locations. Details are given below in Table 2-7

Table 2-7a : Details of Service road

Sl. No.	Location of service road(from km to km)	Right hand side(RHS)/Left hand side(LHS)/or Both sides	Length (km)of service road	Reference to TCS	Remarks
1	Km 0.000 to km 0.373	Both sides	2X0.373=0.746	TCS 4F1	2x5.5m
2	Km 0.373 to km 0.598	Both sides	2X0.225=0.450	Tapered	Varying Width
3	Km 0.800 to km 1.540	Both sides	2X0.740=1.480	-	2x5.5m
4	Km 6.350 to km 7.225	Both sides	2X0.875=1.750	TCS 6B	2x5.5m
5	Km 7.225 to km 7.450	Both sides	2X0.225=0.450	Tapered	Varying Width
6	Km 7.985 to km 8.210	Both sides	2X0.225=0.450	Tapered	Varying Width
7	Km 8.210 to km 8.880	Both sides	2X0.670=1.340	TCS 4F	2x5.5m
8	Km 8.880 to km 9.223	Both sides	2X0.343=0.686	TCS 6B1	2x5.5m
9	Km 9.223 to km 9.500	Both sides	2X0.277=0.554	-	2x5.5m
10	Km 9.500 to km 9.678	Both sides	2X0.178=0.356	-	2x5.5m
11	Km 9.678 to km 9.950	Both sides	2X0.272=0.544	-	2x5.5m
12	Km 10.668 to km 11.366	Right sides	1X0.698=0.698	-	1x5.5m
13	Km 11.900 to km 12.125	Both sides	2X0.225=0.450	Tapered	Varying Width

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Location of service road(from km to km)	Right hand side(RHS)/Left hand side(LHS)/or Both sides	Length (km)of service road	Reference to TCS	Remarks
14	Km 12.125 to km 12.175	Both sides	2X0.050=0.100	TCS 4F	2x5.5m
15	Km 12.175 to km 12.400	Both sides	2X0.225=0.450	Tapered	Varying Width
16	Km 12.498 to km 12.723	Both sides	2X0.225=0.450	Tapered	Varying Width
17	Km 12.723 to km 13.454	Both sides	2X0.731=1.462	TCS 4F	2x5.5m
18	Km 13.454 to km 13.725	Both sides	2X0.271=0.542	TCS 4F1	2x5.5m
19	Km 13.725 to km 13.950	Both sides	2X0.225=0.450	Tapered	Varying Width
20	Km 14.408 to km 14.633	Both sides	2X0.225=0.450	Tapered	Varying Width
21	Km 14.633 to km 15.170	Both sides	2X0.537=1.074	TCS 4F	2x5.5m
22	Km 15.170 to km 15.395	Both sides	2X0.225=0.450	Tapered	Varying Width
23	Km 15.395 to km 15.575	One side	1X0.180=0.180	TCS 4F2	2x5.5m
24	Km 15.575 to km 15.800	One side	1X0.225=0.225	Tapered	Varying Width
25	Km 16.115 to km 16.340	Both sides	2X0.225=0.450	Tapered	Varying Width
26	Km 16.340 to km 17.225	Both sides	2X0.885=1.770	TCS 4F	2x5.5m
27	Km 17.225 to km 17.450	Both sides	2X0.225=0.450	Tapered	Varying Width

Table 2-7b : Details of Cover Drain

Chainage (m)		Side	Length (m)	Remarks
From	To			
7985	8210	Both	2X225=450	Tapered Portion
8210	8880	Both	2X670=1340	TCS-4F
8880	9223	Both	2X343=686	TCS-6B1



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Chainage (m)		Side	Length (m)	Remarks
From	To			
9223	9500	Both	2X277=554	-
10668	11366	One	1X698=698	TCS-5E
11900	12125	Both	2X225=450	Tapered Portion
12125	12175	Both	2X50=100	TCS-4F
12175	12400	Both	2X225=450	Tapered Portion
12498	12723	Both	2X225=450	Tapered Portion
12723	13454	Both	2X731=1462	TCS-4F
14408	14633	Both	2X225=450	Tapered Portion
14633	15170	Both	2X537=1074	TCS-4F
15170	15395	Both	2X225=450	Tapered Portion
15395	15575	One	1X180=360	TCS-4F2
15575	15800	One	1X225=225	Tapered Portion
16115	16340	Both	2X225=450	Tapered Portion
16340	17225	Both	2X885=1770	TCS-4F
17225	17450	Both	2X225=450	Tapered Portion
Total Length of 1.0m Width Covered Drain =			11869	

2.2.7 Bus Bay & Passenger Shelter

Details of Bus-bay with passenger shelter is given below in Table 2-8

Table 2-8: List of the bus bay with Passenger Shelter along the project road for PKG-1

Sl. No.	Project Facility	Location (km)	Name of the Place
1	Bus Bay with Passenger shelter	14.268(Both side)	Near Aryarjhar

2.2.8 Toll Plaza

1 Nos. Toll Plaza has been proposed along the project stretch for PKG-1. Details are given in Table 2-9

Table 2-9: List of the Toll Plaza

Sl. No.	Design Chainage (km)	Name of the Place	Remarks
1	0.736	Chirakuta	8 Lane Toll Plaza

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PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

2.2.9 Proposed FLYOVER/VUP/SVUP/VOP/Viaduct

1no VOP, 3 nos Viaduct, 1 no Flyover, 2nos Vehicular Underpass(VUP) and 5nos Small Vehicular Underpasses(SVUP) have been proposed in the project road for PKG-1. Details of VOP, Viaduct, Flyover, VUP, and SVUP are given below in Table 2-10, Table 2-11, Table 2-12 and Table 2-13

Table-2.10: List of VOP

Sl. No.	Location (Chainage) (from km to km)	Span/Opening(m)	Remarks
1	3.608	2 x 21m, RCC T Girder	VOP

Table-2.11: Details of Viaduct

SI No.	Design Chainage (km)	Improvement Proposal	
		Type of Structure	Span Arrangement (No. x Span in m)
1	5.04	RCC T Beam + PSC T Girder, Viaduct	1 x 35m + 11 x 40m + 1 x 20.8m + 2 x 30m
2	5.66	RCC T Beam + PSC T Girder + Simply Supported Voids Slab, Viaduct	1 x 20.8m + 1 x 30m + 6 x 40m + 2 x 35m + 1 x 15m
3	5.929	PSC T Girder, Viaduct	2 x 40m

Table 2-12: Details of Flyover

SI No.	Design Chainage (km)	Improvement Proposal	
		Type of Structure	Span Arrangement (No. x Span in m)
1	Km 9.223 to Km 9.678	PSC Box Girder	13x35m

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Table 2-13: Location of Vehicular/Small Vehicular Underpass (VUP/SVUP)

SI. No.	Design Chainage (km)	Type of Structure	Span Arrangement (No. x Span)m
1	0.346	SVUP	1 x 8.0mx5.0m, RCC Box
2	1.000	SVUP	1 x 8.0mx5.0m, RCC Box
3	1.528	SVUP	1 x 8.0mx5.0m, RCC Box
4	4.754	SVUP	1 x 15m, Simply Supported Voided
5	5.869	VUP	1 x 40m ,PSC T Girder
6	6.332	SVUP	1 x 8.0m x 5.0m, RCC Box
7	6.725	VUP	1 x 24m, RCC Integral Voided Slab

2.2.10 Road Markings/Signage/Road Furniture

Traffic signage, Thermoplastic road markings, road studs, delineators, Rumble Strip, Thrie-Metal Beam crash barriers & Overhead gantry etc. has been proposed at required locations to ensure adequate safety of the road users. Details are given below inTable 2-14.

Table 2-14: List of various road signs and marking

SI No	Traffic Signages, Road Marking and other appurtenances	unit	Quantity
1	Right Hand Side Curve(900 mm Triangular)	Nos.	58
2	Left Hand Side Curve(900 mm Triangular)	Nos.	52
3	School (900 mm Triangular)	Nos.	36
4	Side road left(900 mm Triangular)	Nos.	80
5	Side road right(900 mm Triangular)	Nos.	76
6	Bus Stop(800 mm x 600 mm rectangular)	Nos.	2
7	Direction Sign<.0.9 sqm	Nos.	10
8	Stop Sign(900 mm Octagonal)	Nos.	156
9	Horn prohibited(600mm Circular)	Nos.	36
10	Hazard Marker (one way) (900mm x300 mm rectangular)	Nos.	264
11	Object Marker (one way) (900mm x300 mm rectangular)	Nos.	2
12	Rumble strip	Nos.	160
13	Road Stud	Nos.	2696
14	Built-up area(900 mm Triangular)	Nos.	20
15	Delineator	Nos.	600



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

SI No	Traffic Signages, Road Marking and other appurtenances	unit	Quantity
16	Lane marking, edge marking	Sqm	14300
17	Cats Eye	Nos.	21202
18	Hexagonal woven mesh fencing	Rm	8436
19	Solar Bilnker	Nos	4

Overhead traffic signs: Details is given below

Sl. No.	Location (Km)	Size
1	0.150	Minimum Clear Span of 22.5m.(Ref TCS-1D)and minimum clear height from road top level shall be 6.0m

2.2.11 Enhancement of Inventories

Apart from developing the existing road, the project has also proposed several other enhancements such, Maintenance facility.

2.3 Cost Estimate

For Rate Analysis, Schedule of Rate- Public Work Department (NH), 2020-21, Assam. has been adopted

For the details cost estimate refer to Volume-VII: in cost estimates.

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3 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

India has well defined institutional and legislative framework. The legislation covers all components of environment viz. air, water, soil, terrestrial and aquatic flora and fauna, natural resources, and sensitive habitats. India is also signatory to various international conventions and protocols. The environmental legislations in India are framed to protect the valued environmental components and comply with its commitment to international community under conventions and protocols.

This chapter reviews the existing institutional and legislative set-up pertaining to the project at the National and state levels. The chapter also elaborates on the various clearances and permissions required for the project from Government of Assam, Ministry of Environment and forests, Government of India

3.1 Institutional Setting

The project has been initiated and is being carried out by the National Highways and Infrastructure Development Corporation Ltd.(NHIDCL). The primary responsibility of the project rests with the NHIDCL in providing encumbrance free ROW to the concessionaire who shall implement the project. The main government agencies who uphold the implementation of the various environmental legislations are:

- Ministry of Environment and Forests, Government of India (MoEF), New Delhi formulates and regulates all country level legislations besides giving prior environmental clearances through a committee for category A projects, wild life clearances and forest diversion clearances.
- State Level Environmental Impact Assessment Authority (SEIAA), in the states gives prior environmental clearances to category B projects.
- Central Pollution Control Board (CPCB) monitors and implements pollution related legislations
- State Pollution Control Board monitors and implements pollution related legislations in the state besides giving NOC for establishing and operating plants under air and water acts
- State Department of Forests gives permission for forest diversion and felling of trees

3.2 The Legal Framework

The Government of India and the Governments of Assam have formulated a host of policy guidelines, acts and regulations aimed at protection and enhancement of environmental resources. The following sections discuss the various legal issues associated with the project.

3.2.1 Country Level Environmental Legislations

The Government of India has formulated various legislatures for protection and enhancement of environmental resources. The following table summarises the relevant legislations as well as clearances required for the project.

Sl. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for application	Implementing / Responsible Agency
1	The Environmental (Protection) Act. 1986, and the Environmental (Protection) Rules, 1987-2002 (various amendments)	Umbrella Act. Protection and improvement of the environment. Establishes the standards for emission of noise in the atmosphere.	Yes	All environmental notifications, rules and schedules are issued under the act	MoEF. (Govt. of Assam) State Gov. SPCB
2	The EIA Notification, 14th September 2006 and subsequent amendments	To accord environmental clearance to new development activities listed in	No	1. This notification is applicable for NH, SH and Expressways only – this project relates development of Economic Corridors,	MoEF. SEIAA

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for application	Implementing / Responsible Agency
		schedule of EIA notification.		Inter Corridors and Feeder Routes 2. Package length is less than 100Km 3. Total NH road length is more than 100km but does not involve additional right of way greater than 40m in existing alignment.	
3	Notification for use of Fly ash, 3rd November 2009	Reuse large quantity of fly ash discharged from thermal power plant to minimize land use for disposal	No	No thermal power plants within 100 km	MoEF
4	Office memorandum dated 18.05.12 by MoEF in view of Apex Court order dated 27.2.2012	Conserve top soil, aquatic biodiversity, hydrological regime etc. by haphazard and unscientific mining of minor minerals	Yes	In case of renewal of quarries and opening of new borrow areas	SEIAA
5	National Environment Appellate Authority Act (NEAA) 1997	Address Grievances regarding the process of environmental clearance.	No	Grievances are dealt with, within this act.	NEAA
6	Forest Conservation Act (1980)	To check deforestation by restricting conversion of forested areas into non- forested areas	Yes	Road widening and improvement work requires diversion of significant forest land	Tree removal will be guided as per state government rules.
7	Air (Prevention and Control of Pollution) Act, 1981	To reduce air pollution by controlling emission of air Pollutants as per the prescribed standards.	Yes	For construction; for obtaining NOC for establishment of hot mix plant, Diesel Generator, etc	SPCB
8	Water Prevention and Control of Pollution) Act1974	To reduce water pollution by controlling discharge of pollutants as per the prescribed standards	Yes	This act will be applicable during construction for (establishments of hot mix plant, effluent disposal, etc.	SPCB

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for application	Implementing / Responsible Agency
9	Noise Pollution (Regulation and Control Act) 1990	The standards for noise for day and night have been promulgated by the MoEF for various land uses.	Yes	This act will be applicable as vehicular noise on project routes is required to be assessed for future years and necessary protection measure need to be considered in design.	SPCB
10	Public Liability and Insurance Act 1991	Protection from hazardous materials and accidents.	Yes	Contractor need to stock hazardous material like diesel, Bitumen, Emulsions etc.	SPCB
11	Explosive Act 1984	Safe transportation, storage and use of explosive material	Yes	Blasting may be involved in some locations	Chief Controller of Explosives
12	Minor Mineral and concession Rules	For opening new quarry.	Yes	Regulate use of minor minerals like stone, soil, river sand etc.	District Collector
13	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989	To check vehicular air and noise pollution.	Yes	These rules will be applicable to road users and construction Machinery.	Motor Vehicle Department
14	National Forest Policy 1952 National Forest Policy (Revised) 1988	To maintain ecological stability through conservation and restoration of biological diversity.	Yes	This policy will be applicable as project intervention requires forest land to be acquired.	Forest Department, Govt. of Assam
15	The Mining Act	The mining act has been notified for safe and sound mining activity.	Yes	The construction of project road will require aggregate through mining from riverbeds and quarries	Department of mining. State Govt. of Assam
16	The Building and Other Construction Workers (regulation of employment and conditions of service) Act, 1996	To regulate the employment and conditions of construction workers and to provide for their safety, health and welfare measure and for other matter incidental thereto	Yes	A large number of construction workers skilled, semiskilled or unskilled will be employed temporarily during Construction Phase of the project	Ministry of Labor and Employment
17	Hazardous Wastes (Management and	Protection to the general public against improper	Yes	Hazardous wastes such as used oil, batteries, paint residues, etc. will	SPCB

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for application	Implementing / Responsible Agency
	Handling) Rules, 1989	handling and disposal of hazardous wastes		be generated during the project.	

3.3 Applicability of EIA Notification, 2006 and Amendments

According to the Environmental Impact Assessment Notification, dated 14th September 2006 (amended till date) various development projects and activities require prior Environmental Clearances. All these projects and activities are categorized into two categories - Category A and B, based on the spatial extent of potential impacts on human health, natural and manmade resources.

The requirements for highway projects are specified in schedule item 7(f) of the Notification.

Project or Activity		Category with Threshold Limit		Conditions, if any
		A	B	
(1)	(2)	(3)	(4)	(5)
7 (f)	Highways	(i) New National Highways; and (ii) Expansion of National Highways greater than 100 km involving additional right of way or land acquisition greater than 40m on existing alignments and 60m on re-alignments or by-passes.	(i) All New State Highway Projects; and (ii) State Highway expansion projects in hilly terrain (above 1000 MSL) and/or ecologically sensitive areas.	General Condition shall apply. <u>General Conditions:</u> Any project or activity specified in Category 'B' will be treated as Category 'A', if located in whole or in part within 10km from the boundary of: i) Protected Areas notified under Wild Life (Protection) Act, 1972; ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time; iii) Notified Eco-sensitive areas; iv) Inter-state boundaries and international boundaries. <u>Note:</u> Highways include Expressways.

This is the Indian Government's Guidelines for environmental impact assessment governing all the development interventions that takes place within the boundaries of India. EIA notification was issued by Ministry of Environment, Forests and Climate Change (MoEF&CC) in 2006. This project doesn't attract Environment clearance. The project road is a national highway, passing through some habitation areas, forest area and length of the project road is 209.998 km (based on topographic survey). The PKG-1 of the project road starts near Chirakuta and ends Near Mowatari, before Chapar Bypass (Ex.Ch.5.580km to Ex.Ch.25.633km). The Design length of the Package-1 is 17.737km (Design Ch. 0.000km to Ch. 17.737km). The Package-1 is comes under Dhubri district of Assam. The objective of the notification is to formulate a transparent, decentralized and efficient regulatory mechanism.

3.3.1 State Level Environmental Legislation

Clearances for setting up hot-mix plants, batching plants, etc., under the Air and the Water Acts, establishing new quarries and establishment of new tube-wells / bore-holes to be procured from SPCB, State Department of Mining and Sate Ground Water Boards / Authorities respectively.

3.3.2 Other Legislations Applicable to Road Construction Projects

The concessionaire shall ensure that other legislations like Child Labour (Prohibition and Regulation) Act; 1986, Minimum Wages Act; 1948, The Factories Act; 1948, The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 etc. are properly followed.

3.4 Clearance Requirements for the Project

The summary table showing time requirements for agency responsible for obtaining clearance, and a stage at which clearance will be required is given below.

Sl. No.	Type of clearance	Statutory Authority	Applicability	Project stage	Responsibility
1	Prior Environmental Clearance	MoEF	Not Applicable	Pre construction	-
2	Permission for Activities near archaeological protected area	Archaeological survey of India / the state department of Archaeology	Applicable, if relics are found	Pre construction	Contractor/ PIU
3	Clearance for working / diversion of sanctuary land	Chief Wild Life Warden	Not applicable	Pre construction	-
5	Forest Clearance	State Department of Environment and Forest and MoEF	Applicable	Pre construction	Contractor/ PIU
6	Tree felling permission	Forest department	Felling of trees	Pre construction	Contractor/ PIU
7	NOC And Consents Under Air , Water, EP Acts & Noise rules of SPCB	State Pollution Control Board	For establishing hot mix/ batching plants	Construction (Prior to work initiation)	Concessionaire / Contractor
8	Permission to store Hazardous Materials	State Pollution Control Board	Storage and Transportation Of Hazardous Materials and Explosives	Construction (Prior to work initiation)	Concessionaire / Contractor
9	Explosive license	Chief controller of explosives	Storage of explosive materials	Construction (Prior to work initiation)	Concessionaire / Contractor

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Type of clearance	Statutory Authority	Applicability	Project stage	Responsibility
10	NOC under Hazardous Waste (Management and Handling) Rules, 1989	State Pollution Control Board	Disposal of hazardous wastes	Construction (Prior to work initiation)	Concessionaire / Contractor
11	PUC certificate for use of vehicles for construction	Department of Transport	For all construction vehicles	Construction (Prior to work initiation)	Concessionaire / Contractor
12	Quarry lease deeds and license	Dept. of Geology and Mines	Quarrying and borrowing operations	Construction (Prior to work initiation)	Concessionaire / Contractor
13	NOC for water extraction for construction and allied works	Ground Water Authority	Ground water extraction	Construction (Prior to work initiation)	Concessionaire / Contractor

3.5 Conclusion

The project requires permission for cutting the trees within the proposed ROW. In addition to the above, the concessionaire would require the following NOCs & licenses from the authorities during construction:

- NOC & Consents under Air, Water, EP Acts & Noise rules for establishing & operating plants from SPCB
- PUC certificate for use of vehicles for construction from Department of Transport
- Quarry lease deeds and license and Explosive license from Dept. of Geology and Mines & Chief controller of explosives
- NOC for water extraction for construction and allied works from Ground Water Authority

Apart from the above clearances, the concessionaire also has to comply with the following:

- Clearance of Engineer for location and layout of Worker's Camp, Equipment yard and Storage yard
- Clearance of Engineer for Traffic Management Plan for each section of the route after it has been handed over for construction
- An Emergency Action Plan should be prepared by the contractor and approved by the Engineer for accidents responding to involving fuel & lubricants before the construction starts
- Submit a Quarry Management Plan to the Engineer along with the Quarry lease deeds

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

4 Analysis of Alternatives

The concept of alternative can be defined as a possible course of action, in place of another, that would meet the same purpose and need. Alternative analysis in EA is designed to bring environmental and social considerations into the "upstream" stages of development planning—project identification and earlier—as well as the later stages of site selection, design and implementation.

For Chirakuta -Jalukabari sections, various alternate alignment options were studied. Besides this an evaluation has been carried out for the 'with' and 'without' project situation-in terms of the potential environmental impacts for the justification of the project. This chapter discusses how environmental parameters were assigned due importance and were carefully considered in the analysis of alternatives.

4.1 Alignment Selection due to Environmental Considerations

The selection of the alignment / widening options along various sections has been worked out based on continuous interaction between the engineering design team and environmental study teams. Various alignment improvement alternatives for the project road have been analyzed along entire project road considering rural sections, urban sections, forest areas and junctions.

The factors considered for evaluation of alternatives are:

- Flora and fauna likely to be impacted;
- Productive agricultural land likely to be impacted;
- Impacted water resource and surface water bodies;
- Environmental quality to be impacted;
- Land availability;
- Land use along the alignment;
- Residential / Commercial structures Impacted;
- Utilities likely to be impacted;
- Common property resources likely to be impacted;
- Religious structures affected;
- Impact on sensitive, cultural and community properties;
- Impact on air and noise quality

4.2 Safety Aspects

In assessment of the impacts of the project, safety of the road users and the roadside communities has been found to be a major concern. A number of measures have been proposed to reduce the risk of traffic accidents. The safety measures taken are:

- Improvement of existing Deficient horizontal Curve,
- Improvement of existing Deficient Vertical Curve
- Provision of Adequate Traffic Signage,
- Provision of Retaining Wall
- Widening of Bridge
- Improvement of Existing Highway Junction

4.3 With And Without Project Alternatives

The 'with Project' scenario includes improvement of the project road starts near Chirakuta and ends at Jalukbari in Guwahati. The Package-1 of the project road starts near Chirakuta and ends near Mowatari, before Chapar Bypass (Ex.Ch.5.580km to Ex.Ch.25.633km). The existing length of Package-1 is 20.053km (As per Topographic Survey). The Design length of the package-1 is 17.737km (Design Ch.0.000km to

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The proposed road will be 4-lanes with paved shoulder configuration. The project will have multiple benefits.

The 'with project' scenario has been assessed to be economically viable and will alleviate the existing conditions. To avoid the large-scale acquisition of land and properties, the project envisages the widening of road to two lanes and mostly along the existing tracks to minimize the loss of properties and livelihood.

With project scenario project road will reduce travel time substantially. In addition this project road will provide further benefit like:

- Fast and safe connectivity resulting in saving in fuel, travel time and Total
- Transportation Cost to the Society;
- Employment opportunities to people;
- Development of local industries, agriculture and handicrafts;
- Development of tourism and pilgrimage;
- Transporting, processing and marketing of agricultural products;
- Reduction in accidents;
- Reduction in pollution;
- Opening of opportunities for new occupations;
- Better approach to Medical & Educational services and quick transportation of Perishable goods like fruits, Vegetables and Dairy products; and
- Improved quality of life for people and so on

In spite of the various development benefits likely to accrue due to the project, the project would be accompanied by certain impacts on the social and environmental components. The potential impacts on the various environmental components can be avoided through good environmental practices. Wherever avoidance of negative impact is not possible, appropriate mitigation and enhancement actions will be worked out to effectively offset the environmental damages inflicted due to the project. Action Plan has been worked out to improve the well-being and livelihood of the people to be impacted.

The "with" and "without" project scenarios are analysed with respect to the development of the state by the back-drop of requirement of reliable quality infrastructure for sustained growth economy and consequent well-being of its citizens. The comparison of both the scenario is presented at

Table 4-1.

Table 4-1: Comparison "with" and "without" project scenario

Sr. No	Parameters	Without Project Impacts		With Project Impacts	
		Positive	Negative	Positive	Negative
1.	All weather Accessibility		Due to improper drainage system & bad conditions of road except small section, road get blocked for traffic during heavy rains	Road will be accessible throughout year since drainage will be improved along all sections.	
2.	Road Safety/ Accident rate		There is insufficient road safety signage at present and due to this sometimes road accidents take place at habitation areas and at critical road sections.	Proposal includes Sufficient safety provisions at highly populated areas and critical sections, so road accidents definitely will reduce.	
3.	Transportation/ Vehicle		Operating and maintenance cost	Operating and maintenance cost	

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sr. No	Parameters	Without Project Impacts		With Project Impacts	
		Positive	Negative	Positive	Negative
	maintenance /operating cost		of vehicles running on project road is very high as pavement condition is very bad and also more wear & tear because of frequent application of sudden brakes.	of vehicles will significantly reduce with smooth road and more comfortable driving at critical sections due to improvement.	
4.	Travel time / increased speed		Travel time is more due to less speed & congestion.	Reduction in travel time and speed will increase.	
5.	Loss of Property and livelihood		There are no commercial establishments in area due to bad connectivity.	Project may provide job/ livelihood opportunities to people through commercial establishment in area due to good connectivity with other cities and towns.	Some people will lose their property and livelihood due to land acquisition for bypass and realignment for approaches of minor bridges and for geometrical improvement. Where ROW is not sufficient to accommodate improvements.
6.	Change in Environmental quality during construction		Slow speed of vehicles on rough road emit high level of particulate matters and gases which cause air pollution and drivers use horn during congestions which lead noise pollution.	-	1. Temporary degradation of air quality because of hot mix plant, stone crusher, generator and other machinery during construction 2. Machinery will cause noise pollution 3. Construction spills, wastes, degraded materials will cause deterioration of

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sr. No	Parameters	Without Project Impacts		With Project Impacts	
		Positive	Negative	Positive	Negative
					soil quality and surface water.
7.	Change in Environmental quality after construction		Deterioration of air quality through dust, gasses and noise pollution because of vehicles speed and congestions.	Less Noise pollution because of ease in congestion and diversion of traffic through bypass.	
8.	Loss of vegetative cover	No felling of trees.	The old trees may become a safety hazard to the road users with passage of time.	Vegetative cover will be removed within corridor of Impact.	Compensatory plantation will enhance vegetative cover of area
9.	Access to basic facilities such as Markets, schools, Hospitals etc.		Difficulty in accessing the basic facilities due to heavy traffic.	Easy access to basic facilities due to fine road	
10.	Employment opportunities & local economy growth.		Very limited business opportunities. Very poor economic condition of local public	Business opportunities will create and life style will improve due to well connectivity with state capital and other areas	
11.	Others (Fuel consumption, Tourism)		Increase in fuel consumption, dust pollution because of rough road	1. Fuel consumption will be reduced due to smooth road 2. Tourism opportunity may be developed after road improvement	

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

4.4 Location and Alignment Alternatives

Bypass has been proposed at Sonamukhi & Tilapara the details of same are mentioned below:

Location of Proposed Bypass

S.No.	Name of bypass	Survey Chainage(km)			Design Chainage (km)		
	(town)	From (km)	to (km)	Length (in Km)	From(km)	To(km)	Length (km)
1	Sonamukhi & Tilapara	7.080	14.480	7.400	1.500	6.938	5.438

4.5 Engineering / Technological Alternatives

As per IRC:37-2018, flexible pavement option is recommended for the project road for its lowest cost

4.6 Conclusion

The analysis of alternatives for the Chirakuta-Jalukabari Project alignment indicates that the socio economic and environmental considerations have been given due weightage in the finalisation of the alignment. The minor adverse impacts would be manageable to an acceptable level by implementing Environmental Management Plan and the unavoidable losses will be compensated as per the applicable R&R guiding principles.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

5 BASELINE ENVIRONMENTAL PROFILE

This chapter provides an overall description of the existing environmental status in the project influence area. Studies were conducted to generate baseline data within a 10 Km radius along the proposed project on micro – meteorology, air quality, ground and surface water quality, noise levels, land environment including soil quality, geomorphology, land-use pattern, forest cover, biological environment and socio-economic status of the population, etc. From these inputs, possible significant impacts are identified. Impacts are quantified and an appropriate Environmental Management Plan is prepared to manage and mitigate these impacts.

EIA is a formal process for identifying the likely effects of particular activities or projects on the environment and human health and welfare. EIA also encompasses the development of mitigation measures to address these impacts and suggested approaches for implementation of mitigation and monitoring measures. EIA is not to be regarded as an academic exercise as this has to ensure that environmental values and factors have to be integrated into the decision-making process. EIAs convey information about environmental effects of a project to decision makers at a stage when such information can materially affect the output.

5.1 Project Area

The Project Road starts near Chirakuta and passes through village / localities namely Chirakuthi, Sonamukhi, Koliarkhal, Tilapara, MohishBathan, Salkocha, Hatipota, Dhirghat, Arayarjhar, Kharida Gossaigaon, Chapar, Bahalpur, Nitya Bazar, Kayethpara, Talguri, Salbari, Besimari, Boitamari, Borkhata (Nolbari), Khagarpur, Uttar Salmara, Tulungia (junction with NH-117), Deohati, Choutaki, Singimari, Kabaitary Tinali, Oudubi, Jogighopa, Kharbhuja, Makri, Dakurivitha, Hadalpara, Kalyanpur, Solmari, Gendra, Balijan, Budhipara, Agia, Ulupara, Agia Paharkata, Dudhnoi, Fafal, Puranibitha, Amjonga, Kachadal, Darangiri, Dosimapara, Rangjuli, Dhanubhanga, Deoshila, Gathiapara, Kothakuthi, Dhupdhara, Sakite, Hakite, Bandapara, Kukurmara, Rajapara, Dhupguri, Chukunai Para, Burgrui, Singra, Boko Nagopara, Chak Baho, Boko Jarapara, Boko Dakhurpara, Boko, Barpara, Turukpur, Turukpara, Agucka Boko, lampara, Bripara, Bongaon market, Bamunigaon, Khabibe, Gobardhan, Kumi, Chhaygaon, Champak Nagar, Kharavanga, Kukurmara, Bartezipur, Surutezipur, Rampur, Bhagabatipara, Rajapokubi, Batarhat, Haligaon, Bijohnagar, Uparhali, Sarpara, Mirza, Barkuchi, Sontola, Bongara, Khuikuchi, Bullapara, VIP chok, Kahikuchi, Azara, Lankeswar and ends at Jalukbari in Guwahati. The project road passes through the Congested built-up town at Chapar, Chalantapara, Krishnai, Dudhnoi and Mirza, In general eccentric widening has been proposed in rural area.

The Package-1 of the project road starts near Chirakuta and ends Near Mowatari, before Chapar Bypass) (Ex.Ch.5.580km to Ex.Ch.25.633km). The existing length of Package-1 is 20.053km (As per Topographic Survey). The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain. The proposed road is planned for improvement of existing 2 lane road to 4 lane road.

5.1 Methodology

5.1.1 Study area:

Project Influence Area: As per guidelines of EIA Notification-2006 and MoEF Environmental Impact Assessment Guidelines Manual for Highways, the Project Influence Area has been defined as 10 km on either side from boundary of road for collection of secondary data, including impacts due to ancillary sites like borrow areas, quarry, material storage and disposal areas.

Direct Impact Zone (DIZ): The primary baseline data has been collected within the right of way as well as area falling within 500 m on either side of existing right of way. The overall project's direct impact has been identified for the areas coming under Direct Impact Zone, which is the proposed ROW that is 30 m-45 m for the project area.

Baseline Environmental Conditions: A detailed survey has been carried out and a strip plan has been prepared covering all environment features and components in the project stretch, within the project influence zone. The primary baseline data has been collected within the proposed ROW as well as area falling within 500m on either side of existing ROW. The secondary data has been collected within the 10 km of the existing centerline of highway. Primary data for ambient air quality, ambient noise status, water quality (Ground and surface) and soil quality were collected.

5.2 Physical Environment

Determination of baseline conditions of natural and physical environmental components along project road is vital for robust impact assessment. The components of the environment for which the information has been collected are described in the following sections.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

5.2.1 Meteorology

The study of Meteorological and micro meteorological parameters is significant in a road project as these parameters regulate transport and diffusion of pollutants released into the atmosphere. The following sections describe the key elements of the climate, viz., temperature, wind, rainfall and relative humidity and evaporation. The project road is passing through the five districts of Assam. The Package-1 is comes under dhubri districts of Assam. The districts of Package-1 are in Table 5-1.

Table 5-1: Districts of Package-1

Sl. No.	Package	District
1.	Package-1	Dhubri

5.2.1.1 Climate of Dhubri

The climate of Assam is characterised by hot humid summer and cool-dry winter conditions. As is typical for Assam, Dhubri has a monsoon-influenced humid subtropical climate, being a little too cool to qualify as a tropical monsoon climate. The "cool" or winter season from November to February is warm to very warm during the afternoon, and pleasantly cool in the morning. The "hot" season of March and April is indeed hot and sees increasing humidity and rain, leading into the oppressively humid and extremely wet monsoon season from May to the middle of October.

Temperature: The average ambient temperature remains 24.3°C, varies from 8.8°C to 36.4°C. The average relative humidity remains around 79.4%, varies from 39% to 99%.

Precipitation: The district received rainfall of 2732 mm, 1515 mm and 1549 mm during 2011, 2012 and 2013 respectively.

5.2.2 Land

5.2.2.1 Dhubri District

Geology

Dhubri District is bounded both by inter-state and international border i.e. West Bengal and Bangladesh in the west, Goalpara and Bogaigoan district of Assam and Garo Hills district of Meghalaya in the east, Kokrajhar district in the north, Bangladesh and state of Meghalaya in the south. The district has no known source of minerals or mines. But in the areas namely Gauripur, Golokganj, Bilasipara and Chapar clay soil of highest quality is found exorbitantly. Therefore manufacture of bricks, roofing tiles and pottery are seen to have flourished in plenty. Granite and granite-genesis and intrusive dolerite are of common sight. Artisans making Terracotta are found in plenty.

Physiography

Dhubri is one of the plains districts of Assam. It falls in the Brahmaputra valley. The present Dhubri District has three Sub-divisions viz. (a) Dhubri(Sadar), (b) Bilasipara and (c) South Salmara/Mankachar. The mighty river Brahmaputra bisects the district, on Northern side with Dhubri and Bilasipara Sub-Division and Southern side with Southa Salmara-Mankachar Sub-Division.

The district has eight revenue circles. The revenue circles are-Gassaigaon(Pt), Agamoni, golokganj(Pt), Dhubri (Pt), Bagribari(Pt), Bilasipara(Pt), Chapar(Pt), South Salmara and Mankachar as per Census 2011. Many of the Revenue Circles were marked as Part because after formation of BTAD many villages from original Revenue Circles were transferred to Kokrajhar district of BTAD

Soil

The soil of the district has been found to exhibit heterogenous characteristics. In the district majority of the places particularly riverine tracts loamy to sandy loam soil are predominant. In some pockets clay to heavy clay soil are also in existence. Soil reaction is acidic.

5.2.3 Hydrogeology

The state has vast water resources in the form of lakes, ponds, rivers and streams, some with marshy areas. It has abundant of water potential both ground as well as surface water. The ground water aquifers in the region occur in sediments and fractured rocks. Springs are either seasonal or perennial and are often used for irrigation and drinking purposes. There are number of hot springs in the region which are being used by the local communities for domestic and agricultural purposes and also being used by the visiting tourists.



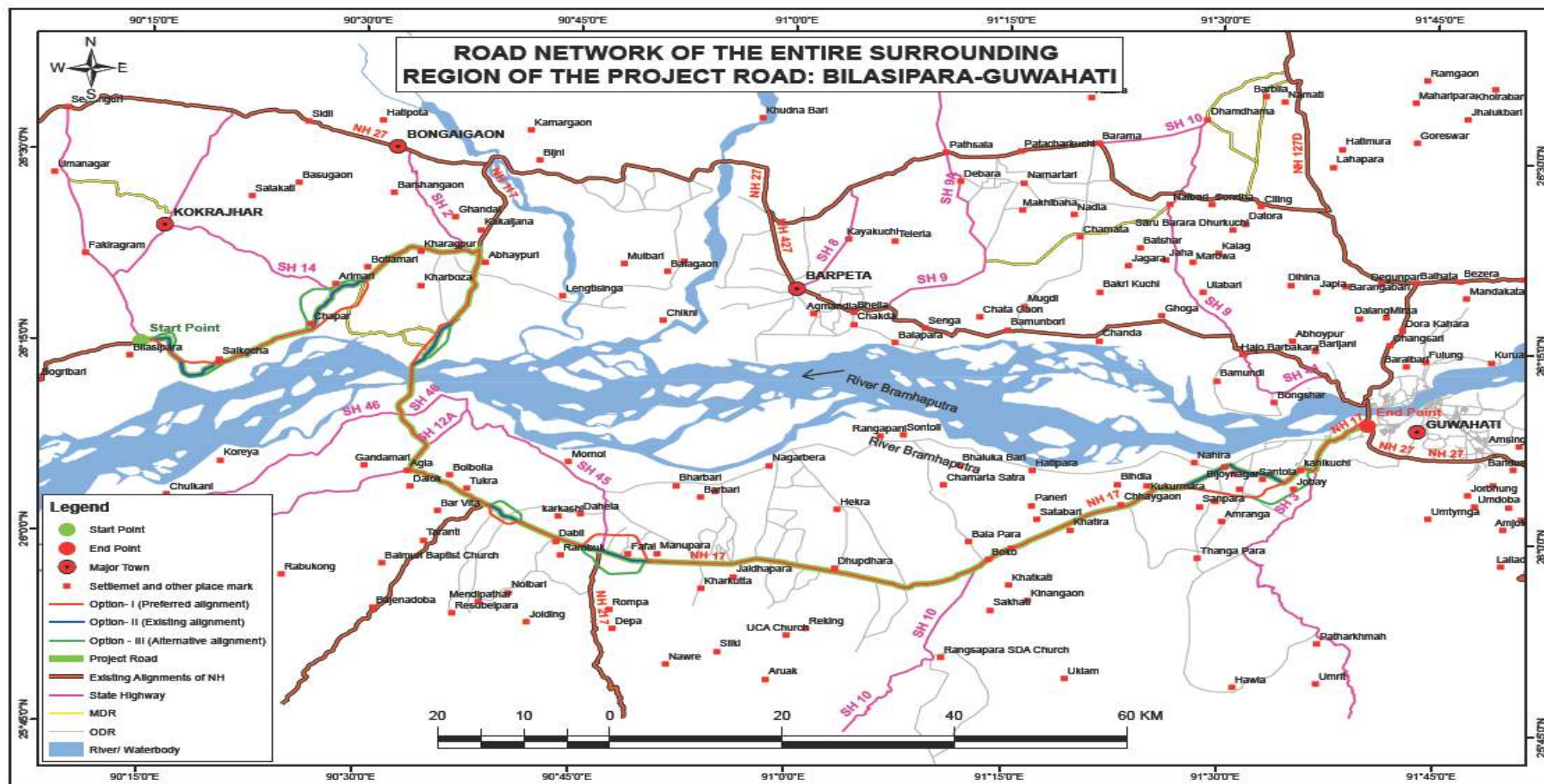
PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

In general, data and information regarding catchment area and its characteristics, river profiles, flood and design discharge parameters etc. collected from concerned authorities and CWC publications will form the basis of hydrological and hydraulic studies for all existing cross-drainage structures along the project road. Flood marks will be observed on existing bridges and other structures in project area. Distinct water marks on bridge piers and other structures will be determined by observation or local inquiry, noting period and time of observation. Longitudinal sections of the streams along the central line of the deep water channels will be undertaken, indicating highest flood level and low water level.

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana (Lot-1) Package 1A (Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Final Detailed Project Report
Environmental Impact Assessment report



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

5.2.4 Seismicity

Based on the distribution of epicenters, fault plane solutions and geotectonic features, northeastern region is divided into five seismotectonic zones. These are (i) Eastern Himalayan collision zone (ii) Indo-Myanmar subduction zone (iii) Syntaxis zone of Himalayan arc and Burmese arc (Mishmi Hills) (iv) Plate boundary zone of the Shillong Plateau and Assam Valley and (v) Bengal Basin and Plate Boundary Zone of Tripura Mizoram fold belt.

The proposed project corridor attracts under zone-5 (Plate boundary zone of the Shillong Plateau and Assam Valley). Seismicity in this zone is considered as the plate-boundary zone activity. Seismic activity is quite high in this zone.



Figure 5-2: Seismic Zone Map of India & Assam

5.2.5 Baseline Environmental Monitoring

5.2.5.1 Result and Analysis of Soil Quality

Land and soil constitute the basic components of the physical environment. The alignment of a road may cause changes in land, land use, soil and denudation processes in different intensities. To understand the soil quality in the area, 8 locations were selected for soil sampling. Composite sampling of soil up to root depth (10-15 cm) was carried out at each location.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Table 5-2: Location of Soil Sampling

Sl no	Location Code	Name of the Location	Chainage (KM)
1.	SQMS 1	Starting Point (Bilasipura)	001+200
2.	SQMS 2	Near Chapar Bypass	022+500
3.	SQMS 3	Uttar Salmara	047+800
4.	SQMS 4	Chalantapara Bypass	063+100
5.	SQMS 5	Krishnai Bypass	096+100
6.	SQMS 6	Amjonga	118+400
7.	SQMS 7	Bhatipara	179+500
8.	SQMS 8	Mirza	199+150

The characteristics of soil of the project area vary from place to place due to topographical variations. The soil in the project area is mostly clay to sandy loam. Chemical and physical tests were carried out on soil at selected locations along the project road and the test results are given Table.

Table 5-3: Soil Characteristics along the Project Road

S. No.	Parameter (s)	Test Result								Unit
		SQMS 1	SQMS 2	SQMS 3	SQMS 4	SQMS 5	SQMS 6	SQMS 7	SQMS 8	
1	Soil Texture	Sandy Loam	Loamy	Sandy Loam	Loamy	Loamy	Sandy Loam	Sandy Loam	Sandy Loam	-
2	Soil Colour	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	
3	pH Value at 25°C	7.85	7.39	7.94	7.77	7.84	7.54	7.66	7.49	-
4	Conductivity at 25°C	934	912	888	808	932	1010	984	1041	µS/cm
5	Moisture	11.8	13.8	11.4	13.4	13.2	14.2	13.2	13.4	% by mass
6	Bulk Density	1.41	1.35	1.43	1.37	1.21	1.37	1.38	1.41	gm/cc
7	Water Holding Capacity	1.18	1.27	1.19	1.22	1.28	1.24	1.20	1.18	Inches/foot
8	Nitrogen as N	24.2	19.2	26.2	21.2	21.4	19.2	22.1	24.1	mg/Kg
9	Phosphorus	4.12	4.12	3.8	3.17	3.88	4.12	3.18	3.46	mg/Kg
10	Potassium (as K)	61.5	58.6	58.4	62.4	60.5	61.2	64.9	58.4	mg/Kg
11	Calcium as Ca	49	51	51	44	43	46	48	38	mg/Kg
12	Nitrate as NO ₃	82	89	81	86	78	84	88	67	mg/Kg
13	Sulphate as SO ₄	12.1	12.2	10.8	12.4	13.1	12.1	11.2	14.2	mg/Kg
14	Chloride	3.1	3.2	2.8	2.9	3.4	2.9	2.8	3.1	mg/Kg
15	Organic Carbon	4.2	4.1	3.4	3.9	3.8	3.5	3.1	3.1	% by mass
16	Organic Matter	4.7	4.6	4.1	4.8	4.6	4.6	4.1	3.6	% by mass
17	Total Soluble Solids	13.0	13.2	11.8	14.2	14.1	12.4	12.4	10.5	mg/Kg



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

S. No.	Parameter (s)	Test Result								Unit
		SQMS 1	SQMS 2	SQMS 3	SQMS 4	SQMS 5	SQMS 6	SQMS 7	SQMS 8	
18	Particle size distribution									
a	Sand	45.1	42.0	50.6	44.7	40.2	43.7	49.6	50.1	% by mass
b	Silt	28.8	21.1	28.1	23.7	25.2	23.7	24.6	27.8	% by mass
c	Clay	26.1	36.9	21.3	31.7	34.6	32.7	25.8	22.1	% by mass

Source: Soil Quality Monitoring carried out by EIA Team, 2020

Texture of soil was observed to be Sandy Loamat SQMS 1, SQMS 3, SQMS 6, SQMS 7 & SQMS 8, Loamyat SQMS 2SQMS 4, and SQMS 5, Colour of soil sample was found to be Yellowish Brown. Moisture content of soil ranges from 11.4-13.8 %. Bulk density in the soil sample of area was in the range of 1.21-1.43 g/cc. Low bulk density has favorable physical conditions, whereas those with high bulk densities exhibit poor physical conditions. Calcium contents in soil ranges from 38-51 mg/KG. Potassium (as K) content in soil ranges from 58.4-64.9 mg/kg. Available phosphorus content in the soil ranges from 3.18-4.12 mg/kg. Sulphate in soil of the area was found in the range from 10.8-14.2 mg/kg. Details is furnished in Table 5-3.

The road passes through a region where the potential for erosion is moderate. Erosion is not considered to be an issue in this project, as major portion of the road runs in the plain areas with practically no or very low grading. There are no high grades hence embankment erosion may not exist on high embankment, in case of inadequate compaction/design.

5.2.5.2 Ambient Air Quality

In order to assess the Ambient Air Quality (AAQ), samples of ambient air will collected by installation of Respirable Dust Sampler at different locations within the study area during study period and analyzed for primary air pollutants to work out the existing status of air quality.

Ambient air quality is the most important parameter that is required to quantify the impact on the natural and biophysical environment. Ambient air quality has been conducted during winter season in the year of 2018-2019 at total one (1) locations along the project road alignments. SPM and RPM have been determined gravimetrically and as specified in IS 5182 (Part 23):2006. The concentration of NOx has been estimated IS 5182 Part 2:2001 method and SOx has been estimated by IS 5182 Part 6:2006 method. CO was measured with EPA Method 13.

The monitoring station had been distributed throughout the project road so as to get representative baseline of any variation in land use as well as road geometrics and traffic conditions across the project road. The purpose is also to establish a benchmark, which can form the reference for monitoring in the construction and operation period.

Baseline AAQ Monitoring

Ambient air quality in the state is quite pure compared to other neighbouring states. There are no major industrial activities in the State. Dust arising from unpaved surfaces, forest fire, smoke charcoal production and domestic heating, and vehicular pollution are sources of pollution in the region. Firewood burning is the major contributor in the ambient pollution load. Industrial and vehicular pollution is mainly concentrated in the major commercial areas in State capital. The National Ambient Air Quality Standards (NAAQS) are presented in Table 5-4.

Vehicular pollution is a secondary source of pollution in the state as the traffic density is low. Pollution from vehicles is mainly due to use of low-grade fuel, and poor maintenance of vehicles. The level of pollution in rural areas is much lower than that of the urban areas due to lower volume of traffic. The traffic density in the state is very low.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Table 5-4: National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient air ($\mu\text{g}/\text{m}^3$) ***	
		Industrial, Residential, Rural and Others	Ecologically Sensitive
Sulphur Dioxide (SO ₂)	Annual Average*	50	20
	24 hr**	80	80
Nitrogen Dioxide (NO ₂)	Annual Average *	40	30
	24 hr**	80	80
PM ₁₀	Annual Average *	60	60
	24 hr**	100	100
PM _{2.5}	Annual Average *	40	40
	24 hr**	60	60
Carbon monoxide mg/m ³	8 hr **	02	02
	1 hr	04	04
* Annual Arithmetic mean of minimum 104 measurements in a year taken for a week 24 hourly at uniform interval. ** 24 hourly / 8 hourly values should meet 98 percent of the time in a year *** except for CO			

The base-line status of the ambient air-quality was assessed using a scientifically designed ambient air-quality monitoring network. To establish the baseline ambient air quality, Ambient Air Quality Monitoring (AAQM) stations were set up at 9 locations as indicated in Table 5-5.

Table 5-5: Details of Ambient Air Quality Monitoring Locations

Sl. No	Location Code	Name of the Location	Chainage (KM)	Distance from project road (m)
1.	AAQM-1	Chirakuta (Near Mosque)	004+500	100m
2.	AAQM-2	Near Chapar	022+000	200m
3.	AAQM-3	Tulungia Market	049+100	150m
4.	AAQM-4	Chalantapara-IV	063+000	200m
5.	AAQM-5	Agia	086+100	200m
6.	AAQM-6	Dudhnoi Bypass Point	109+100	150m
7.	AAQM-7	Rangjuli	128+800	100m
8.	AAQM-8	Near Chhayagaon Health Centre	177+850	150m
9.	AAQM-9	Deepor	206+800	200m

At each of the nine locations monitoring was undertaken as per new notification issued by MoEF on 16th November 2009, in the month of February and March, 2020. Data for the following parameters was collected.

- PM 10
- PM 2.5
- Sulphur Dioxide (SO₂)

[Signature]



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

- Oxides of Nitrogen (NO_x)
- Carbon monoxide (CO)
- Hydrocarbons (HC); and
- Lead (Pb)

The sampling of PM₁₀, PM_{2.5}, SO₂, NO_x & Pb was undertaken on a 24-hourly basis while 8- hourly samples were collected for CO and HC.

A summary of results for each location is presented in Table 5-6. Figure 5-3 shows the graphically presentation of the existing air quality along the project road at five monitored locations. These results are compared with the new National Ambient Air Quality Standards prescribed by the MoEF for respective zones

Table 5-6: Summary of AAQM Results

Para-meters	Statistics	AAQM-1	AAQM-2	AAQM-3	AAQM-4	AAQM-5	AAQM-6	AAQM-7	AAQM-8	AAQM-9
PM _{2.5} µg/m ³ (60)	Min	36	51	46	51	40	41	42	50	42
	Max	44	62	64	64	48	46	51	59	54
	Mean	40	56.25	55	58.75	43.25	43.25	46.25	54.25	48.74
PM ₁₀ µg/m ³ (100)	Min	65	78	84	92	71	64	64	82	68
	Max	80	105	107	112	82	77	84	94	81
	Mean	74.125	91.38	94	100	76.13	70.13	72.63	90	74.63
SO ₂ µg/m ³ (80)	Min	6.5	8.7	8.2	9.4	6.4	7.2	7.8	7.3	7.1
	Max	7.9	11.2	9.6	11.3	9.4	9.6	9.4	10.2	8.2
	Mean	7.46	9.6	8.91	9.99	7.9	8.21	8.63	8.66	7.68
NO ₂ µg/m ³ (80)	Min	14.5	17.5	16.7	16.8	12.9	12.8	14.5	14.6	15.4
	Max	17.2	19.4	18.4	18.6	15.7	16.2	17.2	19.2	18.6
	Mean	15.95	18.4	17.29	17.89	14.14	14.44	15.73	16.33	16.68
CO (mg/m ³)	Min	0	1	0	1	0	0	0	0	0
	Max	0	1	1	1	0	0	0	1	0
	Mean	0	1	0.50	1	0	0	0	0.5	0
Hydrocarbon (µg/m ³)	Mean	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Lead µg/m ³	Mean	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL-Below Detectable Limit

Source: Ambient Air Quality Monitoring carried out by EIA Team, 2020

It can be seen from the Table 5-6 that out of nine locations of air monitoring the PM₁₀ and PM_{2.5} concentration at AAQM 2, AAQM 3 and AAQM 4 marginally exceeds permissible limits. While at other locations the PM₁₀ and PM_{2.5} conc. is well within limits. Other parameters monitored i.e. NO_x, SO₂, CO were found within the permissible limits for all the locations. Overall, the air quality in the project area is not an issue.

J. Murali



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

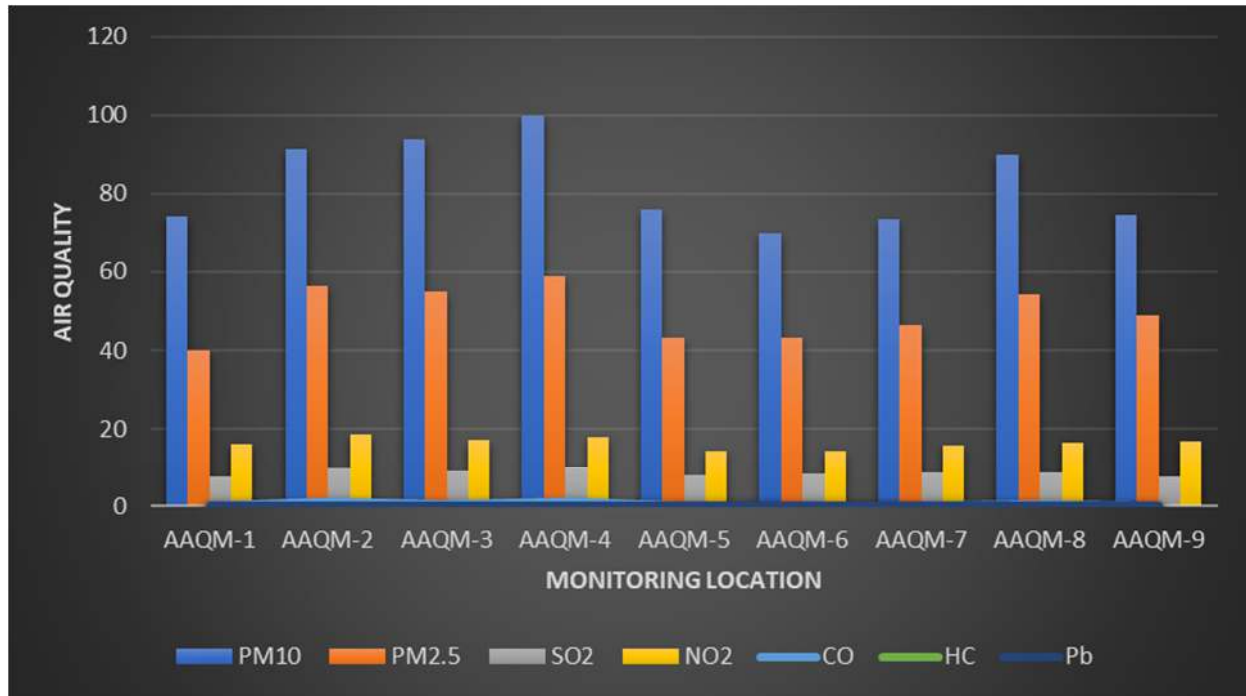


Figure 5-3: Air Pollutant Concentration in Ambient Air along the Project Area

5.2.5.3 Surface Water Quality

In order to establish baseline conditions, surface samples were collected. The sampling locations were selected after the field reconnaissance and a review of all the water bodies/ resources in the project influence area. Samples were collected as per IS 3025 Part-I. In order to represent the true profile of the project area, samples of surface water of the area through which the project road runs were collected and analysed. Grab sample were collected from water source and were analysed for various parameters as per the procedures laid down in the APHA and BIS.

Table 5-7: Details of Surface Water Quality Monitoring Station

Sl. No	Location Code	Name of the Location	Chainage (KM)	Distance from project road (m)
1.	SW-1	Near Bamunpara Pt IV (River)	004+600	150m
2.	SW-2	Near Tulungia Bazar	048+800	100m
3.	SW-3	Chalantapara IV	068+800	150m
4.	SW-4	Dudhnoi	115+100	150m
5.	SW-5	Birpara (Pond)	166+100	50m
6.	SW-6	Chhayagaon	178+200	150m
7.	SW-7	Kukurmara	182+400	200m
8.	SW-8	Deepor (from Pond)	207+800	100m

The results of the analysed of these samples are presented in Table 5-8. The results were compared with standards for drinking water quality.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Table 5-8: Surface Water Quality Characteristics along the Project Road

S. No.	Parameter (s)	Test Result								Acceptable Limit	Permissible Limit
		SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8		
1	Colour, Hazen units	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	5 Max	15 Max
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	7.32	7.51	7.27	7.08	7.14	7.44	7.14	7.54	6.5 – 8.5	No Relaxation
4	Temperature, °C	19.8	19.3	19.6	20.1	19.6	20.1	19.4	18.4	-	-
5	Conductivity at 25°C, µS/cm	288	294	371	441	512	422	362	756	-	-
6	Total Dissolved Solids, mg/l	187	191	241	287	333	274	235	20	500 Max	2000 Max
7	Total Suspended Solids, mg/l	12	10	9	10	12	10	11	512	-	-
8	Total Solids, mg/l	199	201	250	297	345	284	246	94.2	-	-
9	Calcium (as Ca), mg/l	23.4	27.4	34.6	45.2	52.4	48.2	35.2	25.3	75 Max	200 Max
10	Magnesium (as Mg), mg/l	12.5	12.4	15.2	16.2	21.1	14.6	13.6	14.2	30 Max	100 Max
11	Sodium (as Na), mg/l	11.2	10.2	12.4	13.2	12.4	10.2	11.2	6.6	-	-
12	Potassium (as K), mg/l	5.1	4.5	5.8	5.8	8.4	6.4	6.7	94.2	-	-
13	Total Alkalinity (as CaCO ₃), mg/l	101	106	151	176	208	164	154	274	200 Max	600 Max
14	Sulphate (as SO ₄), mg/l	29	34	31	42	58	51	34	104	200 Max	400 Max
15	Chloride (as Cl), mg/l	11.8	11.2	12.8	13.4	12.8	12.4	11.8	16.2	250 Max	1000 Max
16	Nitrate (as NO ₃), mg/l	1.1	1.2	1.4	1.8	1.6	1.8	1.2	2.4	45 Max	No Relaxation
17	Ammonia (as NH ₃), mg/l	0.16	0.16	0.15	0.11	0.17	0.12	0.18	0.21	0.5 Max	No Relaxation
18	Iron (as Fe), mg/l	0.05	0.04	0.06	0.08	0.05	0.06	BDL	0.12	0.3 Max	No Relaxation
19	Dissolved Phosphate (as PO ₄), mg/l	0.2	0.4	0.3	0.2	0.1	0.3	0.4	1.2	-	-
20	Total Hardness (as CaCO ₃), mg/l	110	119	149	180	218	180	144	512	200 Max	600 Max
21	BOD, (mg/l)	2.1	2.5	2.4	2.8	5	2.1	2.4	8	-	-

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

S. No.	Parameter (s)	Test Result								Acceptable Limit	Permissible Limit
		SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8		
22	COD, (mg/l)	10	11	10	12	17	10	11	18	-	-
23	Dissolve Oxygen, mg/l	7.2	6.9	7.2	7.5	6.3	7.2	7.1	6.4	-	-
24	Lead as Pb, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	1.5
27	Zinc as Zn, mg/l	0.2	0.1	0.2	0.1	0.1	0.1	0.2	0.1	5	15
28	Cadmium as Cd, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01	0.05
30	Total Chromium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	No Relaxation

Source: Water Quality Monitoring carried out by EIA Team, 2020

It can be seen from Table 5-8 that the pH of the sampled water in the region is well within permissible limits (6.5 – 8.5). Total hardness as CaCO₃ in the water sample from SW-8 is found at 512 mg/l which is highest in all samples but very less than the permissible limit (600mg/l) prescribed for drinking water standard limits. BOD level for all analysed water samples is higher than the permissible standards. Other parameters analysed like chloride, sulphate, fluorides are found well within standards. Overall the surface water quality in the project areas in good.

5.2.5.4 Ground Water Quality

All ground water sources monitored were Hand Pumps and deep wells. Since the ground water is used without treatment by a large portion of population, the quality of ground water is of great concern. 7 representative ground water monitoring stations were selected based on their importance as source of irrigation and water supply, size, future impacts and quantum of water available. The physical and chemical parameters of the collected samples were tested as per established standard methods and procedures. The locations selected for ground water sampling are presented in table below. The monitoring has been carried out with the following objectives:

- To establish the baseline water quality at critical locations to be impacted; and
- To work out the extent of enhancement of water resources along the corridor in terms of improvement of water quality.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Table 5-9: Details of Ground Water Quality Monitoring Station

Sl. No	Location Code	Name of the Location	Chainage (KM)	Distance from project road (m)
1.	GW-1	Bilasipuara	0+050	150m
2.	GW-2	Near Chapar Bypass	22+600	150m
3.	GW-3	Besimari	035+050	100m
4.	GW-4	Krishnai College	097+100	150m
5.	GW-5	Near Goalpara	159+200	150m
6.	GW-6	Chhayagaon	179+500	200m
7.	GW-7		207+800	

In order to establish baseline conditions, groundwater samples were collected. The sampling locations were selected after the field reconnaissance and a review of all the water resources in the project influence area. Samples were collected as per IS- 2488 (Part I-V). The results of the analysed of these samples are presented in Table 5-10

Table 5-10: Ground Water Quality Characteristics along the Project Road

S. No	Parameter(s)	Test Result							Acceptable Limit	Permissible Limit
		GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7		
1	Colour, Hazen units	< 1	< 1	< 1	< 1	< 1	< 1	< 1	5 Max	15 Max
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Temperature, °C	22.2	21.1	20.9	20.8	19.5	20.1	21.2	-	-
4	pH Value at 25°C	7.48	7.19	7.86	7.37	7.62	7.41	7.08	6.5 – 8.5	No Relaxation
5	Conductivity at 25°C, µS/cm	426	405	333	376	438	387	299	-	-
6	Total Dissolve Solids, mg/l	277	263	217	244	285	251	194	500 Max	2000 Max
7	Calcium (as Ca),mg/l	46.2	35.2	23.7	34.2	41.2	32.4	28.4	75 Max	200 Max
8	Magnesium (as Mg) , mg/l	14.2	19.4	18.4	16.2	20.1	18.6	12.4	30 Max	100 Max
9	Sodium (as Na) ,mg/l	13.4	12.4	11.2	11.2	11.4	12.5	9.5	-	-
10	Potassium (as K) ,mg/l	6.7	5.6	6.2	7.4	6.8	7.2	5.8	-	-
11	Alkalinity (as HCO ₃), mg/L	168	174	134	144	156	147	118	-	-
12	Sulphate (as SO ₄) ,mg/l	44	36	34	46	52	46	28	200 Max	400 Max
13	Chloride (as Cl),mg/l	15.2	13.4	11.8	12.4	13.4	14.2	10.2	250 Max	1000 Max
14	Nitrate (as NO ₃) ,mg/l	1.9	2.3	1.6	2.1	1.9	2.1	1.2	45 Max	No Relaxation
15	Boron (as B), mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.5 Max	1.0 Max



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

S. No.	Parameter(s)	Test Result							Acceptable Limit	Permissible Limit
		GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7		
16	Nitrite (as NO ₂), mg/L	0.06	0.05	0.03	0.08	0.03	0.04	0.02	-	-
17	Fluoride (as F), mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1 Max	1.5 Max
18	Dissolve Phosphate (as PO ₄), mg/L	0.2	0.4	0.05	0.4	0.1	0.2	0.1	-	-
19	Total Hardness (as CaCO ₃), mg/L	101	168	135	151	185	157.3	122	200 Max	600 Max
20	E. Coli, (MPN/100ml)	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Shall not be detected in 100ml sample	
21	Total Coliform, (MPN/100ml)	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Shall not be detected in 100ml sample	

Source: Water Quality Monitoring carried out by EIA Team, 2020

It can be seen from Table 5.10 that the pH of the sampled water in the region is well within permissible limits (6.5 – 8.5). In the ground water samples collected from bore well at GW-5 show highest value of the total dissolved solids of 2485 mg/l which is well within the permissible standards. Overall the ground water quality in the project areas in good.

5.2.5.5 Noise

Noise attributed to roads depends on factors such as traffic intensity, the type and condition of the vehicles plying on the road, acceleration/deceleration/gear changes by the vehicles depending on the level of congestion and smoothness of road surface (IRC: 104-1988). High noise levels are a concern for sensitive receptors, i.e. hospitals, educational institutions, etc.

The Central Pollution Control Board has specified ambient noise levels for different land uses for day and night times and these are given below in Table 5-11 below. Importance was given to the timing of exposure and areas designated as sensitive.

Table 5-11: National Ambient Noise Level Standards

Area Code	Category	Limits in Decibels (dB A)	
		Day Time	Night Time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zones	50	40

Source: Central Pollution Control Board, New Delhi

Note:

1. Day-time: 6 AM to 10 P.M., Night-time: 10 PM to 6 AM;
2. Silence zone is an area up to 100 m around premises as hospitals, educational institutions and courts.

Noise pollution is not a current problem in the region except in commercial location in urban areas where major settlements are along the road, and high traffic flow. During construction period, temporary increase in the noise levels are expected from the movement of construction machineries and construction activities. Suitable barriers and timely scheduling of construction activities will minimize these impacts.

Sl. No.	Location Code	Name of the Location	Chainage(KM)	Source
1	NL-1	Chirakuta (Near Mosque)	4+500	Silence Zones
2	NL-2	Sreegram PT	014+800	Residential

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Sl. No.	Location Code	Name of the Location	Chainage(KM)	Source
3	NL-3	Near Chapar	022+000	Residential
4	NL-4	Tulungia Market	049+100	Commercial
5	NL-5	Chalantapara-IV	063+000	Residential
6	NL-6	Agia	086+100	Residential
7	NL-7	Dudhnoi Bypass Point	109+100	Commercial
8	NL-8	Rangjuli	128+800	Residential
9	NL-9	Near Chhayagaon Health Care Centre	177+850	Silence Zones
10	NL-10	Deepor	206+800	Residential

At each of the ten locations, Sound Pressure Level (SPL) measurements were taken at an interval of 1 minute using a sound level meter of Lutron make Digital Sound Level Meter. At all these locations, daytime noise levels were monitored during the period 6 am to 9 pm and night-time noise levels during the period 9 pm to 5am. Noise readings, with setting at 'A' response - slow mode, were recorded. The readings were tabulated and a frequency distribution table prepared from which 24 hourly, hourly, and Average Leq noise levels were calculated.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Table 5-12: Ambient Noise Level in decibel (A) along the Project Road

Location	Date of Sampling	Noise Level dB (A)					
		Day Time			Night Time		
		L _{min}	L _{max}	Leq	L _{min}	L _{max}	Leq
NL-1	18/02/2020 to 19/02/2020	40.2	60.2	53.1	36.4	41.2	36.9
	22/02/2020 to 23/02/2020	39.8	54.5	49.8	35.2	40.2	36.1
NL-2	19/02/2020 to 20/02/2020	40.2	60.2	53.7	39.2	43.2	40.5
	23/02/2020 to 24/02/2020	39.8	61.2	55	38.4	41.2	38.4
NL-3	19/02/2020 to 20/02/2020	41.5	63.4	59.5	39.3	42.7	40.5
	23/02/2020 to 24/02/2020	42.3	64.2	59.8	40.1	45.2	40.3
NL-4	19/02/2020 to 20/02/2020	42.1	64.2	56.8	37.5	43.2	39.1
	23/02/2020 to 24/02/2020	42.5	67.2	58.9	38.1	44.2	40.3
NL-5	19/02/2020 to 20/02/2020	43.2	67.5	62.4	40.2	45.2	41.5
	23/02/2020 to 24/02/2020	42.5	66.2	61.2	40.2	43.2	41.2
NL-6	18/02/2020 to 19/02/2020	37.8	56.4	50.8	35.2	43.2	37.2
	22/02/2020 to 23/02/2020	37.8	54.2	49.6	34.5	41.2	37.6
NL-7	18/02/2020 to 19/02/2020	38.7	54.2	50.3	36.2	39.4	36.3
	22/02/2020 to 23/02/2020	38.4	54.2	50.2	35.4	38.6	35.7
NL-8	17/02/2020 to 18/02/2020	41.1	57.4	52.2	35.1	42.3	35.9
	21/02/2020 to 22/02/2020	40.5	55.6	50.6	34.9	41.8	35.2
NL-9	17/02/2020 to 18/02/2020	41.7	63.4	57.5	36.4	44.1	38.9
	21/02/2020 to 22/02/2020	40.8	61.2	55	35.2	44.6	38.3
NL-10	17/02/2020 to 18/02/2020	40.1	54.2	50	35.2	40.2	36.9
	21/02/2020 to 22/02/2020	41.5	53.2	45.4	35.1	41.2	35.7

Source: Ambient Noise Quality Monitoring carried out by EIA Team, 2020

 marginally High  Very High

Presentation of Results-It can be seen from the Table 5-12 that at locations (NL1-NL10) along proposed alignment, the average day time noise level varies from 45.4 dB(A) to 62.4 dB(A), whereas average night time noise level ranges from 35.2 dB(A) to 41.5 dB(A).

The noise monitoring survey shows that noise levels are in silence area higher than the noise standards. This may be due to mix activities as well as vehicular movement on the road. It is found that the recorded noise level is marginally higher than the permissible limits for residential area prescribed by CPCB and also by World Bank EHS standards of 55 dB(A) and 45 dB(A) for day time and night time respectively. Night time noise level readings were taken upto 10 pm to 6 AM, although as after 12am no traffic movements were observed. This noise is mainly from vehicular traffic and local domestic/commercial activities.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

5.3 Ecological Environment

The ecology is the scientific analysis and study of interactions among organisms and their environment. It is an interdisciplinary field that includes biology and Earth science. The biodiversity and conservation discipline explores natural landscapes, species and ecosystems and acquires theories and practical methods in preserving environments and organisms. Biodiversity refers not only to endangered species but also to every organism, including microbes and fungi. Biodiversity and conservation programmes increase awareness and understanding of how human life depends on preserving animal species and natural ecosystems. Biodiversity and conservation is connected to similar disciplines like environmental science, natural resources management and animal sciences.

5.3.1 Flora and fauna in Dhubri

Forest wealth is one of the major source of economy of the people of Dhubri district. A large number of people in the district primarily the rural areas depend on forest to a great extent. The total Forest area of Assam (excluding unclassified State Forest) is approximately 1932657.06 Hecter. The valuable trees available in forests of the district are – Sal (Shorea-rousta), Poma (Cedrela-tuna), Outenga (Dellenia-indicum), Sida (Legerstroonia-parviflora, Azar (Lfloreginae), Bhomra (Terminaliajambolana), Simul (Bomhax-malabarica) etc.

The districts forest has significant areas which are ecologically fragile and bio-diversity rich. The Bio-diversity of the forests is abundant in variety. Wild animals mostly like tiger, leopard, golden langur, leopard cat, gaur, mongoose, porcupine, pangoline, flying squirrel, civet cat. Along with all these prolific gifts of the nature Chakrasila has a wide variety of avifauna is found in this district.

5.3.2 Forest Areas along the Project Road

Forest are important natural resources and they influence climate, soil conditions particularly soil and water balance, erosion, floods, maintenance of bio-sphere, ecology as well as wild flora and fauna etc. Forest cover in the project districts are given in Table 5-13.

Table 5-13: Forest Cover in the Project Districts (km²)

District	Geographical Area (GA) Sq Km	Total forest area	% of GA
Dhubri	2798	418	14.94

Forest stretch has been observed along the project stretch. Affected Length of the forest for PKG-1 is 2.169km along the project road

5.3.3 Road Side Trees along the Project Road

The baseline ecological survey has primarily taken into account the flora along the roadside, as the direct impact of the road project is on trees in and adjacent to the RoW. Road side vegetation is likely to be impacted due to road widening. However, no endangered floral species was seen along the roadside. The total numbers of trees to be cut is presented in Table 5-14. Road side vegetation is likely to be impacted due to road widening.

Table 5-14: Package wise total Numbers of trees

SI no	Package	No. of trees
1.	Package 1	4392(Approx)

5.4 Socio-Economic Environment

5.4.1 Demographic pattern

The project highway passes through the districts of Dhubri, Goalpara, Bongaigaon and Kamrup in Assam. As per the 2011 census, Assam has a total population of 311,69,272 and the total male and female population in the state is 159,54,927 and 152,14,345 respectively. The population density per sq km is 397 in Assam. The literacy rate of the Assam is 73.18 while the sex ratio is 954. Table below gives the census profile of the project district.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Table 5-15: District Wise Population

Districts/ State	Population		
	Total	Male	Female
Dhubri	1,948,632	998,346	950,286

5.4.2 Educational Institutes

There are a number of educational institutes including private and government along the project corridor. These sensitive receptors are exposed to dust and noise from the road. Signage and Safety measures are required. The total list of noise sensitive features like school along the project road is given in Table 5-6.

Table 5-16: list of school along the project road

Sl. no	Description	Design Chainage (km)	Existing Chainage (km)	Side
Package-I				
1	School	8.025	15.575	RHS
2	School	9.500	17.050	LHS
3	School	12.575	20.470	RHS
4	School	15.125	23.020	LHS
5	School	15.430	23.325	LHS
6	School	17.480	25.375	LHS

5.4.3 Presence of Healthcare Center

Road side Sensitive receptors such as Health Center not found in the project section for PKG-1.

5.4.4 Religious Structures within RoW

Under the direct and indirect impact zone there is no Site or Property protected under the Archeological Survey of India and the State Archaeological Department. The project highway traverses through a number of settlements and there are some religious and cultural properties which though not of archaeological significance are nevertheless, significant to the community. Cultural properties along the project highway were identified and documented based onsite surveys and during strip mapping. Chainage wise details of these are presented in Table 5-7.

Table 5-17: Details of Religious Structures in RoW

Sl. no	Description	No.	Design Chainage (km)	Existing Chainage (km)	Side
Package-I					
1	Temple	1	6.190	-	LHS
2	Temple	1	8.035	15.585	LHS
3	Temple	1	8.060	15.615	LHS
4	Temple	1	8.130	15.680	LHS
5	Temple	1	8.170	15.717	LHS
6	Temple	1	16.075	23.975	RHS
Total=		6			

J. Mulya



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

5.4.5 Land Use Pattern of the Project Area

The land use pattern of the road stretch is mainly agricultural land and some settlement areas are observed along the project road. In some stretches forest are observed. Detailed landuse map with the help of remote sensing satellite data has been prepared for within 10 km radius on either side of the project road shown in Figure 5-4.

5.4.6 Terrain Classification

The project road passes through plain terrain. The topography is mainly agricultural and barren area, also some settlement areas are observed along the project road.

5.4.7 Settlement

During survey work, it has been observed that there are 10 nos. of habitations along the project road. Details of the habitations are given below.

Table 5-18: Habitation Name along the project road

Sl. No.	Chainage (Km)		Length (Km)	Name of Habitation
	From	To		
1	5.580	8.000	2.420	Chirakuthi
2	8.000	10.000	2.000	Sonamukhi
3	10.000	10.800	0.800	Koliarkhal
4	10.800	12.000	1.200	Tilapara
5	12.000	13.400	1.400	Mohish Bathan
6	13.400	15.600	2.200	Salkocha
7	15.600	20.000	4.400	Hatipota
8	20.000	23.000	3.000	Dhirghat
9	23.000	25.000	2.000	Arayarjhar
10	25.000	25.633	0.633	Kharida Gossaigaon

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

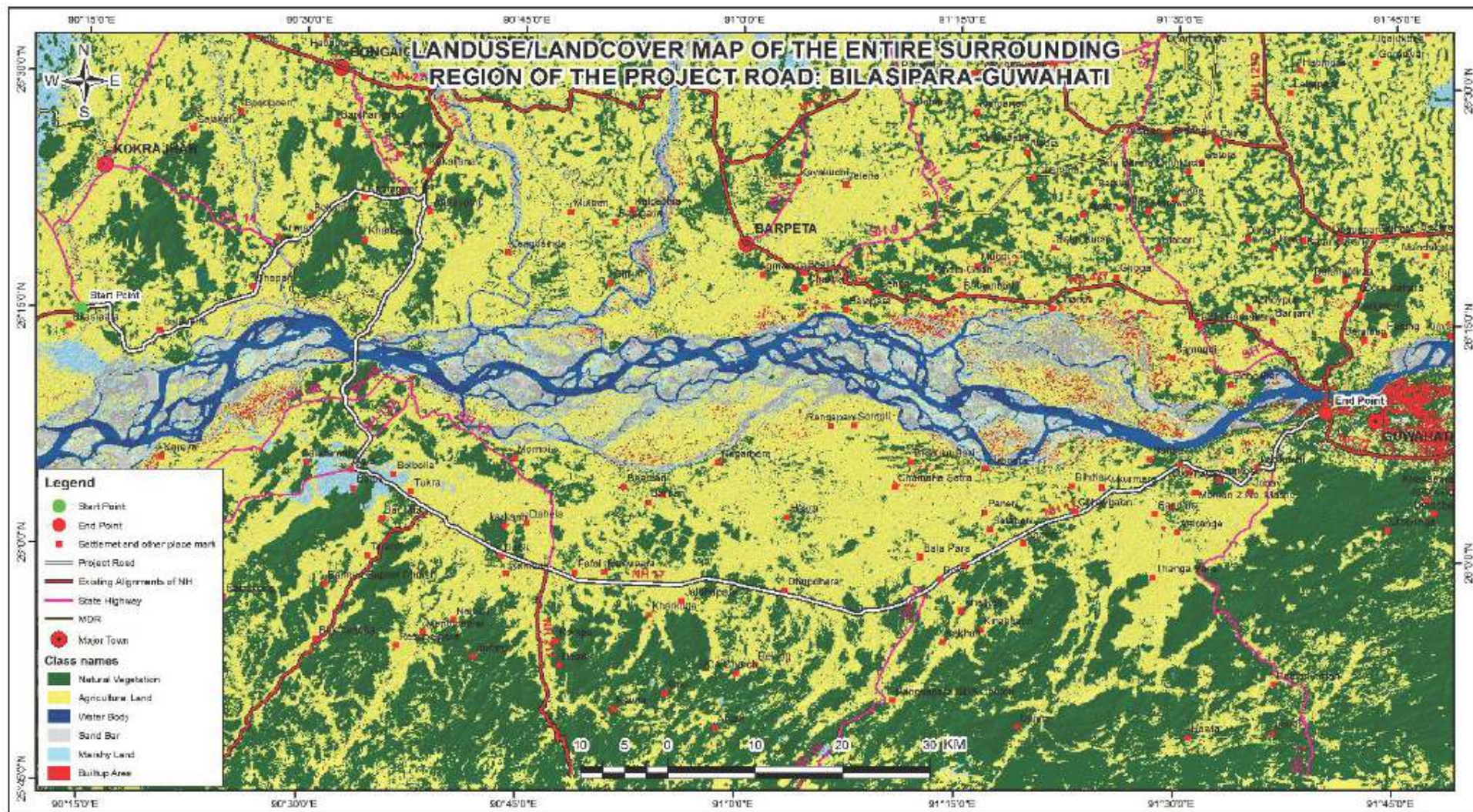


Figure 5-4: Landuse and landcover map of entire surrounding region of the project road

6 PUBLIC CONSULTATION

As a part of the project preparation and to ensure that the community support is obtained and the project supports the felt needs of the people; public consultations were carried out as an integral component. A continuous involvement of the stakeholders and the affected community was obtained. The feedback in the consultation sessions has led to substantial inputs for the project preparation – including, influencing designs. Consultations involve soliciting people's views on proposed actions and engaging them in a dialogue. It is a two-way information flow, from project authorities to people and, from people to project authorities. While decision making authority would be retained by the project authority, interaction with people and eliciting feedback allows affected populations to influence the decision making process by raising issues that should be considered in designing, mitigation, monitoring and management plans and the analysis of alternatives.

This chapter documents the issues that are close to the community, their aspirations and their addressal by the project. The objectives of consultation sessions, the procedure adopted and the outputs of the consultation conducted have been briefly described in the following sections.

6.1 Objectives

The main objective of the consultation process is to minimise negative impacts of the project and to maximise the benefits from the project to the local populace. The objectives of public consultation as part of this project are:

- Promote public awareness and improve understanding of the potential impacts of proposed projects;
- Identify alternative sites or designs, and mitigation measures;
- Solicit the views of affected communities / individuals on environmental and social problems;
- Improve environmental and social awareness;
- Clarify values and trade-offs associated with the different alternatives;
- Identify contentious local issues which might jeopardise the implementation of the project;
- Establish transparent procedures for carrying out proposed works;
- Inform the affected populace about the entitlement framework and to settle problems with mutual consent; and
- Create accountability and sense of local ownership during project implementation.

6.2 Stake Holders Consultation

The institutional level consultations were held with representatives of institutions having stakes in implementation of the project. The institutions contacted included State Forest Department, State Pollution Control Board etc. In addition to this, officials from other departments were also contacted on several occasions. The contacted officials included revenue officers, industry department etc.

6.2.1 Consultations during Design

Consultations were carried out at the design stages to identify:

- Location specific social and environmental issues to be addressed through designs;
- Socio-economic profile of community along the project route;
- Extent of likely social and environmental impact due to the project;
- Expectations and reservations of people towards project; and
- Resettlement and rehabilitation options

Stake holder meeting with DC, Dhubri was held on 07.07.2023 & 13.07.2023

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

6.3 Identification of Issues

Table 6-1: Addressal of General Issues and Concerns under the Project

Issue / Concern	Addressal under the project
Dust and Air Pollution	- Plantation of trees and shrubs along the highway and on median - Turfing on earthen slopes and earthen shoulders - Water spraying to be adopted near the crushers during construction stage.
Increased noise levels	- Provision of Noise attenuating wall near sensitive receptors - No-horns signage near schools, colleges and hospitals - Tree plantation and development of green belts along the project corridor abutting settlements to attenuate traffic noise
Traffic Congestion	- Improvement of intersections - Provision of Flyovers, bypasses, underpasses and service lanes etc at suitable locations - Road widening itself will be a major factor to avoid traffic jams
Road safety	- Provision of Service lane to separate local traffic from through traffic - Proper highway signals provided - Widening of bridges to avoid accidents - Grade level pedestrian crossing - Proper lighting at accident prone locations
Cultural properties	- Care has been taken to preserve sites of cultural heritage as far as possible. - Where unavoidable the religious structures within ROW to be relocated only after consultation with local community.
Fauna and flora	- Tree clearing within ROW has been avoided beyond what is directly required for construction activities and or to reduce accidents - Compensatory afforestation would be done as per the directives of the forest department. - Fruit bearing trees and shade trees, to be planted on the roadside.
Roadside Drainage	- Rising of road sections and cross drainage structures in areas facing overtopping problems. - Location of structures based on hydrological study - Provision of proper drainage scheme for the settlements
Water bodies	In unavoidable cases provision for increasing depth of water bodies to increase its capacity is made.
Road side amenities	Provision of facilities like Rest Areas, Truck stoppage site (lay bye) and bus stops along the highway

6.4 Key Findings of the Consultation

Major findings related to key issues such as general perception about the project; suggestions the adverse impacts (if any):

- It was observed that stakeholders welcomed the project in general.
- They requested for facilities and amenities like road safety and safer accessibility
- People suggested that adequate safety measures should be provided such as speed breakers, signage's etc.
- The EMP – both generic and specific has been designed to address environmental related issues

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

7 IMPACTS ASSESSMENT

The existing environmental conditions have been described in the Chapter 5. In this chapter, the impacts of the proposed project on the environment have been predicted. Impacts on various environmental attributes during construction as well as operation and mitigate measures have been discussed.

The environmental impacts caused due to the development of the project road sections can be categorised as primary (direct) and secondary (indirect) impacts. Primary impacts are those which are induced directly by the project where as the secondary impacts are those which are indirectly induced and typically include the associated investment and changing patterns of social and economic activities due to the proposed action.

Table 7-1: Activity-Impact Identification Matrix

Sl. No.	Activities	Type of Impact							
		Air	Water	Noise	Flora	Fauna	Drainage	Soil	Topography
1.	Labour camp activities		-ve/t						
2.	Quarrying	-ve/t		-ve/t	-ve/t		-ve/t		-ve/p
3.	Material transport and storage	-ve/t		-ve/t					
5.	Earthwork						-ve/p	-ve/t	-ve/t
6.	Payment works	-ve/t	-ve/t	-ve/t	-ve/t			-ve/t	-ve/p
7.	Use of construction equipments	-ve/t	-ve/t	-ve/t		-ve/t			
8.	Plantation	-ve/p		-ve/p	-ve/p				
9.	Drainage work						-ve/p		
10.	Culvert and bridge construction		-ve/t	-ve/t			-ve/p		
11.	Stripping of top soil							-ve/p	
12.	Debris generation						-ve/t	-ve/t	
13.	Oil and grease							-ve/t	
14.	Construction in forest and sensitive areas	-ve/t	-ve/t	-ve/t	-ve/t	-ve/t	-ve/p	-ve/p	-ve/p

Notes: t – temporary, p – permanent. Impact indicated in bold letters indicates significant impacts

Matrix method is adopted as methodology for assessment of cumulative impacts on the project. Based on the scoping of the areas and the work being proposed the following key issues were assessed for this project.

- Preservation of aesthetic and landscape of the area to the possible extent
- Effective restoration of borrow area and quarries
- Noise and air quality
- Tree removal and tree plantation
- Sanitation and waste disposal
- Road safety
- Protection of flora and fauna

Road development projects can have impacts or cause impacts in four specific situations as follows:

- Impacts of Location
- Impacts of Project Design
- Impacts during Construction, and
- Impacts when the Road become Operational.

A few permanent as well as short-term and long-term adverse effects, mainly at the construction and operation stages, are, nonetheless, anticipated. Temporary short term impacts can be kept in check through proper planning and adopting environment friendly road construction methods and the appropriate regulatory measures.

7.1 Type of Impacts of project road

The types of environmental impacts due to construction and operation phases of project road can be identified in following phases. Pre-construction phase, Construction phase, and Operation phase.

During the construction and operation phase of the project road, the environmental impacts may be in form of: Direct impact, Indirect impact and Cumulative Impact

Direct Impacts: Direct impacts of the road include mainly impacts caused by the road construction such as soil and land surface disturbances, vegetation clearance and material removal activities. These impacts are expected to be significant and need to be mitigated properly.

Indirect impacts of the project: Indirect impacts occur within the region of influence of the road project, at locations more distant from the construction corridor. These include induced development, water quality deterioration downstream, soil erosion, likely to be experienced at furthest distances from the project. These impacts are normally observed during the operation phase of road projects.

Cumulative Impacts: This type of impact results from synergetic effects or added up of several impacts which results in environmental changes. Due to the possibility of a combination of the different categories of impacts in one of the main elements of the environment that will be affected by the road construction activities impacts evaluation and mitigation measures will take in consideration both categories.

7.2 Positive Environmental Impacts due to improvement of subproject road sections

Positive impact expected for the improvement of Chirakuta to Jalukabari road section includes:

- **Improved Quality Of Life For The Rural Population In The Project Influence Area:** This is due to a result of better access to markets, health, education and other facilities and the derived stimulus for local economic activity;
- **A more efficient and safe road transport system:** Through reduced travel times, reduced road accidents, reduced vehicle operating and maintenance costs and reduced transportation costs for goods;
- The project road will play a vital role towards socio-economic development of road side settlement areas. The Social benefits arising due to the project will be triggered off due to improved accessibility to various services such as easy access to markets, health facilities, school, work place etc.
- The project road is of significant importance as the road connects three National Highway NH-117, NH-217 and NH-27 and seven State Highways SH-5, SH-14, SH-2, SH-46, SH-12, SH-12A & SH-10.

7.3 Environmental issues, to be considered for project road

Identification and assessment of the potential environmental impacts are based on secondary information supplemented by field visits. Impacts on various environmental components have been assessed at three different stages, namely: design and preconstruction; construction; and operation stages.

The identified impacts are the following:

- Disfiguration of landscape by road embankments on road widening;
- Risk of encroachment on precious ecology such as sensitive or protected areas.
- Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction sites
- Creation of temporary breeding habitats for mosquito vectors of diseases.
- Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life.
- Increased noise and air pollution resulting from traffic, leading from increased traffic volume.
- Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road.
- Social conflicts between locals and migrant workers.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

- Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as fuel and other chemicals, explosives, etc. during construction and operation.
- Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.

7.4 Adverse Environmental Impacts due to improvement of project road sections

The adverse environmental impacts anticipated from the improvement of the project road section are:

- Change in topography and land use due to acquisition of land for widening of the road
- Loss of productive soil and agriculture land
- Cutting of road side trees that falls within the ROW may reduce the ecological balance of the area and also increase soil erosion problem.
- Noise, air and water pollution and disposal of construction waste, during construction, will adversely impact both local residents. These latter effects should, however, only be temporary/reversible
- A number of quarries and other sources will be established which will change the landscape
- Improvement on existing road and construction of new road and bridges, although limited, may enhance soil erosion, landslips and reduce the micro-level ecological balance of the area. Construction may also disturb the habitation of fauna living in this area. These should, however, be only temporary/reversible effects
- Minor impacts of noise and air quality for those now living and workings close to the project road will deteriorate during the construction period and afterwards during operation

7.5 Impact and Mitigation Measure on Physical Environment

7.5.1 Topography

7.5.1.1 Impact

Construction Stage

Construction of cross drainage structures, across the streams and nallah's being crossed by project road. The changes in topography may also take place due to opening and operations of borrow areas for construction of along the project road.

Operation Stage

The topography during operation stage may be impacted due to break in embankment.

7.5.1.2 Mitigation Measure

Construction Stage

The borrow area preferably be filled with the rejected waste and then finally layer of top soil be spread over it before carrying out plantations, etc.

Operation Stage

During operation stage maintenance of embankment will be carried out, so that there is no breach of embankment resulting in change of topography of the area due to floods.

7.5.2 Geology

Construction Stage

Impact on the geological resources will occur from the extraction of materials (granular subbase and aggregates for base courses and bridges). Sand and aggregates are requiring for the construction of the project road. The quantity of material required is not much to impact the geology of the area.

Operation Stage

The alignment is not passing through the area which is rich in minerals and proposed project is linear therefore loss of localized area is also not much.

7.5.2.1 Mitigation Measure

No new quarries are proposed to be opened for this project. The material will be obtained from the existing quarries in the project; which have all valid permits.

7.5.3 Seismicity

7.5.3.1 Impacts

During Construction

The project road is located in seismic zone V. Road construction in this area will not have any impact on its overall earthquake potential since no blasting is envisaged at the construction site.

During Operation

No impact on seismicity is anticipated during operation phase. However the embankment and structures may be subjected to seismic effect as it lies in the area which comes under earthquake prone zone.

7.5.3.2 Mitigation Measure

The necessary factors in design have been taken to resist the seismic forces.

7.5.4 Physiography

7.5.4.1 Impacts

During Construction

The impact of road construction on physiography is a function of the terrain of the area. It is most drastically altered in case of hilly terrain or where extensive cut-and-fill operations are involved. The impact on physiography will be felt in the stretches of project road where new alignments have been planned. These stretches will be service road and bypass. This is because the project road in these plain areas will be at an average height. The visual impacts will be felt during construction period. The visual impacts will be pleasing to eyes due to Seeding & Mulching on side slopes and plantation in open space. The change in physiography will be limited within the RoW of the project.

During Operation

No impact on physiography is anticipated during operation phase.

7.5.4.2 Mitigation Measures

Since change in physiography will be pleasing to the eyes and construction of embankment for project road is a requirement, therefore, no mitigation measures are warranted except provision for adequate cross drainage structures.

7.5.5 Soil Erosion

According to secondary data the soil in the study area varies from sandy loam to silty clay. Therefore, the potential for erosion is low.

7.5.5.1 Impacts

Pre Construction Stage

The soil erosion may take place due to following

- Site preparation may involve demolition of building, clearing of brushwood, tree removal, temporary rerouting of utilities. This brings risks of erosion to the exposed ground or stored top soil.
- Setting up of workers camp along the project road may lead to loss of productive soils and impact the soil productivity especially at micro level.

During Construction

The soil erosion may take place at the slopes of the construction sites of cross drainage structures due to rains, at borrow areas and at construction sites which has been exposed during monsoon.

During Operation

The soil erosion may take place during operation at the slopes of the bridge approach and high embankments.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

7.5.5.2 Mitigation Measures

Design Stage

The slope of the project road at high embankment stretches has been fixed at 1:2 to 1:3, which is fairly stable and reduces the possibilities of slope failures. To check soil erosion on critical road embankment slopes seeding with mulching will be carried out, in accordance with the recommended practice for treatment of embankment slopes for erosion control, IRC: 56-1974. At the locations of steep slopes near crossings of project road with major rivers suitable protection measures such as stone pitching will be adopted. At locations where provisions for 1:2 to 1:3 slopes are not possible the retaining wall will be provided.

Construction Stage

Prior to the start of the relevant construction, the contractor shall submit to the Engineer for approval his schedules for carrying out temporary and permanent erosion / sedimentation control works as are applicable for the items of clearing and grubbing, roadway and drainage excavation, embankment / subgrade construction bridges and other structures across water courses, pavement courses and shoulders. The contractor shall also submit for approval his proposed method of erosion / sedimentation control on service road / inspection road and borrow areas and his plans for disposal of waste materials. Work shall not be started until the erosion / sedimentation control schedules and methods of operations for the applicable construction have been approved by the Engineer in charge. The surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill material operations shall be limited to the extent practicable. The contractor may be directed to provide immediate permanent or temporary erosion control measures to prevent soil erosion and sedimentation that will adversely affect construction operations, damage to adjacent properties or cause contamination of nearby streams or other water courses.

Operation Stage

The seeding with Mulching shall be monitored regularly and in case of any sign of cracks or non-maintenance of slope protection measures immediate action will be taken to restore it to original position. Stone pitching & Retaining wall will be provided near bridge approach and high embankment zones.

7.5.6 Compaction of soil

7.5.6.1 Impacts

Pre-Construction Stage

Compaction of soil will occur in the pre-construction phase due to movement of the construction equipment and machinery and during the setting up of construction camps.

Construction Stage

Compaction occurs beyond the carriageway and within the vegetated area of the RoW by the movement of vehicles and heavy machinery. Movement of vehicles during road construction is the major cause of soil compaction. This impact is direct and will be maximum in the RoW. It is necessary to ensure that there is no adverse impact of soil compaction in areas other than the RoW, where vegetation can grow and rain infiltration will take place.

Operation Stage

During the operation period compaction will be restricted to the carriageway of project road and service roads. Compaction cannot be said to be an impact of the operation stage as the pavement itself is a function of compacted base and sub base.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

7.5.6.2 Mitigation Measures

Pre-Construction Stage

During pre- construction stage plant, machinery and equipment will be unloaded at campsite only. All construction vehicles will move and parked at the designated location only. The movement of construction machinery and plants preferably be limited to Right of way. All Haul roads shall be constructed and maintained in good condition.

Construction Stage

During Construction phase all construction vehicles will ply within the RoW and identified routes. In no case these shall ply through open land or agriculture fields.

Operation Stage

No mitigation measures are warranted.

7.5.7 Contamination of Soil

7.5.7.1 Impacts

Pre-Construction Stage

Contamination of soil in the pre-construction stage may be considered as a short-term residual negative impact. Soil contamination may take place due to solid waste contamination from the labour camp set up during pre-construction stage. This impact is significant at locations of construction camps; stockyards, hot mix plants etc. as these will come up in this stage.

Construction Stage

Contamination of soil during construction stage is primarily due to construction and allied activities. The sites where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Pollution of soil can also occur at hot-mix plants from leakage or spillage of asphalt or bitumen. Refuse and solid waste from labour camps can also contaminate the soil. Contamination of soil during construction might be a major long-term residual negative impact. Unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to water bodies in case of dumping being done near water body locations.

Operation Stage

During the operation stage, soil pollution due to accidental vehicle spills or leaks is a low probability but potentially disastrous to the receiving environment, should they occur. These impacts can be long term and irreversible depending upon the extent of spill. The contamination due to deposition of heavy metals such as Lead along the road in agriculture field is a cause for concern. However, monitoring of soil quality will be done during construction and operation phase.

7.5.7.2 Mitigation Measures

Contamination of Soil from Fuel and Lubricants

Construction Stage

At the various construction sites, the vehicles and equipment will be maintained and refuelled in such a fashion that lubricating oil/diesel spillage does not contaminate the soil. It will be ensured that the fuel storage and refueling sites are kept away from drainage channels and important water bodies. At the wash down and refueling areas, "Oil Water Separators" shall be provided. All spills and petroleum products shall be disposed off in accordance to the ASPCB Guidelines. Fuel storage and refuelling areas will be located at least 500 m from all water bodies along the alignment of project road.

In all fuel storage and refueling areas located on agricultural lands or productive lands, the topsoil preservation shall be carried out.

Operation Stage

Probability of contamination of soil being only from the road runoff, which is directed into nearest water bodies through well-designed drains, no impact on the soil during operation stage except in case of accidents, is anticipated. Accidental spillage will be handled as per established emergency procedure. This emergency procedure will be developed by the Contractor in consultation with Supervision Engineer /NHIDCL once project road is completely opened for vehicular traffic.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Contamination of Soil from Construction Wastes and Quarry Materials

Construction Stage

It will be required that earth works are carried out strictly in accordance to the design drawings. Unsuitable earth, if required, will be dumped in approved areas. The spoils will be used to reclaim borrow pits and quarries, low-lying areas in barren lands and settlements along the project corridors. All spoils will be disposed off and the site will be fully cleaned before handing over. The construction wastes will be dumped in selected pits, developed on infertile land. Non-bituminous wastes from construction activities will be dumped in borrow pits and covered with a layer of the conserved topsoil. Bituminous wastes will be disposed off in approved dumping site.

7.5.8 Loss of Productive Soil

7.5.8.1 Impacts

Pre-construction stage

Loss of productive soil, albeit during the construction stage only, is envisaged at locations of workers' camps, stockyards, storage sheds, etc. if these are located on fertile areas.

Construction stage

Loss of productive soil of Right of way will take place at stretches of project road falling in new alignments (bypass and realignment).

Operation Stage

No Impact is anticipated in operation phase.

7.5.8.2 Mitigation Measures

Pre Construction Stage

The camps will be sited on unproductive land only unless unavoidable. Topsoil in case of productive land will be stripped to a depth of 150 mm and stored as per IRC guidelines. After completion of work these areas shall be restored.

Construction Stage

At location of alignment in agriculture areas, at construction camps, borrow areas in productive lands and all areas to be permanently covered, the top soil will be stripped to a specified depth of 150 mm and stored in stockpiles of height not exceeding 2 m. The stockpiling will be done in slopes of 2:1, to reduce surface runoff and enhance percolation through the mass of stored soil. The locations of top soil storage will be identified by the Engineer.

The stored topsoil will be spread back to maintain the physicochemical and biological activity of the soil. The stored topsoil will be utilized for:

- Covering all disturbed areas including for the redevelopment of borrow areas;
- Top dressing of the embankments and fill slopes;
- Filling up of tree pits, proposed as part of compensatory afforestation; and
- Filling up of the median for shrub plantation

To prevent any compaction of soil in the adjoining productive lands, the movement of construction vehicles, machinery and equipment will be restricted to RoW / Construction Camps.

7.5.9 Borrow Pits

The proposed project corridor requires raw materials from borrow areas, metal quarries and sand quarries. Borrow Areas with large quantity of earth/ gravel material is required for widening of formation and embankment, necessitating earth/ gravel from borrow pits.

7.5.9.1 Impacts

Large quantity of earth / gravel material is required for widening of formation and embankment, necessitating earth / gravel from borrow pits. Borrow earth shall be taken from in & around the study area as per the requirement of project (road) component. 28 numbers of operational licensed borrow areas are allotted for the proposed project road.

Construction Stage

Cartage of the borrow materials to the construction sites is of significance, as almost all such areas are accessible through dirt tracks only and therefore, spillage and compaction of soil along these tracks will be a significant impact. Proper protection measures need to be worked out for the minimising of such impacts during the haulage.



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

of borrow materials. Rehabilitation of borrow areas from which earth has been excavated, is a potential problem which needs to be addressed. In addition to visual blight, safety issues shall also be considered. Opening of Borrow Areas may result in loss of productive soil. Moreover, the borrow area pits, if not treated properly after the borrowing is complete, can form stagnant pools and pose health hazards to prevent which redevelopment of borrow areas need to be worked out. Additionally, they can also act as breeding ground for vectors like mosquitoes just after monsoon.

7.5.9.2 Mitigation Measures

Design Stage

For borrowing of earth for the project, two borrow area locations have been identified and recommended. Following precaution will be taken to restrict unauthorized borrowing by the contractors

- No borrow area shall be opened without permission of the Engineer. The borrowing shall not be carried out in cultivable lands, unless and until, it shall be agreed upon by the Engineer that there is no suitable uncultivable land in the vicinity for borrowing, or there are private land owners willing to allow borrowing on their fields. It will be ensured by the contractor that, there will be no loss of productive soil and the requisite environmental considerations are met with.
- Location of source of supply of material for embankment or sub-grade and the procedure for excavation or transport of material shall be in compliance with the environmental requirements of the MoEF and as specified in IRC: 10-1961
- Redevelopment of the identified borrow areas worked out, as part of the project preparation will be implemented to mitigate the impacts.

Construction Stage

To avoid any embankment slippages, the borrow areas will not be dug continuously. In case borrow areas other than specified are selected, the size and shape of borrow pits will be decided by the Engineer. Borrowing of earth shall be carried out at locations recommended as per IRC: 10-1961 The mitigation measures to be adopted for borrow areas at different land uses are given below:

- Non-Cultivable lands: Borrowing of earth will be carried out up to a depth of 1.0 m from the existing ground level. Borrowing of earth shall not be done continuously. Ridges of not less than 8m width shall be left at intervals not exceeding 300 m. Small drains shall be cut through the ridges, if necessary, to facilitate drainage. Borrow pits shall have slopes not steeper than 1 vertical to 4 horizontal.
- Public or Private agricultural lands: Borrowing of earth shall not be carried out on productive lands. However, in the event of borrowing from productive lands, topsoil shall be preserved in stockpiles. A 150mm layer of the top soil shall be stripped off from the area designated for borrowing and it shall be stored in stock piles in a designated area for height not exceeding 2m and side slopes not be steeper than 1:2. At such locations, the depth of borrow pits shall not exceed 45 cm and it may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside.
- Borrow pits on the riverside: The borrow pit shall be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood. Precautionary measures like the covering of vehicles will be taken to avoid spillage during transport of borrow materials. To ensure that the spills likely to result from the transport of borrow and quarry materials do not impact the settlements, it will be ensured that the excavation and carrying of earth will be done during day time only. The unpaved surfaces used for the haulage of borrow materials will be maintained properly.
- During works execution, the Contractor shall ensure preservation of trees during piling of materials; spreading of stripping material to facilitate water percolation and allow natural vegetation growth; re-establishment of previous natural drainage flows; improvement of site appearance; digging of ditches to collect runoff; and maintenance of roadways where a pit or quarry is declared useable water source for livestock or people nearby. Once the works are completed, and at own expense of the Contractor, he shall restore the environment around the work site to its original splits.
- Quarries and borrow pits will be back filled with rejected construction wastes and will be given a vegetative cover. If this is not possible, then slopes will be smoothed and depression will be filled in such a way that it looks more or less like the original ground surface.
- To avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the Site Engineer. Redevelopment of the borrow areas to mitigate the impacts will be the responsibility of the Contractor. The Contractor shall evolve site specific redevelopment plans for each borrow area location, which shall be implemented after the approval of the Supervision Consultant.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

- As per the Sustainable Sand Mining Management Guidelines 2016 for activities of borrowing/ excavation of 'brick earth' and 'ordinary earth' for purpose of construction of roads, embankments etc., attract the following guidelines.
 - The activity associated with borrowing for construction of roads, embankments etc. shall not involve blasting.
 - The borrowing/ excavation activity shall be restricted to a maximum depth of 2m below general ground level at the site.
 - The borrowing/ excavation activity shall not alter the natural drainage pattern of the area.
 - The borrowed/ excavated pit shall be restored by the project proponent for useful purpose (s).
 - Appropriate fencing all around the borrowed/ excavated pit shall be made to prevent any mishap.
 - Measures shall be taken to prevent dust emission by covering of borrowed/ excavated earth during transportation.
 - Safeguards shall be adopted against health risks on account of breeding of vectors in the water bodies created due to the borrowing/ excavation of earth.

The contractor shall evolve site-specific redevelopment plans for each borrows area location.

7.5.10 Quarries

Similarly natural sand quarries have also been identified for the project road for PKG-1. It has been found that all the quarries material are import from others area. Table 7-2 shows details of quarry areas identified and recommended for the project.

Table 7-2: Details of sources of material for PKG-1

Sl. No.	Name of Material	Place
1	Fine Sand	Kuklung(Near Borjharni)
2	Stone Metal	Kuklung(Near Borjharni)
3	Stone Boulder	Kuklung(Near Borjharni)
4	Stone Chips, Aggregate	Kuklung(Near Borjharni)
5	Coarse Sand	Kuklung(Near Borjharni)
6	Cement	Guwahati
7	Steel	Guwahati
8	Tar, Bitumen	Guwahati
9	Bitumen Emulsion	Guwahati
10	Structural Steel	Guwahati
11	Lime	Guwahati
12	Brick	Local

7.5.10.1 Impacts

The excavation of quarries and borrow pits used for obtaining rocks, soil and aggregate materials for road construction can cause direct and indirect long-term adverse impacts on the environment. Although the cut operations shall generate ample rock and soil material, it is likely that material from quarry and borrow areas could be needed depending on the appropriateness of the material quality. The impacts of Quarrying operations could be significant at various stages of road construction. Quarrying and crushing could have a critical impact especially on the air quality of the area especially the area downwind to the quarry. The stage wise impacts are as described below.

Pre Construction Stage

The bulk of the materials needed for the construction of the embankments will be procured from the existing quarries. As these quarries are already in operation with the requisite environmental clearances and redevelopment plans, no major impacts, which arise in making new quarries operational, are likely. Necessary environmental mitigative measures recommended by the Assam State Pollution Control Board are being followed at these quarries.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Construction Stage

A major source of dust during the construction stage is from stone crushing operations from the crusher and the vibrating screen. The dust, in addition to being an eyesore, reduces visibility thereby increasing safety concerns. Dust is generated due to procurement and transport of raw materials from quarries and borrow sites to the road construction area. These impacts will persist till the activity ceases. The regions especially downwind to the quarries/borrow areas are more vulnerable to air pollution.

7.5.10.2 Mitigation Measures

Design Stage

As part of the project preparation process, an evaluation of all existing quarries along the corridor has been carried out and the status in terms of the suitability of the quarry material and their legal status assessed.

Construction Stage

It will be ensured that quarries from where material is taken have all valid permits and licenses. The Haul road network is properly maintained.

Operation Stage

No mitigation measures from project end are warranted.

7.5.11 Ambient Air Quality

The ambient air quality in the project area varies at different locations. Based on secondary data high values of PM₁₀ and PM_{2.5} are observed in the stretch of start point of Chirakuta to Jalukabari. SO₂ and NO_x levels are found to be well within limits at all the monitoring locations along the project roads.

7.5.11.1 Impact

Pre-Construction Stage

Impact to air environment during pre-construction stage will be limited to activities such as setting of construction camp, unloading of materials, and exhaust from Diesel Generators, etc.

Construction Stage

During construction phase, there will be two main sources of air emissions i.e. mobile sources and fixed sources. Mobile sources are mostly vehicles involved in construction activities while emissions from fixed sources include DG sets, construction equipment (e.g. compressors) and excavation/ grading machineries that produce dust emissions.

During the construction phase, dust emissions in unpopulated areas will be emitted and deposited on the leaves of trees and other vegetation which may affect the growth of the trees and other vegetation. Certain amount of dust and gaseous emissions will generate during the construction phase from excavation machine and road construction machines.

Generation of dust particle due to:

- Site clearance and use of heavy vehicles and machinery etc.
- Transport of raw materials, borrow and quarry material to construction sites;
- Earthworks;
- Handling and storage of aggregates at the asphalt plants;
- Concrete batching plants and;
- Asphalt mixing plants due to mixing of aggregates with bitumen.

Certain amounts of dust and gaseous emissions will be generated during the construction phase from excavation and road construction machines. Pollutants of primary concern include Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM). However, suspended dust particles are typically coarse and will settle within a short distance of construction area. Maximum of the project road has settlements within 10m from the project road. Therefore, although construction phase impact will be temporary but it will be moderate in magnitude.

Considerable amount of emissions of carbon monoxide (CO), unburnt hydrocarbon, sulfur dioxide, particulate matters, nitrogen oxides (NO_x), etc, will be generated from the hot mix and batching plants. Hot mix plants

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

should be located away from the populated areas and be fitted with the air pollution control equipments, the emission shall meet Assam Pollution Control Board standards. Further, the hot mix plants must be sited at least 1 km away in the downwind direction from the nearest human settlement. It shall be ensured that the dust emissions from the crusher and vibrating screen from the stone quarries do not exceed the requirements of the State Pollution Control Board.

During construction air quality may be degraded for short periods due to

- The exhaust emissions from the operation of construction machinery
- fugitive emissions from brick, concrete, and asphalt plants
- the dust generated from the haulage of materials, exposed soils and material stockpiles
- cleaning of the road
- material loading and unloading

The impact is expected to be localized, temporary and confined to construction areas.

Construction stage impacts will have adverse impacts on the workers as well as the settlements adjacent to the road, especially those in the down wind direction. Adverse air quality impacts during construction are likely to result from three main sources; (i) emissions from construction equipment, including delivery trucks; (ii) fugitive dust from earth-moving operations and demolition; and (iii) increased traffic congestion in construction areas.

The adverse impacts on air quality during construction stage were classified and presented in the table below. The impacts will mostly be concentrated in the ROW. There are two types of pollution i.e. dust pollution and pollution from harmful gases.

Table 7-3: Adverse impacts on air quality during construction stage

Sl no	Impact	Source
1	Generation of Dust (SPM)	Transportation and tipping of cut material - while the former will occur over the entire stretch between the cutting location and disposal site, the latter is more location specific and more intense;
		Activation of landslides and rock falls etc.;
		Transportation of raw materials from quarries and borrow sites
		Stone crushing, handling and storage of aggregates in asphalt plants
		Site levelling, clearing of trees, laying of asphalt
		Concrete batching plants;
		Asphalt mix plants – due to the mixing of aggregates with bitumen;
		Construction of structures and allied activities
2	Generation of polluting gases including SO ₂ , NO _x and HC	Hot mix plants
		Large construction equipment, trucks and asphalt producing and paving equipment
		The movement of heavy machinery, oil tankers etc. on steep slopes will cause much higher emissions of gases
		Toxic gases released through the heating process during bitumen production
		Inadequate vehicle maintenance and the use of adulterated fuel in vehicles.

It is expected that air quality will be affected to some minor extent by dust and particulate matters generated by construction, vehicular movements, site clearance, earth filling and material loading and unloading. The impacts are expected to be localised, temporary and confined to construction areas.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Operation Phase

During the operation phase, air quality along the road will be affected by increased vehicular emissions on the project road. Pollutants of primary concern include NO_x, CO, HC, SPM, RSPM and SO₂. However, the increment in pollutant emission expected due to increased vehicular load is estimated to be only 2%. Improvement in road geometry and easing of bottlenecks are expected to significantly offset this increase in pollutant emission. Therefore, the resultant ambient air quality is expected to remain same, if not improved.

Emissions of SPM from the road will depend on the roughness. It is suggested that roughness of road should be maintained at about 4000 to minimise the dust emissions.

7.5.11.2 Mitigation Measures

Pre-construction stage

As no major impact is anticipated during the pre-construction stage, no mitigation measure is required.

Construction Phase

- Road should be designed with good geometry and roughness less than 4000.
- Road should be designed in such a manner that no traffic congestion happens in the populated areas along the road.
- Vehicles delivering loose and fine materials like sand and fine aggregates shall be fully covered to reduce spills on existing road. Water may be sprayed on earthworks, on a regular basis. During and after compaction of the sub-grade, water will be sprayed at regular intervals to prevent dust generation.
- All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the SPCB norms
- All the vehicles carrying construction material will be covered. Vehicles and machinery will be regularly checked as per the NAAQ standard. Mixing equipment will be well sealed and equipped with dust control removal devices
- All slopes and embankments will have vegetative turfing as per best engineering practices will help to minimize the dust generation during operation of the road.
- During the construction of the project road, emissions from asphalt hot-mix plants, transportation of construction materials and vehicular movement along the stretch will have temporary impact on air quality. However, air quality level is anticipated to be within the prescribed limit for short-term average, except for PM₁₀.

The following mitigation measures will also be taken to mitigate the dust entrainment and fugitive emissions from the various sources:

- Asphalt and hot-mix plants will be located at least 1 km away from inhabited urban and rural stretches along the road with the clearance from Assam Pollution Control Board.
- Sprinkling water will control fugitive dust entrainment.
- The hot mix plant will be fitted with dust extraction units.
- Sprinkling of water on the dust prone areas and construction yard.
- Regular maintenance of machinery and equipment will be carried out.
- Water will be sprayed on earthworks, temporary haulage and detour roads on a regular basis. During and after compaction of the sub-grade, water will be sprayed at regular intervals to prevent dust generation.
- Ambient air quality monitoring should be carried out during construction phase. If monitored parameters are above the prescribed limit, suitable control measures must be taken.
- Workers and construction site will be provided with adequate numbers of personal protective equipments, such as nasal masks, gloves, etc. to reduce the chances of exposure to dust and toxic gases.

Operation Phase

Following mitigation measures are suggested to control the air pollution during operation phase:

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

- Bottlenecks should be avoided for smooth flow of traffic.
- Plantation of trees, with thick leaf coverage, along the road

Ambient air quality monitoring should be carried out during operation phase. If monitored parameters are above the prescribed limited, suitable control measures must be taken.

7.5.12 GHG Emission

7.5.12.1 Impact

Construction Phase

The GHG emissions from a road project typically involve the following components:

- Transport emissions
- Material emissions
- Machines emissions

Table 7-4: Typical breakdown of GHG emissions by generator for various road categories (t CO₂ eq./km)

Type of Road	Transport emissions	Material emissions	Machines emissions	Total (t CO ₂ eq.)
Double bituminous surface treatment Road (DBST)	26	62	14	103

Source: Greenhouse Gas Emissions Mitigation in Road Construction and Rehabilitation - A Toolkit for Developing Countries, World Bank, 2010

For the construction of the project road would result in approximately emission is in below table.

Therefore, 212.324km of road construction would result in emission of approximately 21975.05t CO₂eq

Operation Phase

The operation phase GHG emission has been calculated based on the emission factors provided in EMEP/EEA air pollutant emission inventory guidebook - 2009, Technical report No 9/2009. Since, the fuel consumption of the vehicles plying on this highway are not available, assumptions have been made on the fuel type and vehicle type based on the Annual Daily Traffic projection provided by the Client.

It has been assumed that:

- Car/ Van/ Jeep : has Cubic Capacity 1.4 – 2.01 L and runs on petrol
- Light Commercial Vehicles (LCV) : has Cubic Capacity < 2L and runs on diesel
- Mini Bus/Bus/2-Axle Trucks/3-Axle Trucks/MAV : has Cubic Capacity > 2L and runs on diesel

Emission Factors Used:

FUEL	CUBIC CAPACITY	EMISSIONS ACCORDING TO SPEED (g CO ₂ /km)		
		URBAN (21 km/h)	AVERAGE (70 km/h) Other roads	HIGH (107 km/h) Motorways and dual carriageways
Petrol	<1.4 l	205.87	135.96	156.50
	1.4 - 2.01 l	252.62	157.34	173.33
	>2 l	344.32	192.88	220.33
Diesel	<2 l	215.90	134.54	160.68
	>2 l	265.94	169.62	202.22
Hybrid	Any	105.43	101.86	129.44
LPG	Any	175.95	136.10	175.07

Therefore, the estimated GHG emission for the project road in operation phase would be:

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Total CO₂ Emission (t CO₂/day)					
Year	0.000 km to 31.000 km	31.000 km to 91.000 km	91.000km to 141.000km	141.000 km to 186.000 km	186.000 km to 212.324km
2019	28.84	71.30	54.44	76.99	153.50
2030	49.32	121.93	93.10	131.68	262.54
2042	88.58	218.96	167.10	236.47	471.48

7.5.12.2 Mitigation Measure

Construction Phase

Table 7-5: Summary of Mitigation measure of GHG emission

Alternative practice	Work components & GHG generators concerned	Remarks, if any
Use labor intensive techniques for excavation	Earthworks (Transport, Equipment)	
Optimize location of road safety barriers	Equipment/furniture (Materials, Transport, Equipment)	GHG emissions from barriers > 5% of total emissions
Optimize street lighting	Equipment/furniture (Materials, Transport, Equipment)	
Use recycling	Pavement (Materials, Transport, Equipment)	
Consider gravel roads and surface treatment instead of bituminous / cement concrete pavements	Pavement (Materials, Transport, Equipment)	
Ensure low roughness	Structures (Materials, Transport)	
Ensure recycling of steel	Structures (Materials, Transport)	GHG emissions from metal > 10% of total emissions

Reduction in Transport Emissions:

Transport of materials represents about 30% of the GHG emissions of a road project. From that, about 50% are related to local transport (less than 25 km).

- Use of more efficient road vehicle fleets having a lower unit emission ratio. This can be significant as the efficiency improves with the use of trucks with higher payload (50% decrease in unit emission and savings of more than 20% in total transport emissions).
- Modal shift from road to more efficient modes (rail or water having unit emissions 17 times lower) over long distances. Further improvement can be up to 8% of the total emissions after road transport has been optimized

Reduction in Material Emissions:

- Excavation in hard soil generates two to three times more GHG than in ordinary soil.
- The use of drilling rigs rather than light drillers is twice as productive, but produces 35% more GHG per cubic meter of rock excavated.
- Cold mixtures as well as recycling technologies and materials have lower emissions (a factor of three when compared to hot mixture bituminous structures).

Reduction in Machine Emissions:

- Regular maintenance of the machineries ensure optimum performance of the machines.

Operation Phase

- Increased use of hybrid and electric cars would reduce the GHG emission;
- Use of solar power in the rest Areas and traffic signals will also reduce carbon foot-print of the project.

7.5.13 Water Resources

To prevent accumulation of water by the road side, adequate cross drainage (CD) structures in the form of culverts with adequate discharge and drain along the road capacity will be constructed. During reconstruction of old cross

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

drainage structures and construction of new ones, diversion is required to aid uninterrupted movement of traffic. Material will not be put in the drainage to avoid blockage and prevent the erosion. This will help in protecting the aquatic ecology.

There are 8nos. of existing bridge (Minor Bridge=8Nos.) in the project stretch for PKG-1.

The surface water bodies along the project road might be subject to adverse impacts due to the various construction activities as well as during the operation stage of the project. 8 numbers of water bodies are found along the project road for PKG-1. The impacts on water resources have been summarised in

Table 7-6: Total numbers of water bodies along the project road

Sl no	Package	Total number of water Bodies
1.	Package-1	8
Total		8

Table 7-7: Likely Impacts on Water Resources during the Construction Stage

Impacts due to Construction	Indicators
Loss of water bodies	Area of water bodies affected
Loss of other water supply sources	Hand pumps, wells etc. affected
Alteration of drainage, run off, flooding	No. of cross drainage channels
Depletion of ground water recharge	Groundwater in Area rendered inaccessible & impervious
Use of water supply for construction	Quantum of water used
Contamination from fuel and lubricants	Nature and quantum of contaminants
Contamination from improper sanitation and waste disposal in construction camps	Area of camp / disposal site and proximity to water bodies / channels

7.5.13.1 Impact

Impact on Drainage in construction Stage

Impacts of road construction, which lead to alteration of drainage, are generally due to widening at culvert or bridge locations. This requires river and or gully training for the period during which the bridge is to be constructed. Alteration of drainage can lead to soil erosion of adjacent areas, disturb local vegetation and impair local ecology.

- Incidence of water stagnation due to obstruction of drainage on the on-set of monsoon.
- Incidence of accidents in case of blockage of drainage spouts that create water pool on road.
- Increase of flood duration due to obstruction of natural drainage in construction of high embankment.
- Blockage of existing drainage in courses of earth work

Impacts on Surface Water Resource

In the project, construction of bridges is proposed to across the nallah. Bridge constructions require foundation works in the nallah which includes excavation, drilling and piling works. Minor disturbance of the water flow may likely to occur due to piling and drilling works inside the nallah and river bed for establishing bridge foundations. However these are standard practices for bridge construction works. There are 44 water bodies along the project road stretch. These water bodies might be disturbed due to the construction of this road.

Bridge foundation works may result into generation of some quantity of debris materials due to excavation and drilling works. These wastes may cause temporary increase in turbidity and thereby contaminating the water but such situation will occur only for short duration. The impact of increase in turbidity and siltation can be mitigated by providing coffer dams and silt trap around the foundation site before start of piling/drilling works

Impacts on Ground Water Resources

Water will be required for earthwork, compaction and other construction purposes. Water will also be required for dust suppression at different locations during construction. At workers camp, plant site relatively small quantity



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of water will be required for drinking and other domestic purposes. The water demands for the construction work may pose severe stress on the public water supply if common water sources are used to meet the water demand for construction as well as various domestic usages by the workers.

7.5.13.2 Mitigation Measure

Drainage in construction Stage

- Adequate drains facilities (longitudinal, median and chute drains) should be provided along the road to facilitate the stability of road carriageway. It prevents soil erosion also.
- Existing drainage and cross drainage (CD) structures should be duly augmented, wherever necessary, to accommodate high discharges to avoid flooding and formation of water pool.
- Adequate new drainage and cross drainage (CD) structures should be provided for smooth runoff to avoid water stagnation.
- Inspection of existing drainage spouts before the on-set of monsoon.
- Adequate facilities of drainage at construction site and camp in order to avoid stagnant water pools that also lead to soil erosion and incidence of diseases.

Surface Water Resource

The above-mentioned problems associated with foundation works can be managed through the proposed mitigation measures

- The bridge construction works will be carried out only during lean period when water flow in the nallah is minimum.
- The bed of the nallah will be cleared from all excavated soils and debris immediately after completion of foundation works.
- All water and liquid wastes arising from construction activities will be properly disposed off and will not be discharged into any water body without adequate treatment.
- Littering or unauthorized discharge will not be permitted.
- Permission of the engineer and the concerned regulatory authorities will be obtained for disposal of the waste at the designated disposal point.
- The stream course and drain will be kept free from any dumping of solid wastes and earth materials.
- The fill and debris materials will be stored away from water bodies and only on the designated sites along the construction zones.

Ground Water Resources

The Contractor will arrange their water demand from separate sources so as not to interfere with the normal public water supply. Water from surface water source will be used for construction works with requisite permission from concerned Irrigation Department. However, when the surface water is not available during lean period, approved bore-well from Central Ground Water Authority may be used with prior permission from the competent authority.

7.5.14 Rainwater Harvesting

The proposed project will increase of surface run-off due to more paved road surface. It will have adverse impact on ground water recharging if measures are not taken during the design. Therefore, compensation is required to recharge ground water.

7.5.14.1 Impacts

- Loss of ground water table due to withdrawal of ground water for construction.
- Increase of surface run-off due to more paved road surface

7.5.14.2 Mitigation Measure

Detailed hydrological survey will be conducted and adequate drainage facilities provided to discharge the run-off to existing catchments area.

- Provision of recharge pits, in the design to recharge ground water, in the suburban area.
- Longitudinal road-side drains on both sides of the road and out fall should be nearby culverts/ bridges on nallas/ rivers/ drains.
- All the construction preparatory activities for culverts, bridges and other structure will be carried out during dry seasons.
- Water for construction will be arranged by the contractor from the existing sources.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

- Minimum use of water from existing sources for construction purpose will be ensured promoted at construction site/camps to minimize likely impacts on other users.

Rainwater harvesting structures shall be provided near the disposal point of the side drains as prescribed by CGWB guidelines.

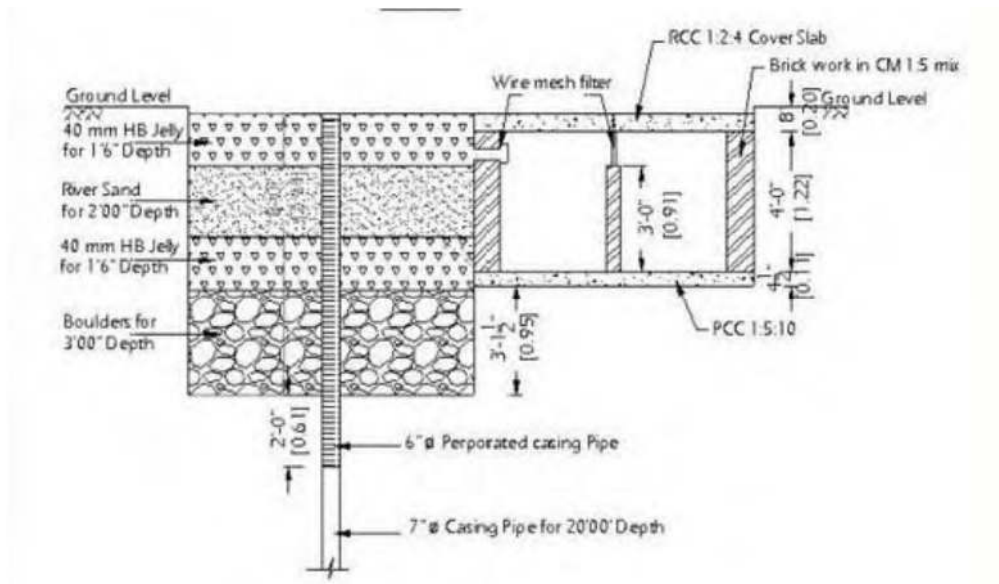


Figure 7-1: Typical rain water harvesting structure

Table 7-8: Summary of Mitigations for Impacts on Water

Sl. No.	Item	Impact	Impact (Reason)	Mitigation / Enhancement
1.	Loss of water bodies	Major, direct impact	Part complete acquisition of source of water	- Land acquisition to be minimized with provision of Retaining walls - Relocation of ground/ surface water sources.
2.	Alteration of Cross Drainage	Very Low Impact	Major bridge constructions Widening of minor bridges and culverts.	Widening & construction of bridges, there will be an improvement in the drainage characteristics of the project area.
3.	Runoff and drainage	Direct Impact	Siltation of water bodies Reduction in ground recharge Increased drainage discharge	- Silt fencing to be provided. - Recharge well to be provided to compensate the loss of pervious surface. - Continuous drain is provided, unlined in rural area and lined in urban area.
4.	Water requirement for project	Direct impact	Water requirement for Construction activity. Water requirement for labour	- Contractor needs to obtain approvals for taking adequate quantities of water from surface and ground water sources. - This is required to avoid depletion of water sources. - Water harvesting structures to be provided.

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Sl. No.	Item	Impact	Impact (Reason)	Mitigation / Enhancement
5.	Increased sedimentation	Direct impact	Increased sediment laden runoff after the nature and capacity of the watercourse	Silt fencing to be provided
6.	Contamination of Water	Direct adverse impact	Scarified bitumen wastes Oil and diesel spills Emulsion sprayer and laying off hot mix Production facilities for the labour and officers. Routine and periodical maintenance	- Hazardous wastes (Management and Handling) Rules, 1989 to be enforced. - Oil Interceptor will be provided for accidental spill of oil and diesel. Rejected material will be laid as directed by Engineer. - Septic tank will be construction for waste disposal.
7.	Water quality monitoring		Effectiveness / shortfall measurement	Measures will be revised and improved to mitigate / enhance environment due to any unforeseen impact.

7.5.15 Noise Environment

Though the level of discomfort caused by noise is subjective, there is a definite increase in discomfort with an increase in noise levels. Road noise depends on factors such as traffic intensity, the type and condition of the vehicles plying on the road, acceleration/deceleration/gear changes by the vehicles depending on the level of congestion and smoothness of road surface (IRC: 104-1988).

The noise is concern as during construction and operation phases there will be generation of significant noise. The impacts on noise due to the project will be of significance in both the construction as well as the operation stages.

7.5.15.1 Impact

Pre-Construction stage

Noise levels during the preconstruction stage are mostly expected to be indicative of prevalent baseline levels apart from localised noise levels at locations where preconstruction stage activities are taking place such as establishment of workers camps, stockyards. These increased noise levels will prevail only for a short duration during the preconstruction stage. Moreover, as these activities are not likely to be placed near settlement the increased noise impact is bound to be negligible.

Construction Stage

During the construction phase, noise will be generated from the various activities such as site clearing activities, excavation, erection and finishing. The typical noise levels from these activities are given hereunder:

- Site clearing activities 85 dB(A)
- Erection 80 dB(A)
- Finishing 85 dB(A)

During the construction phase, the noise level is bound to increase by the use of construction machines, generators, etc. The increase is expected to be between 10 - 20 %. However, these noise levels will be temporary in nature mostly during daytime only.

For an approximate estimation of dispersion of noise in the ambient air, a standard mathematical model for sound wave propagation is used. The sound pressure level generated by noise sources, decreases with increasing

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distance from the sources, due to wave divergence. An additional decrease in sound pressure level from the source is expected due to atmospheric effect or its interaction with objects in the transmission path.

Resultant Noise Level

The resultant maximum noise level for the above sources as calculated using combined effect equation is 88.7 dB(A). Assuming no environmental attenuation factors, based on the equations, calculations are made which shows that noise level at different distance will be as under:

Area	Permissible Limits (Day Time)	Distance (m) from source
Residential	55 dB (A)	19.2
Commercial	65 dB (A)	6.1
Industrial	75 dB (A)	1.9

Therefore, the impact of noise on surrounding area during the construction phase will be limited within 20 m, hence inferred as moderate. However, in the populated area residential structures are located within 20 m from the road.

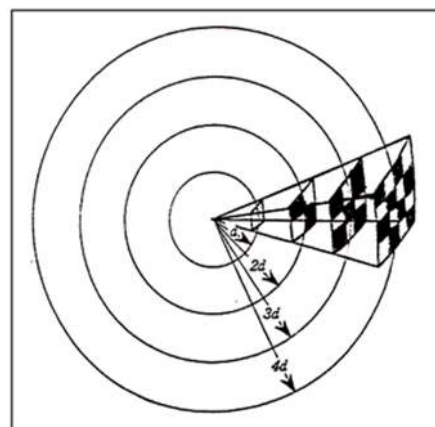
Operation Phase

Noise during the operation phase will be solely due to plying of vehicles. Based on the traffic projection provided in Section **Error! Reference source not found.** it was found that the AADT is too small for performing the Noise dispersion model.

However, based on the 'inverse square law' of sound propagation, it can be stated that as a sound wave propagates spherically, the sound energy is distributed over the ever-increasing surface diameter of the wave front surface. Thus as per Inverse Square Law for every doubling of the distance from the sound source in a free field situation, the sound intensity will diminish by 6 decibels.

However, World Bank Technical Paper No.376, provides following guidance for calculation of noise from highway source:

- Doubling the distance between the road and the receptor results in a decrease of 3 dB (A) in the noise level.
- When traffic on road is doubled, the noise level increases 3 dB (A), all other factors being equal
- Doubling the speed results in an increase of 6 dB (A)



The residential area is not on the edge of the road. Therefore residential area is not expected to be affected by the noise of the traffic plying on the highway.

7.5.15.2 Mitigation Measures

- **Site Controls:** Stationary equipment will be placed along un-inhabited stretches as per distance requirements computed above as far as practicable to minimize objectionable noise impacts. These locations should be away from known bird nesting areas.
- **Scheduling of Project Activities:** Operations will be scheduled to coincide with period when people would least likely to be affected. Construction activities will be strictly prohibited between 10 P.M. and 6 A.M. near residential areas. Noisy operation near known nesting areas should be avoided during winter, typical breeding period of migratory birds.
- Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines.
- Construction equipment and machinery should be fitted with silencers and maintained properly.
- Noise measurements should be carried out along the road to ensure the effectiveness of mitigation measures.

Operation Phase

To reduce noise and vibrations, noise barriers in the form of compound wall is proposed. In case of space crunch, the use of concrete screens is also suggested. The noise barrier wall shall be constructed by excavation of

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

foundation, laying of brick masonry wall up to a height of 2m above ground, plastering and coping as per the direction of the engineer and as laid in the specification. Creepers and paints shall be used in consultation with the affected community to give an aesthetic look. Shade and flowering trees shall be planted within the boundary of the sensitive receptor, between the building line and the compound wall, wherever space shall be available, 5m centre to centre.

The measures adopted for noise attenuation is given below

- Plantation within the premises if space available for plantation
- Rising of existing boundary wall / construction of new wall up to 2m height
- Planting creepers to provide aesthetic view

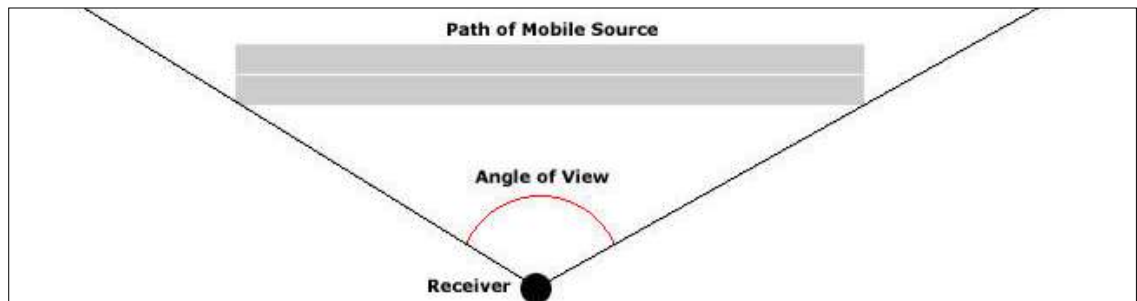
In urban areas the boundary wall can be painted with posters to provide aesthetic views. The option of posters or creepers shall be agreed by the school / hospital administrator.

7.5.15.3 Estimation of Construction Phase Noise

At the outset, it should be noted that unavailability of exact information on the construction methodology, hours of work, no. of equipment and their ratings / fuel consumption, construction schedule, etc. are the limiting factors while estimate the construction noise for this subject project; however, to represent the possible worst case scenario, an effort has been made based on our knowledge on the construction of similar project using QUESTOR Construction Noise Tool.

The QUESTOR Construction Noise Tool is a simple application capable of calculating noise levels for construction sites. It is based on the construction site noise calculation model documented in PR70 "How much noise do you make? A guide to assessing and managing noise on construction sites" by Dr Alan Wills (KVÆRNER) and David Churcher (CIRIA). The tool itself works on a relationship of one receiver to many sources.

'QUESTOR Construction Noise Tool' provides a library of sample plants and the activities they are performing from the **BS 5228 standard: The British Standard on Noise**. The total noise level calculated by the application is the noise level at the receiver.



As depicted in the above picture, it is considered that for particular construction zone, the source is located at a distance of 50m with 90° angle of view. Accordingly, the sound pressure levels are predicted at the receptor location during different activities.

Assessment of Impact:

Based on the calculations, presented below it is anticipated that whenever the construction will happen in any zone other than industrial, the ambient noise level will exceed the statutory level at a distance of 50m away from the construction zone, if no barrier is put.

Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana (Lot-1) Package 1A (Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam)

Final Detailed Project Report
Environmental Impact Assessment report

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

ID	Type	Noise pressure (dB), 1m from the source	Distance (m)	Barrier	Reflection	On Time (%)	Angle of View (°)	Traffic Volume / hour	Speed (km/hr)	Total (dB(A))
Site Clearing										
1	Dozer	116	50	None	None	20	90	10	10	46
2	Tracked excavator	113				20	90			76
3	Tracked loader	113				20	90			76
4	Wheeled loader	108				20	90			71
Total noise from site at receiver										80
Ground Excavation										
1	Dozer	114	50	None	None	20	90	10	10	44
2	Tracked excavator idling	96				20	90			59
3	Tracked excavator	113				20	90			76
4	Wheeled loader	104				20	90			67
5	Tracked loader	112				20	90			75
Total noise from site at receiver										79
Tipping Fill										
1	Dump Truck	110	50	None	None	100	90	10	10	57
Total noise from site at receiver										57
Spreading Fill										
1	Wheeled excavator / loader	104	50	None	None	50	90	10	10	81
2	Dozer	117				50	90	10	10	61
Total noise from site at receiver										81
Spreading Fill										
1	Wheeled excavator / loader	104	50	None	None	50	90	10	10	81
2	Dozer	117				50	90	10	10	61

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

ID	Type	Noise pressure (dB), 1m from the source	Distance (m)	Barrier	Reflection	On Time (%)	Angle of View (°)	Traffic Volume / hour	Speed (km/hr)	Total (dB(A))
Total noise from site at receiver										81
Ground leveling										
1	Dozer	114	50	None	None	50	90	10	10	58
2	Grader	111				50	90	10	10	55
Total noise from site at receiver										60
Unloading										
1	Tipper lorry	113	50	None	None	50	90	10	10	57
2	Tracked loader	112				50	90	10	10	89
Total noise from site at receiver										89
Rolling gravel / bricks										
1	Road roller	108	50	None	None	100	90	10	10	55
Total noise from site at receiver										85
Compacting fill										
1	Vibratory roller	106	50	None	None	50	90	20	15	84
2	Compactor rammer	108	50	None	None	50	90	20	15	86
Total noise from site at receiver										88
Compacting sub-base										
1	Compactor rammer	108	50	None	None	100	90	20	15	89
Total noise from site at receiver										89
Compacting earth										
1	Compactor rammer	108	50	None	None	100	90	20	15	89
Total noise from site at receiver										89
Road surfacing										

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

ID	Type	Noise pressure (dB), 1m from the source	Distance (m)	Barrier	Reflection	On Time (%)	Angle of View (°)	Traffic Volume / hour	Speed (km/hr)	Total (dB(A))
1	Asphalt melter (Stationary)	103	50	None	None	70	NA	NA	NA	59
2	Asphalt spreader	110	50	None	None	70	90	10	10	88
3	Road roller and lorry	96	50	None	None	80	90	10	10	42
Total noise from site at receiver										88
Installation of traffic light controls										
1	Groove cutter	115	50	None	None	100	NA	NA	NA	73
Total noise from site at receiver										71

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Noise Pollution Monitoring

The effectiveness of mitigation measures and further improvement in designs to reduce the noise level due to construction and operational activity shall be monitored. The frequency, duration and monitoring plan shall be functional in construction as well as in operation stages as per the Environmental Monitoring Plan. Noise shall be monitored at all locations stated in Environmental Monitoring Plan beside the plant sites.

Table 7-9: Specific Noise Mitigation Measures

Sl. No.	Item	Impact	Reason	Mitigation / Enhancement
1.	Sensitive receptors	Direct impact	Increase in noise pollution Man, material and machinery movements.	- Noise barrier to be provided where ever required - Traffic calming devises to be used. - No Horn Zone sign Post.
2a.	Noise Pollution (Pre Construction Stage)	Direct impact, short duration	Establishment of labour camps, onsite offices, stock yards and construction plants	- Area specific and for short duration. - Machinery to be checked and complied with noise pollution regulations. - Camps to be setup away from the settlements, in the down wind direction
2b.	Noise Pollution (Construction Stage)	Marginal Impact	Stone crushing, asphalt production plant and batching plants, diesel generators etc. Community residing near to the work zones.	- Camps to be setup away from the settlements, in the down wind direction. - Noise pollution regulation to be monitored and enforced. - Temporary as the work zones will be changing with completion of construction.
2c.	Noise Pollution (Operation Stage)	Marginal Impact	Due to increase in traffic (due to improved facility)	Will be compensated with the uninterrupted movement of heavy and light vehicles
3.	Noise Pollution Monitoring		Effectiveness shortfall measurement /	Measures will be revised and improved to mitigate / enhance environment due to any unforeseen impact.

7.5.16 Management of Debris/ Waste

7.5.16.1 Impact

Waste material will generate due to dismantling of pavement, structures etc. in some sections wherever existing pavement cannot be utilized as determined by the contractor and approved by the NHIDCL. Quarry dust and unused iron bars or damaged support structures constitutes significant waste. Mitigation for solid waste from construction camp has been described in construction camp section.

7.5.16.2 Mitigation measures

- The excavated bituminous mix materials can be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions and haulage routes.
- All excavated materials from roadway, shoulders, verges, drains, cross drainage and the like will be the property of the NHIDCL and will be used for backfilling embankments, filling pits, and landscaping.
- Unusable debris material should be suitably disposed off at predestinated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes, and its disposal MoRTH guidelines should be followed.
- Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.
- The locations of dumping sites should be selected with following considerations.
- Unproductive/wastelands shall be selected for dumping sites.
- Away from residential areas and located at least 500 m downwind side of these locations,
- Dumping sites do not contaminate any water sources, rivers etc

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

- Dumping sites have adequate capacity equal to the amount of debris generated.
- Public perception and consent from the village Panchyats about the location of debris disposal site has to be obtained before finalizing the location.
- Form works will be re-used to the extent possible, more than 20 times as dictated by good practice. All stripped formworks will be examined for any damage and rectified in the workshop for re-use. Rectification includes plugging holes, and straightening bent steel props.

7.6 Biological Environment

7.6.1 Flora

The proposed alignment is not likely to impact the forest. Removal of the existing vegetative cover and the uprooting of few numbers of trees is an unfortunate activity, which will reduce the ecological balance in the areas. This will also enhance soil erosion. The loss of vegetative cover will mostly be permanent and only some might be revived through mitigation efforts. Another impact from road construction activities and deriving from the borrow area, quarrying, preparation and transfer of stone chips and other earthwork; is the accumulation of dust on the surrounding vegetation. This leads to deterioration of the vegetative health, which in turn will affect the ecology as well as the aesthetic beauty of the area.

7.6.1.1 Impact

The principal impact on flora involves the removal of trees for the creation of a clear zone within the Corridor of Impact. Reason for clearing trees is threefold:

- To prevent single-vehicle collision with the roadside trees, trees very close to the road need to be cleared. Roadside trees are safety hazards, particularly those trees with strong and rigid stems. Some trees are safety hazards because they preclude clear sight distances.
- To ease construction of the embankment for the widened road formation and, to permit construction of adequate roadside drainage structure, trees located within the area between the pavement and the daylight line needs to be removed.
- Trees need to be cleared to facilitate construction of traffic detours.
- The stage wise impact on roadside trees and plantation has been described in the following sections.

Pre Construction Stage

The project has a significant, direct and long-term impact on the trees within the RoW. The cutting of trees shall have manifold impact. Most visible impact is the loss of shade. Also, there is a possibility of the local people being deprived of tree products, such as wood, fruits, leaves, etc. The numbers of trees to be cut have been given in Table 5-14.

It is estimated almost 4392 (Approx) trees need to be felled for construction of this road. The micro-ecosystems supported by the trees are also a point of environmental concern. The removal of road side trees will not only lead to erosion, and depletion of the ground water table, but also to the loss of the micro-ecosystems developed in the project area. Since most of trees to be removed are in fertile agriculture fields, therefore these are productive either due to fruit bearing or due to timber usage.

Construction Stage

The construction of new road shall involve removal of topsoil and clearing of vegetation cover and felling of trees. The widening and strengthening of the road is involved in forest land acquisition. Hence diversion of forest land is required. Though the loss of these trees is an irreversible and long-term impact, the loss of the roadside plantations shall have to be compensated in accordance to the principles of the Forest (Conservation) Act.

During the construction phase, there may be accidental cutting of trees by the construction workers for cooking fuel. The compensatory plantation and plantation in median will also take place at the end of construction period.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Operation Stage

The operation phase is envisaged to have significant long-term positive impact with regard to roadside plantation. During operation stage there will be positive impact on flora as compensatory plantation inRoW will grow and turfing on side slopes will also mature.

7.6.1.2 Mitigation Measure

The major adverse impacts on flora shall involve the removal of trees, shrub and ground cover from within the Corridor of Impact. As part of the project preparation, to minimise the loss of trees, clearance of only those trees identified from the design will be removed.

Design Stage

The loss of trees will be compensated in accordance to the principles laid out in the Forest(Conservation) Act, 1980. Typical landscape plans have been prepared for the project roadbased on geographic, climatic and soil conditions. Compensatory plantation in the ratio of 1:5 is plannedas per IRC: SP: 21-2009 apart statutory requirement as per available land.

Savings of Trees- Best effort shall be given to prevent loss of avoidable trees at every possible location.

Transplantation- In order to minimise the negative impact of tree felling and to conserve the gene pool transplantation of trees shall be adopted wherever possible.

Contractor to identify trees that can be transplanted and adopt methodology for transplantation. The methodology shall be approved by the Environmental expert.

Avenue and Block Plantation

- Avenue plantation along corridor, where ever possible shall be given to compensate the loss of trees due to felling.
- Native indigenous trees species shall be used as far as practicable, strictly avoiding any exotic (but popular) species that can have far-reaching adverse effects on the ecology and water regime of the area.
- Endeavour to initiate plantations before the construction is complete so that the trees are at least a year or two old when the project is completed.
- Contractor shall work out the number of trees to be planted around junctions and for enhancement purposes.
- Avenue plantation with single species only to be planted for a few kilometers (or, the stretch between two market places for example) to provide harmonious and pleasing look, and a regular and wavelike skyline. This row of trees forms the first and innermost line.
- Selection of tree species in outer rows (where multiple rows can be accommodated) has been considered from economic point of view. Therefore, trees that provide fuel and fruit as well as small timber for agricultural implements have been suggested.
- The plantation of trees shall be done subject to availability of space in the proposed ROW.

Protection of Species

Activities during the construction period are likely to have adverse impact on the plant species located along the carriageway. Tree guards shall be provided to protect the young trees in the median and avenue

Construction Stage

No trees out of RoW will be felled. The trees to be felled will be marked inside the RoW. Construction vehicles, machinery and equipment will move or be stationed in the designated area only to prevent compaction of vegetation. While operating on temporarily acquired land for traffic detours, storage, material handling or any other construction related or incidental activities, it will be ensured that the trampling of soil and damage to naturally occurring (RoW or Construction Camp) herbs and grasses will be avoided.

7.6.2 Fauna

Domesticated animals dominate fauna species. There is likelihood of slight impact to local domestic animals, which graze in the area especially after the road is constructed. Increased vehicle movement in the area might lead to accidents involving animals. In areas with high traffic volumes, road kill can be a considerable or even the predominant cause of mortality. To avoid such accidental kill, the project shall provide underpasses as part of the project.



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

More over there shall be positive impact on the faunal species during the operational phase. The plantation activity carried out, as part of the project component shall provide shelter and food for the smaller avian and mammalian species, which in turn shall improve the overall food chain and food web and ultimately the ecology of the area.

7.6.2.1 Impact

Aquatic Ecology

The construction of new bridges will cause some contamination of the river water due to spillage of construction material, sediment loading & increased turbidity downstream of the bridge location. This change shall have short-term impact on the flora and faunal species and change the nature of the substratum resulting in decline in the number and diversity of plants and thus the food web. No negative impacts are envisaged on the aquatic ecology during the operational phase.

Wildlife

There is no wildlife reported in the project area hence, no impact is anticipated.

7.6.2.2 Mitigation measure

Although no significant fauna species were sighted along the project road, following precautionary measures need to be taken up during the construction stage by Contractor.

- All works are to be carried out such that minimum damage and disruption to fauna is caused.
- Construction workers shall be instructed to protect natural resources and fauna, including wild animals and aquatic life.
- Hunting and unauthorised fishing shall be prohibited.
- During construction, at any point of time, if a rare / endangered / threatened fauna species is spotted, Contractor shall make all arrangements to intimate the wild life authorities and measures will be taken for conservation during the operation period also.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Table 7-10: Summary of Mitigations for Impacts on Biological Environment

Sl. No.	Item	Impact	Reason	Mitigation / Enhancement
1.	Forest area	No impact	No Diversion of protected forest area (felling of road side plantation)	Compensatory afforestation.
2.	Wild life	No impact	No protected area like sanctuary, national park, biosphere reserve etc. located within 10Km of project area	- Provision for cattle crossing shall be provided - Avenue plantation shall act as the habitat for various faunal components.
3.	Trees cutting	Direct impact	Increase in soil erosion, silting of water bodies. Dust and noise pollution Loss of shade and loss of tree products	- Five times plantation against trees to be felled as per IRC: SP: 21-2009 - Option of compensatory afforestation through Forest Department. - Avenue plantation along corridor, where ever possible. - Identification of incidental spaces (ox bow areas) for group plantation. - Transplantation of trees also explored.
4.	Vegetation	Direct impact	Increase in soil erosion, silting of water bodies, noise pollution, dust pollution	- Clearing and grubbing will be minimised, and sprinkled with water to reduce dust pollution. - Exposed surface like embankment slopes will be protected with stone pitching and turfing. - Open land in and around plant will be vegetated.
5.	Cattle Grazing	No impact	No cattle grazing found	NII

7.7 Social Environment

Upgrading and operation phases of project road will have some beneficial impacts on social environment. Some increase in income of local people is expected as some local unskilled, semiskilled and skilled persons will gain direct or indirect employment during construction phase. Approximately 50-100 construction workers will be engaged from local sources for about 3 years long construction period. Since the immigration of work force during construction phase is likely to be very small, the social impacts on literacy, health care, transport facilities and cultural aspect are expected to be insignificant.

Temporary medical facilities for the construction workers will be provided if construction camps are required to be set up.

7.7.1 Human Use Values

7.7.1.1 Land Use

Construction of 4 lane road may lead to a change in the land use pattern of areas adjacent to the road. The existing land adjacent to the road at present is mostly of barren and agricultural use. The project corridor lies mostly in plain and thus, no disfiguration of land is envisaged due to construction activities except for the opening of borrow pits. The borrow pit locations have already been identified and will be restricted to those areas only.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

7.7.1.2 Mitigation Measures:

- Construction activities shall be limited to the corridor only.
- Care shall be taken to ensure that the construction workers camp does not disturb the surrounding land use.
- Existing access/ entrances to the urban roads shall be duly maintained.
- The bypass/ flyovers alternatives that are best from Engineering, Environmental and Social aspects are selected for this project.

7.7.1.3 Flood Characteristics

The proposed road project for PKG-1, proposes 54 cross drainage structures proposed in the form of Box culvert. There are 10 minor bridges proposed in this project road. The project stretches are designed for above HFL hence, the flooding in the area can be avoided.

7.7.1.4 Mitigation Measures:

All the project road shall have adequate waterway. The design discharge shall be evaluated in case 4 laning is considered in the design of the project.

- Raising of the embankment height above the submergence depth, with provision of balancing culverts.
- Providing drain on both sides of the widened road and extending the drains to a proper outfall.
- Proper supervision during construction to avoid blocking of micro-drainage across the road.
- Maintaining existing drainage outlets.
- Replace inadequate or distressed drainage structures.
- Adequate number of cross drainage structures will be provided along the bypasses.

7.7.2 Archeological Sites

As per "The Ancient Monuments and Archaeological Sites and Remains Act, 1958, as amended in 2010", the construction activities should be 200m away from the ASI site. Since all of the proposed roads are away from 200m of the ASI site.

7.7.2.1 Mitigation Measures

- The Contractor, will coordinate with the Archeology Department to designate an on-site representative during the entire duration of the project.
- All workers will undergo a briefing with the Archeology Department to ensure safeguarding of heritage resource and cultural/religious practices.

7.7.3 Road Safety

The improvement of the project road will entail doubling the development of existing carriageway and improve its condition to allow increasing the vehicles speed. Increased vehicular speed mean that the fringe areas of the road are at increased risk from speeding vehicles. The existing facilities and amenities along the road shall be subjected to adverse impacts of road operation. The possibility of accidents is likely to increase. The possibility of this happening is a cause of concern as there are few educational, cultural and health institutes along the road.

7.7.4 Construction Workers Camps

During the construction phase of project road, construction worker will be engaged in construction activities. Most of the workers will be from local area and some may be from other areas. This may affect demography of the area for short a time.

7.7.4.1 Impact on Construction Stage

Although the construction contractors are likely to use unskilled labour drawn from local communities, use of specialized road building equipment will require trained personnel not likely to be found locally. Sudden and relatively short-lived influxes of construction workers to communities along road will not have the potential to 'skew' certain demographic variables and the traditional social coherence of towns and villages. It is anticipated that the construction labour inputs for the construction works will be in the order of about 150-200 persons per day. However, this number will fluctuate, and the number of worker on any particular day will be higher or lower.

The construction workforce will be made up of the following groups:



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

- Supervision, specialist and administrative personnel, normally about 50 per cent of the workforce-the contractor would probably arrange local accommodation using boarding houses or rented houses
- Skilled workers, normally about 25 per cent of the workforce - the contractor will probably establish a construction camp for the skilled workers.
- Unskilled workers, normally about 75 per cent of the workforce – contractors normally recruit these workers locally and do not need to provide accommodation.
- The contract documents will require the contractor to obtain all necessary approvals before building a construction camp.

7.7.4.2 Mitigation measure for Construction Camp

- Construction camp shall be sited at such locations to utilize the existing infrastructure. No productive land should be utilized for construction camp. All sites must be graded, ditched, and rendered free from depressions to avoid water stagnation. Accommodation and ancillary facilities including recreational facility for workers shall be erected and maintained to standards and scales approved by the resident engineer.
- All camps should maintain minimum distance of 500 m from habitation and water bodies.
- All construction camps shall be provided sanitary latrines and urinals with provision of septic tanks attached with soak pits. Storm water drains shall be provided for the flow of used water outside the camp. Drains and ditches shall be treated with bleaching powder on a regular basis. Garbage bins must be provided in the camp and regularly emptied and disposed off in a hygienic manner.
- At every workplace, the Contractor will ensure, in collaboration with local health authorities that a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances shall be provided. Workplaces remote and far away from regular hospitals shall have indoor health units with one bed for every 250 workers. Suitable transport shall be provided to approach the nearest hospital. At every workplace, an ambulance containing the prescribed equipment and nursing staff shall be provided.
- The Contractor will ensure the good health and hygiene of all workers to prevent sickness and epidemics. These include the HIV/AIDS prevention program to reduce the risk and transfer of HIV virus between and among the workers and community, promote early diagnosis and assist affected individuals. Activities under the program include monthly information, education, and consultation communication campaigns to workers, drivers, delivery crew, and communities on the risk, dangers, and impacts of STD and HIV/AIDS.
- The Contractor will ensure that sufficient supply of suitable and hygienically prepared food at reasonable price is available to the workers.
- The Contractor will provide adequate and safe water supply for the use of the workers.
- The Contractor will ensure that all precautions to protect the workers from insect and pest to reduce the risk to health. This may include the use of insecticides which should comply with local regulations.
- Migrant workers may be the potential carriers of various diseases. Local community may get exposed to the diseases carried by migrant workers. Regular health check-up and immunization camps shall also be organized for the workers and nearby population.

7.7.5 Quality Of Life Values

7.7.5.1 Impact

Socio-Economic Profile

The impact of the improvements of project road on the socio-economic environment will be significantly beneficial. Improved access and reduced travel time and cost will be major stimuli to economic growth, particularly in rural areas. Better access of agricultural goods to market will be important and a major contributor to poverty reduction. Increased labour mobility will occur. This has both positive and negative impacts. Increased access is a two-way phenomenon, and the corollary to increased access to the project areas is increased access for the residents of these areas to more urban life-styles. Out-migration may result. There is also the likelihood of the relocation of homes and businesses to new roadside locations.

During construction, benefits to local people can be maximized if the contractor recruits construction workers locally regardless of gender. Where possible, he/she should also not discriminate in the employment of women.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Community Impacts

Community impacts are mostly due to the resettlement of people due to the development of project road. Construction camps may put stress on local resources and the infrastructure in nearby communities resulting to people raising grievances. This sometimes leads to aggression between residents and migrant workers.

Health, Safety and Hygiene

Construction of the road will result in the generation of waste. In isolated places, the amount of waste generated may be greater than normal because of substandard subsoil materials, which will need to be replaced.

- Debris generated on account of the above-mentioned activities if not properly disposed might give rise to health problems in the area. However, the structures to be dismantled during pre-construction phase will mainly be of semi-permanent and temporary nature and much of the waste shall be salvageable.
- In case of non-local labour, labour camps are set up at one or more sites adjacent to the alignment, and at some ancillary sites, like aggregate quarries. These labourers hired from outside can have clashes with the local population on account of cultural and religious differences.
- In and around forest areas if alternative fuels are not made available to the workforce, there is a likelihood that trees / branches will be cut down for cooking or heating purposes.
- Unsanitary conditions in the labour camps might also result in impact on health of labourers as well as the local population. Transmission of diseases is also facilitated by the migration of people. During the construction phase work, crews and their dependents may bring with them a multitude of communicable diseases including Sexually Transmitted Diseases (STDs) like AIDS. This is more so if the nature of the project requires more male-workers, who have migrated from other parts of the state or country.
- During road construction allied activities like quarrying and crushing operations, traffic diversions, etc., may cause disruption of social and economic life of the local population of the nearby areas. Dust and noise generated in crushing and blasting operations may cause nuisance to the nearby communities. Other problems perceived during construction period is inconvenience to the local people as well as the highway passengers due to traffic jams and congestion, loss of access and other road accident risks, as a result of diversion of traffic and construction work on road.
- The traffic amount and speeds are likely to increase throughout the road corridors. The accident risk would tend to increase. Although the design speeds have been kept lower in the major settlement areas, some amount of severance is expected in the rural areas.

Nuisance to Nearby Properties

Nuisance to nearby properties is likely to result from:

- noise and vibration from mechanical devices and construction plant;
- dust during quarrying, construction and the trafficking of new surfaces prior to sealing
- gaseous emissions from heavy equipment; and
- Fumes from asphalt boiling sites.

7.7.5.2 Mitigation measure

Community / Cultural Resources

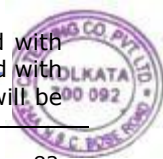
All religious/cultural structures are located beyond ROW. No cultural or community structures except few ground water source shall be affected as the proposed development will be accommodated within available ROW. However, if any structure gets affected in final design phase, the structure shall be relocated accordingly.

Work Associated Risks

Contractor is required to comply with all the precautions as required for the safety of the workmen as per the International Labour Organisation (ILO) Convention No.62 as far as those are applicable to this contract. Contractor will supply all necessary safety appliances such as safety goggles, helmets, masks, etc., to the workers and staff. Contractor shall comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.

Risk at Hazardous Activity

All workers employed on mixing asphaltic material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Stonebreakers will be provided with protective goggles and clothing and will be



PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

shifted at safe intervals. The use of any toxic chemical during construction will be strictly in accordance with the manufacturer's instructions. The Engineer will be given at least 6 working days notice of the proposed use of any toxic chemical. A register of all toxic chemicals delivered to the site will be kept and maintained up to date by Contractor. The register will include the trade name, physical properties and characteristics, chemical ingredients, health and safety hazard information, handling and storage procedures, and emergency and first aid procedures for the product.

Risk of Lead Pollution

No man / woman below the age of 18 years will be employed on the work of painting with products containing lead in any form. No paint containing lead or lead products will be used except in the form of paste or readymade paint. Face masks will be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.

First Aid

At every workplace, a readily available first aid unit including an adequate supply of sterilised dressing material and appliances will be provided as per the Factory Rules. Workplaces remote and far away from regular hospitals will have indoor health units with one bed for every 250 workers. Suitable transport will be provided to facilitate shifting injured or ill person(s) to the nearest applicable hospital. At every workplace an ambulance containing the prescribed equipment and nursing staff will be provided as prescribed.

Potable Water

In every workplace at suitable and easily accessible places a sufficient supply of cold potable water (as per IS) will be provided and maintained. If the drinking water is obtained from an intermittent public water supply, then storage tanks will be provided. All water supply storage will be at a distance of not less than 15m from any latrine, drain or other source of pollution. Where water has to be drawn from an existing well, which is within such proximity of any latrine, drain or any other source of pollution, the well will be properly chlorinated before water is drawn from it for drinking purpose. All such wells will be entirely closed in and be provided with a trap door, which will be dust proof and waterproof. A reliable pump will be fitted to each covered well. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once a month.

Safety

Design Stage

Safety of road users as well as of the vehicles plying on the project road is given highest importance and adequate measures have been incorporated in the design of the alignment. The design incorporates adequate numbers of pedestrian and vehicular underpasses to facilitate crossing of the project road by the locals. Concrete crash barriers and / or steel Beam Guardrails shall be installed at the main carriageway.

Construction Stage

Construction activities cause hindrance to traffic movement and are also hazardous for the traffic. Traffic management plans shall be prepared and temporary diversion routes will be identified to divert traffic from construction locations. Signboards indicating construction sites on the road and flags shall be erected. All the signboards giving caution, barricades for diverting the traffic shall be as per highway specifications.

Operation Stage

All safety measures erected at time of construction will be maintained properly. There will be special attention to signage.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

8 Implementation Arrangement

8.1 Introduction

The institutional arrangement proposed for the Project has been presented here with defined roles and responsibilities. The responsibility of implementing the mitigation measures lies with the contractor and all the construction activities being taken up by the contractor. The Consultant shall monitor the implementation of the work, who will be responsible for planning all Environmental Management Plan (EMP) activities in the construction phase of the Project.

8.2 Environmental Expert

For effective implementation and management of the EMP, the PMC has an Environmental Expert to deal with the environmental issues of the project. This officer shall interact with the Road Manager to ensure that the mitigation and enhancement measures mentioned in the EMP are adhered. His prime responsibility shall be to apprise the Team Leader of PMC and the Road Manager about the ground conditions. He shall also monitor that the requisite clearances and the NOCs for the project and shall also strictly supervise the adherence to the EMP. The qualifications and responsibilities of Environmental Expert are given below box.

Proposed Qualification and Responsibilities of Environmental Expert (EE)

Qualifications & Experience

- Postgraduate in Environmental Science / Environmental Management / degree in Civil Independent Engineering with specialisation in environment
- 7 years of total experience with a minimum of 3 years in the implementation of EMP of highway projects and an understanding of environmental, health and safety issues
- Prior practical experience in State and National Highways would be an advantage

Roles & Responsibilities

- Primarily responsible for implementation of the EMP on site and ensuring that the environmental quality is meeting the standards laid down by CPCB and other related authority
- The EE shall implement the EMP by assigning the necessary resources and attending such meetings as are required for the effective implementation of the EMP on behalf of M/s CE Testing Pvt. Ltd.
- The EE shall interact with the Road Manager to ensure that the mitigation and

8.3 Reporting System

Reporting system provides necessary feedback to ensure quality of the works and that the program is on schedule. Environmental Management Plan gets implemented in the Project. Reporting system shall be for environmental performance indicators as documented in the contract agreement. The items / performance indicators that shall be reported are:

- RoW Encroachment within five working days of observing any encroachment of RoW – Monthly
- Muck dumping area management- Monthly
- Ambient Air Quality & Noise Levels in construction stretches - Quarterly (during construction period)
- Operational Management Processes including labour deployment during routine and maintenance work – Monthly
- Management of any chance discovery of archaeological remains at any site excavated under the contract. Quarterly (during construction period)
- Prevention of communicable diseases spreading to new areas due to increased communications- Quarterly

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

8.4 Environmental Capacity Building

Training of staff will be done at a number of levels to raise their levels of environmental awareness. The training can be conducted by either some external agency or through the help of in-house expertise. The main focus of training programmes shall be on implementation of EMP with special emphasis on the project road.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

9 Project Benefits

Road Project have varied embedded connotations, like the backbone of modern economy, the philosophy of life signifying the voyage unremitting from birth till death, the history of mankind and its endeavor, the passion for speed and dart non-episodically, etc. Road projects promote access to markets, materials and opportunities by facilitating movement of persons and goods and improve earning and thereby enhancing the quality of life. This in turn enhances the demand for transport. This two-way interaction works through a host of inter-sectoral forward and backward linkages effects and dynamic externalities, tend to relocate industries, services and labour and thus helps to shape the economic geography of the region.

The ultimate aim of the developmental activities, such as Chirakuta-Jalukabari Project road is to promote societal welfare of whole Assam State. The development of such a project plays a significant role in changing the socio-economic condition of the living of people of a region through dynamic externalities that such development often generates.

The benefits of the proposed planning with paved shoulder of Chirakuta-Jalukabari Project road may also be seen from a different angle, viz., the local benefit and the wider regional or national level benefit. The entire regional and national economy lying beyond this neighborhood will also be benefitted from the development. Such effect may be called as the regional or national level benefits. Further the benefit may be direct or indirect in nature.

All these should have a bearing on the level of well being of the households, although some of them may not themselves necessarily use road facility created. These would in turn lead to changes in the level of well-being and human development, through their benefit on consumption level, educational attainment, health status, etc.

9.1 Reductions in Operation Cost

Vehicle Operating Cost (VOC) will be reduced when riding quality of road is improved. Maintenance and Operation cost such as fuel consumption, wear and tear of tyres, will be sufficiently reduced. The vehicle operating cost shall be further reduced by improving the geometrics and design. The benefits perceived by the road user are in the form of lower expenditure. VOC consist of the following components:

- Fuel Consumption
- Lubricating oil consumption
- Spare part consumption and repairs
- Tire consumption; and
- Vehicle depreciation.

9.2 Reductions in Accidents, Morbidity and Mortality

The proposed upgradation of Chirakuta-Jalukbari road project will reduce congestion in built-up areas along the project road such as Tulungia, Kherkhabari, Dabli, Singra, Mirza and Jalukbari.

In order to make project road accident free road signage and safety features have been planned at the design stage. Required lightning shall be provided at critical locations to avoid accidents during night and in adverse climatic conditions.

9.3 Tourism Development

The project road is a connecting link between Meghalaya, Nagaland and West Bengal. Meghalaya is an international tourist destination due to Shillong. The project road gives direct connectivity to Shillong via NH-17. The proposed project will also give quick connection to these tourist destinations of West Bengal and Meghalaya. This project road will also provide a short and quick connectivity to NH-27. The project road gives direct connectivity to Arunachal Pradesh.

9.4 Economic Development

The proposed project will also contribute to economic development by encouraging attraction of businesses to sites equipped with good access and by improving the travel efficiencies of existing businesses and to start a new avenue. This also helps for:

- The development of new project sites,
- The development of industrial parks,
- Infrastructure projects, and




PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

- Development of IT parks.

9.5 Employment Opportunity

The proposed upgradation of Chirakuta -Jalukabri project road will serve as an important employment generator and will provide employment opportunity during construction period. After construction period, the industrial and infrastructure development will provide enormous employment opportunities.

9.6 Development of Agriculture

The rehabilitation and upgradation of the project road will help the farmers in getting good prices of their produce by way of quick and fast transportation of perishable goods to the market places.

9.7 Road Safety

The upgradation of Chirakuta -Jalukabri road of existing road will ensure smooth flow of the traffic. Installation of proper road safety system through signage, barricades, and crash barriers will add to be safety to the traffic. Bus bays, lay byes, rest areas, underpasses, service roads are proposed in the project, which shall enhance the road safety.

9.8 Environmental Benefits

The proposed widening project will ensure the smooth flow of traffic, which reduces the emissions and noise level. Apart from these, plantation will be done throughout the project road, which will increase the aesthetic of the project road. All the bus bays will be provided with proper toilet and drinking water facilities for the people who will be using the local communications. Rest areas with various facilities are proposed for the highway users.

9.9 Indirect Benefits

In addition to direct positive impacts, a large number of indirect benefits are also attributed to the upgradation of Chirakuta-Jalukabri project road. Lowering transportation cost for users and improving access to goods and services enables new and increased economic and social activity. Individuals, households and firms adjust to take the advantage of those benefits, leading to several indirect impacts over a period. These indirect impacts include changes in land use and development, changes in decision to locate houses and business in areas where houses and land are less expensive or more desirable, and changes in warehouse and delivery procedure for businesses in order to take advantage of improved speed and reliability in the transportation system. These impacts further lead to increased property values, increased productivity, employment and economic growth.

The indirect benefit of proposed upgradation would work through the dynamic developmental externalities generated through the forward and backward linkages. The change in land use pattern in the area that have better connectivity due to the improved road there, since there will be a change in the patterns of settlement, agricultural land use and location of industries, trading and other services and non-farm unorganized sector activities. All the above would reflect in the changes in the pattern of economic activities, income generation, price evolution, employment condition and ground rent prevailing all along the project corridor.

A new Land use pattern may in turn induce greater accessibility to job market, health and educational facilities etc. attract investment for development of feeder roads, power distribution networks, telecommunication facilities and other modes of connectivity amongst other, leading to a greater access of the local people to markets and infrastructure facilities.

J. Mulya



ANNEXURE-I: TEST RESULT

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/01
Report Issue Date : 23/02/2020
Sample Receipt Date : 19/02/2020
Analysis Date : 19/02/2020 to 23/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/01& 19/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-1)
Type of Sample : Air Sample
Date of Sample Collection : 15/02/2020 to 16/02/2020
Location / Source of Sample : **Deepor**
Latitude - 26.129321° Longitude - 91.620490°
Chainage - 206+800 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	81	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	54	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.6	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

I. M. Saha



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/02
Report Issue Date : 23/02/2020
Sample Receipt Date : 19/02/2020
Analysis Date : 19/02/2020 to 23/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/02& 19/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-2)
Type of Sample : Air Sample
Date of Sample Collection : 15/02/2020 to 16/02/2020
Location / Source of Sample : **Chhayagaon, Near Chhayagaon Health Centre**
Latitude - 26.046380° Longitude - 91.379950°
Chainage - 177+850 Km, Distance from alignment - 150m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	93	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	59	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	15.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/03
Report Issue Date : 23/02/2020
Sample Receipt Date : 19/02/2020
Analysis Date : 19/02/2020 to 23/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/03& 19/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-3)
Type of Sample : Air Sample
Date of Sample Collection : 15/02/2020 to 16/02/2020
Location / Source of Sample : **Rangjuli**
Latitude - 25.967215° Longitude - 90.932838°
Chainage - 128+800 Km, Distance from alignment - 100m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team C)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	76	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	48	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.5	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	15.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/04
Report Issue Date : 24/02/2020
Sample Receipt Date : 20/02/2020
Analysis Date : 20/02/2020 to 24/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/04& 20/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-4)
Type of Sample : Air Sample
Date of Sample Collection : 16/02/2020 to 17/02/2020
Location / Source of Sample : **Dudhnoi Bypass Point**
Latitude - 25.988276 ° Longitude - 90.760839°
Chainage - 109+100 Km, Distance from alignment - 150m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	70	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	42	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.6	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. M. S.



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/05
Report Issue Date : 24/02/2020
Sample Receipt Date : 20/02/2020
Analysis Date : 20/02/2020 to 24/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/05 & 20/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-5)
Type of Sample : Air Sample
Date of Sample Collection : 16/02/2020 to 17/02/2020
Location / Source of Sample : **Agia**
Latitude - 26.083116° Longitude - 90.760839°
Chainage - 086+100 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	71	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	44	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	12.9	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

I. M. Saha



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/06
Report Issue Date : 24/02/2020
Sample Receipt Date : 20/02/2020
Analysis Date : 20/02/2020 to 24/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/06 & 20/02/2020
Reference No. : PI/CTK118-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-6)
Type of Sample : Air Sample
Date of Sample Collection : 16/02/2020 to 17/02/2020
Location / Source of Sample : **Chirakuta (Near Mosque)**
Latitude - 26.232215° Longitude - 90.280316°
Chainage - 004+500 Km, Distance from alignment - 100m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team C)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	79	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	42	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.5	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

I. M. S.

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Test Report No. : ITL/PR/19-20/01/AA/07
Report Issue Date : 25/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 25/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/07 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-7)
Type of Sample	: Air Sample
Date of Sample Collection	: 17/02/2020 to 18/02/2020
Location / Source of Sample	: Tulangia Market Latitude - 26.368834° Longitude - 90.634974° Chainage - 049+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	94	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	53	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/08
Report Issue Date : 25/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 25/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/08 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-8)
Type of Sample	: Air Sample
Date of Sample Collection	: 17/02/2020 to 18/02/2020
Location / Source of Sample	: Chalantapara-IV Latitude - 26.264214° Longitude – 90.584416° Chainage - 063+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	93	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	53	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/09
Report Issue Date : 25/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 25/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/09 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-9)
Type of Sample	: Air Sample
Date of Sample Collection	: 17/02/2020 to 18/02/2020
Location / Source of Sample	: Near Chapar Latitude - 26.268557° Longitude - 90.441831° Chainage - 022+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	104	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	61	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.9	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/10
Report Issue Date : 26/02/2020
Sample Receipt Date : 22/02/2020
Analysis Date : 22/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/10& 22/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-1)
Type of Sample : Air Sample
Date of Sample Collection : 18/02/2020 to 19/02/2020
Location / Source of Sample : **Deepor**
Latitude - 26.129321° Longitude - 91.620490°
Chainage - 206+800 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	73	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	50	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.1	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/11
Report Issue Date : 26/02/2020
Sample Receipt Date : 22/02/2020
Analysis Date : 22/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/11& 22/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-2)
Type of Sample	: Air Sample
Date of Sample Collection	: 18/02/2020 to 19/02/2020
Location / Source of Sample	: Chhayagaon, Near Chhayagaon Health Centre Latitude - 26.046380° Longitude - 91.379950° Chainage - 177+850 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	82	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	52	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.5	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/12
Report Issue Date : 26/02/2020
Sample Receipt Date : 22/02/2020
Analysis Date : 22/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/12& 22/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-3)
Type of Sample	: Air Sample
Date of Sample Collection	: 18/02/2020 to 19/02/2020
Location / Source of Sample	: Rangjuli Latitude - 25.967215° Longitude - 90.932838° Chainage - 128+800 Km, Distance from alignment - 100m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	68	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	42	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/13
Report Issue Date : 27/02/2020
Sample Receipt Date : 23/02/2020
Analysis Date : 23/02/2020 to 27/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/13& 23/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-4)
Type of Sample	: Air Sample
Date of Sample Collection	: 19/02/2020 to 20/02/2020
Location / Source of Sample	: Dudhnoi Bypass Point Latitude - 25.988276 ° Longitude – 90.760839° Chainage - 109+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	67	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	42	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	12.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/14
Report Issue Date : 27/02/2020
Sample Receipt Date : 23/02/2020
Analysis Date : 23/02/2020 to 27/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/14 & 23/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-5)
Type of Sample : Air Sample
Date of Sample Collection : 19/02/2020 to 20/02/2020
Location / Source of Sample : **Agia**
Latitude - 26.083116° Longitude - 90.760839°
Chainage - 086+100 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	78	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	40	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	13.9	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/15
Report Issue Date : 27/02/2020
Sample Receipt Date : 23/02/2020
Analysis Date : 23/02/2020 to 27/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/15 & 23/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-6)
Type of Sample : Air Sample
Date of Sample Collection : 19/02/2020 to 20/02/2020
Location / Source of Sample : **Chirakuta (Near Mosque)**
Latitude - 26.232215° Longitude - 90.280316°
Chainage - 004+500 Km, Distance from alignment - 100m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team C)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	67	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	39	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.1	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/16
Report Issue Date : 28/02/2020
Sample Receipt Date : 24/02/2020
Analysis Date : 24/02/2020 to 28/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/16 & 24/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-7)
Type of Sample	: Air Sample
Date of Sample Collection	: 20/02/2020 to 21/02/2020
Location / Source of Sample	: Tulangia Market Latitude - 26.368834° Longitude – 90.634974° Chainage - 049+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	107	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	62	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.7	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/17
Report Issue Date : 28/02/2020
Sample Receipt Date : 24/02/2020
Analysis Date : 24/02/2020 to 28/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/17 & 24/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-8)
Type of Sample	: Air Sample
Date of Sample Collection	: 20/02/2020 to 21/02/2020
Location / Source of Sample	: Chalantapara-IV Latitude - 26.264214° Longitude – 90.584416° Chainage - 063+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	92	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	51	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.6	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/18
Report Issue Date : 28/02/2020
Sample Receipt Date : 24/02/2020
Analysis Date : 24/02/2020 to 28/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/18 & 24/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-9)
Type of Sample	: Air Sample
Date of Sample Collection	: 20/02/2020 to 21/02/2020
Location / Source of Sample	: Near Chapar Latitude - 26.268557° Longitude - 90.441831° Chainage - 022+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	91	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	53	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	19.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/19
Report Issue Date : 01/03/2020
Sample Receipt Date : 25/02/2020
Analysis Date : 25/02/2020 to 01/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/19 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-1)
Type of Sample : Air Sample
Date of Sample Collection : 21/02/2020 to 22/02/2020
Location / Source of Sample : **Deepor**
Latitude - 26.129321° Longitude - 91.620490°
Chainage - 206+800 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	78	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	52	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.1	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.6	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/20
Report Issue Date : 01/03/2020
Sample Receipt Date : 25/02/2020
Analysis Date : 25/02/2020 to 01/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/20 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-2)
Type of Sample : Air Sample
Date of Sample Collection : 21/02/2020 to 22/02/2020
Location / Source of Sample : **Chhayagaon, Near Chhayagaon Health Centre**
Latitude - 26.046380° Longitude - 91.379950°
Chainage - 177+850 Km, Distance from alignment - 150m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	88	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	51	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.3	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.6	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/21
Report Issue Date : 01/03/2020
Sample Receipt Date : 25/02/2020
Analysis Date : 25/02/2020 to 01/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/21 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-3)
Type of Sample	: Air Sample
Date of Sample Collection	: 21/02/2020 to 22/02/2020
Location / Source of Sample	: Rangjuli Latitude - 25.967215° Longitude – 90.932838° Chainage - 128+800 Km, Distance from alignment - 100m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam . Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	72	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	46	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.6	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Mulya



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/22
Report Issue Date : 02/03/2020
Sample Receipt Date : 26/02/2020
Analysis Date : 26/02/2020 to 02/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/22 & 26/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-4)
Type of Sample : Air Sample
Date of Sample Collection : 22/02/2020 to 23/02/2020
Location / Source of Sample : **Dudhnoi Bypass Point**
Latitude - 25.988276 ° Longitude - 90.760839°
Chainage - 109+100 Km, Distance from alignment - 150m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	77	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	43	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.5	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. M. M. M.



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/23
Report Issue Date : 02/03/2020
Sample Receipt Date : 26/02/2020
Analysis Date : 26/02/2020 to 02/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/23 & 26/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-5)
Type of Sample : Air Sample
Date of Sample Collection : 22/02/2020 to 23/02/2020
Location / Source of Sample : **Agia**
Latitude - 26.083116° Longitude - 90.760839°
Chainage - 086+100 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	72	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	41	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.8	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.7	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

I. M. S. S.



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/24
Report Issue Date : 02/03/2020
Sample Receipt Date : 26/02/2020
Analysis Date : 26/02/2020 to 02/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/24 & 26/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-6)
Type of Sample : Air Sample
Date of Sample Collection : 22/02/2020 to 23/02/2020
Location / Source of Sample : **Chirakuta (Near Mosque)**
Latitude - 26.232215° Longitude - 90.280316°
Chainage - 004+500 Km, Distance from alignment - 100m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team C)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	76	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	40	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.5	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	15.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/25
Report Issue Date : 03/03/2020
Sample Receipt Date : 27/02/2020
Analysis Date : 27/02/2020 to 03/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/25 & 27/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-7)
Type of Sample	: Air Sample
Date of Sample Collection	: 23/02/2020 to 24/02/2020
Location / Source of Sample	: Tulangia Market Latitude - 26.368834° Longitude - 90.634974° Chainage - 049+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	86	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	46	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/26
Report Issue Date : 03/03/2020
Sample Receipt Date : 27/02/2020
Analysis Date : 27/02/2020 to 03/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/26 & 27/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-8)
Type of Sample : Air Sample
Date of Sample Collection : 23/02/2020 to 24/02/2020
Location / Source of Sample : **Chalantapara-IV**
Latitude - 26.264214° Longitude - 90.584416°
Chainage - 063+000 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	112	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	62	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.5	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.6	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/27
Report Issue Date : 03/03/2020
Sample Receipt Date : 27/02/2020
Analysis Date : 27/02/2020 to 03/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/27 & 27/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-9)
Type of Sample	: Air Sample
Date of Sample Collection	: 23/02/2020 to 24/02/2020
Location / Source of Sample	: Near Chapar Latitude - 26.268557° Longitude - 90.441831° Chainage - 022+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	81	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	51	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.5	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.6	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/28
Report Issue Date : 03/03/2020
Sample Receipt Date : 28/02/2020
Analysis Date : 28/02/2020 to 03/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/28 & 28/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-1)
Type of Sample : Air Sample
Date of Sample Collection : 24/02/2020 to 25/02/2020
Location / Source of Sample : **Deepor**
Latitude - 26.129321° Longitude - 91.620490°
Chainage - 206+800 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	71	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	49	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.7	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	15.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

I. M. Saha



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/29
Report Issue Date : 03/03/2020
Sample Receipt Date : 28/02/2020
Analysis Date : 28/02/2020 to 03/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/29 & 28/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-2)
Type of Sample : Air Sample
Date of Sample Collection : 24/02/2020 to 25/02/2020
Location / Source of Sample : **Chhayagaon, Near Chhayagaon Health Centre**
Latitude - 26.046380° Longitude - 91.379950°
Chainage - 177+850 Km, Distance from alignment - 150m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	91	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	57	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	19.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/30
Report Issue Date : 03/03/2020
Sample Receipt Date : 28/02/2020
Analysis Date : 28/02/2020 to 03/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/30 & 28/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-3)
Type of Sample : Air Sample
Date of Sample Collection : 24/02/2020 to 25/02/2020
Location / Source of Sample : **Rangjuli**
Latitude - 25.967215° Longitude - 90.932838°
Chainage - 128+800 Km, Distance from alignment - 100m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team C)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	84	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	51	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.6	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/31
Report Issue Date : 04/03/2020
Sample Receipt Date : 01/03/2020
Analysis Date : 01/03/2020 to 04/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/31 & 01/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-4)
Type of Sample : Air Sample
Date of Sample Collection : 25/02/2020 to 26/02/2020
Location / Source of Sample : **Dudhnoi Bypass Point**
Latitude - 25.988276 ° Longitude - 90.760839°
Chainage - 109+100 Km, Distance from alignment - 150m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	64	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	46	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	13.6	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/32
Report Issue Date : 04/03/2020
Sample Receipt Date : 01/03/2020
Analysis Date : 01/03/2020 to 04/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/32 & 01/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-5)
Type of Sample : Air Sample
Date of Sample Collection : 25/02/2020 to 26/02/2020
Location / Source of Sample : **Agia**
Latitude - 26.083116° Longitude - 90.760839°
Chainage - 086+100 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	73	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	43	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	13.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

I. M. Saha



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/33
Report Issue Date : 04/03/2020
Sample Receipt Date : 01/03/2020
Analysis Date : 01/03/2020 to 04/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/33 & 01/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-6)
Type of Sample : Air Sample
Date of Sample Collection : 25/02/2020 to 26/02/2020
Location / Source of Sample : **Chirakuta (Near Mosque)**
Latitude - 26.232215° Longitude - 90.280316°
Chainage - 004+500 Km, Distance from alignment - 100m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team C)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	75	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	40	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.6	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

I. M. Saha



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/34
Report Issue Date : 05/03/2020
Sample Receipt Date : 02/03/2020
Analysis Date : 02/03/2020 to 05/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/34 & 02/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-7)
Type of Sample	: Air Sample
Date of Sample Collection	: 26/02/2020 to 27/02/2020
Location / Source of Sample	: Tulangia Market Latitude - 26.368834° Longitude - 90.634974° Chainage - 049+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	84	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	48	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/35
Report Issue Date : 05/03/2020
Sample Receipt Date : 02/03/2020
Analysis Date : 02/03/2020 to 05/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/35 & 02/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-8)
Type of Sample	: Air Sample
Date of Sample Collection	: 26/02/2020 to 27/02/2020
Location / Source of Sample	: Chalantapara-IV Latitude - 26.264214° Longitude - 90.584416° Chainage - 063+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	97	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	59	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	10.1	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/36
Report Issue Date : 05/03/2020
Sample Receipt Date : 02/03/2020
Analysis Date : 02/03/2020 to 05/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/36 & 02/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-9)
Type of Sample	: Air Sample
Date of Sample Collection	: 26/02/2020 to 27/02/2020
Location / Source of Sample	: Near Chapar Latitude - 26.268557° Longitude - 90.441831° Chainage - 022+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	78	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	52	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.1	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/37
Report Issue Date : 09/03/2020
Sample Receipt Date : 05/03/2020
Analysis Date : 05/03/2020 to 09/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/37& 05/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-1)
Type of Sample : Air Sample
Date of Sample Collection : 01/03/2020 to 02/03/2020
Location / Source of Sample : **Deepor**
Latitude - 26.129321° Longitude - 91.620490°
Chainage - 206+800 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	76	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	48	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	15.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/38
Report Issue Date : 09/03/2020
Sample Receipt Date : 05/03/2020
Analysis Date : 05/03/2020 to 09/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/38 & 05/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-2)
Type of Sample	: Air Sample
Date of Sample Collection	: 01/03/2020 to 02/03/2020
Location / Source of Sample	: Chhayagaon, Near Chhayagaon Health Centre Latitude - 26.046380° Longitude - 91.379950° Chainage - 177+850 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	88	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	50	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.1	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	15.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/39
Report Issue Date : 09/03/2020
Sample Receipt Date : 05/03/2020
Analysis Date : 05/03/2020 to 09/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/39 & 05/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-3)
Type of Sample	: Air Sample
Date of Sample Collection	: 01/03/2020 to 02/03/2020
Location / Source of Sample	: Rangjuli Latitude - 25.967215° Longitude - 90.932838° Chainage - 128+800 Km, Distance from alignment - 100m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	64	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	45	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.7	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/40
Report Issue Date : 10/03/2020
Sample Receipt Date : 06/03/2020
Analysis Date : 06/03/2020 to 10/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/40& 06/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-4)
Type of Sample	: Air Sample
Date of Sample Collection	: 02/03/2020 to 03/03/2020
Location / Source of Sample	: Dudhnoi Bypass Point Latitude - 25.988276 ° Longitude – 90.760839° Chainage - 109+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	64	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	41	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/41
Report Issue Date : 10/03/2020
Sample Receipt Date : 06/03/2020
Analysis Date : 06/03/2020 to 10/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/41 & 06/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-5)
Type of Sample : Air Sample
Date of Sample Collection : 02/03/2020 to 03/03/2020
Location / Source of Sample : **Agia**
Latitude - 26.083116° Longitude - 90.760839°
Chainage - 086+100 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	81	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	43	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/42
Report Issue Date : 10/03/2020
Sample Receipt Date : 06/03/2020
Analysis Date : 06/03/2020 to 10/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/42 & 06/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-6)
Type of Sample : Air Sample
Date of Sample Collection : 02/03/2020 to 03/03/2020
Location / Source of Sample : **Chirakuta (Near Mosque)**
Latitude - 26.232215° Longitude - 90.280316°
Chainage - 004+500 Km, Distance from alignment - 100m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team C)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	65	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	38	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	6.5	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/43
Report Issue Date : 11/03/2020
Sample Receipt Date : 07/03/2020
Analysis Date : 07/03/2020 to 11/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/43 & 07/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-7)
Type of Sample	: Air Sample
Date of Sample Collection	: 03/03/2020 to 04/03/2020
Location / Source of Sample	: Tulangia Market Latitude - 26.368834° Longitude - 90.634974° Chainage - 049+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	94	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	56	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/44
Report Issue Date : 11/03/2020
Sample Receipt Date : 07/03/2020
Analysis Date : 07/03/2020 to 11/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/44 & 07/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-8)
Type of Sample	: Air Sample
Date of Sample Collection	: 03/03/2020 to 04/03/2020
Location / Source of Sample	: Chalantapara-IV Latitude - 26.264214° Longitude - 90.584416° Chainage - 063+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	103	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	62	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Mulya



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/45
Report Issue Date : 11/03/2020
Sample Receipt Date : 07/03/2020
Analysis Date : 07/03/2020 to 11/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/45 & 07/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-9)
Type of Sample	: Air Sample
Date of Sample Collection	: 03/03/2020 to 04/03/2020
Location / Source of Sample	: Near Chapar Latitude - 26.268557° Longitude - 90.441831° Chainage - 022+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	93	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	58	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.6	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.6	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/46
Report Issue Date : 11/03/2020
Sample Receipt Date : 07/03/2020
Analysis Date : 07/03/2020 to 11/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/46 & 07/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-1)
Type of Sample : Air Sample
Date of Sample Collection : 04/03/2020 to 05/03/2020
Location / Source of Sample : **Deepor**
Latitude - 26.129321° Longitude - 91.620490°
Chainage - 206+800 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	72	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	46	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.5	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

J. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/47
Report Issue Date : 11/03/2020
Sample Receipt Date : 07/03/2020
Analysis Date : 07/03/2020 to 11/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/47 & 07/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-2)
Type of Sample	: Air Sample
Date of Sample Collection	: 04/03/2020 to 05/03/2020
Location / Source of Sample	: Chhayagaon, Near Chhayagaon Health Centre Latitude - 26.046380° Longitude - 91.379950° Chainage - 177+850 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	93	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	52	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/48
Report Issue Date : 11/03/2020
Sample Receipt Date : 07/03/2020
Analysis Date : 07/03/2020 to 11/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/48 & 07/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-3)
Type of Sample	: Air Sample
Date of Sample Collection	: 04/03/2020 to 05/03/2020
Location / Source of Sample	: Rangjuli Latitude - 25.967215° Longitude - 90.932838° Chainage - 128+800 Km, Distance from alignment - 100m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	68	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	47	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.6	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/49
Report Issue Date : 12/03/2020
Sample Receipt Date : 08/03/2020
Analysis Date : 08/03/2020 to 12/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/49 & 08/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-4)
Type of Sample	: Air Sample
Date of Sample Collection	: 05/03/2020 to 06/03/2020
Location / Source of Sample	: Dudhnoi Bypass Point Latitude - 25.988276 ° Longitude - 90.760839° Chainage - 109+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	72	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	46	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/50
Report Issue Date : 12/03/2020
Sample Receipt Date : 08/03/2020
Analysis Date : 08/03/2020 to 12/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/50 & 08/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-5)
Type of Sample : Air Sample
Date of Sample Collection : 05/03/2020 to 06/03/2020
Location / Source of Sample : **Agia**
Latitude - 26.083116° Longitude - 90.760839°
Chainage - 086+100 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	76	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	46	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	15.7	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

I. M. S.



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/51
Report Issue Date : 12/03/2020
Sample Receipt Date : 08/03/2020
Analysis Date : 08/03/2020 to 12/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/51 & 08/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-6)
Type of Sample : Air Sample
Date of Sample Collection : 05/03/2020 to 06/03/2020
Location / Source of Sample : **Chirakuta (Near Mosque)**
Latitude - 26.232215° Longitude - 90.280316°
Chainage - 004+500 Km, Distance from alignment - 100m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team C)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	72	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	36	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.8	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/52
Report Issue Date : 13/03/2020
Sample Receipt Date : 09/03/2020
Analysis Date : 09/03/2020 to 13/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/52 & 09/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-7)
Type of Sample	: Air Sample
Date of Sample Collection	: 06/03/2020 to 07/03/2020
Location / Source of Sample	: Tulangia Market Latitude - 26.368834° Longitude - 90.634974° Chainage - 049+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	102	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	64	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/53
Report Issue Date : 13/03/2020
Sample Receipt Date : 09/03/2020
Analysis Date : 09/03/2020 to 13/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/52 & 09/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-8)
Type of Sample	: Air Sample
Date of Sample Collection	: 06/03/2020 to 07/03/2020
Location / Source of Sample	: Chalantapara-IV Latitude - 26.264214° Longitude - 90.584416° Chainage - 063+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	99	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	58	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	10.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/54
Report Issue Date : 13/03/2020
Sample Receipt Date : 09/03/2020
Analysis Date : 09/03/2020 to 13/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/52 & 09/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-9)
Type of Sample	: Air Sample
Date of Sample Collection	: 06/03/2020 to 07/03/2020
Location / Source of Sample	: Near Chapar Latitude - 26.268557° Longitude - 90.441831° Chainage - 022+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	90	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	56	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.8	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/55
Report Issue Date : 14/03/2020
Sample Receipt Date : 10/03/2020
Analysis Date : 10/03/2020 to 14/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/55 & 10/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-1)
Type of Sample : Air Sample
Date of Sample Collection : 07/03/2020 to 08/03/2020
Location / Source of Sample : **Deepor**
Latitude - 26.129321° Longitude - 91.620490°
Chainage - 206+800 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	68	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	42	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.6	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

J. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/56
Report Issue Date : 14/03/2020
Sample Receipt Date : 10/03/2020
Analysis Date : 10/03/2020 to 14/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/56 & 10/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-2)
Type of Sample	: Air Sample
Date of Sample Collection	: 07/03/2020 to 08/03/2020
Location / Source of Sample	: Chhayagaon, Near Chhayagaon Health Centre Latitude - 26.046380° Longitude – 91.379950° Chainage - 177+850 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam . Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	91	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	56	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	10.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/57
Report Issue Date : 14/03/2020
Sample Receipt Date : 10/03/2020
Analysis Date : 10/03/2020 to 14/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/57 & 10/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-3)
Type of Sample	: Air Sample
Date of Sample Collection	: 07/03/2020 to 08/03/2020
Location / Source of Sample	: Rangjuli Latitude - 25.967215° Longitude – 90.932838° Chainage - 128+800 Km, Distance from alignment - 100m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam . Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	75	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	43	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	15.7	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. M. M. M.



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/58
Report Issue Date : 15/03/2020
Sample Receipt Date : 11/03/2020
Analysis Date : 11/03/2020 to 15/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/58 & 11/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-4)
Type of Sample : Air Sample
Date of Sample Collection : 08/03/2020 to 09/03/2020
Location / Source of Sample : **Dudhnoi Bypass Point**
Latitude - 25.988276 ° Longitude - 90.760839°
Chainage - 109+100 Km, Distance from alignment - 150m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	71	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	44	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.6	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	14.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/59
Report Issue Date : 15/03/2020
Sample Receipt Date : 11/03/2020
Analysis Date : 11/03/2020 to 15/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/59 & 11/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-5)
Type of Sample : Air Sample
Date of Sample Collection : 08/03/2020 to 09/03/2020
Location / Source of Sample : **Agia**
Latitude - 26.083116° Longitude - 90.760839°
Chainage - 086+100 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam .**
Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	76	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	48	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	6.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	13.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/60
Report Issue Date : 15/03/2020
Sample Receipt Date : 11/03/2020
Analysis Date : 11/03/2020 to 15/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/60 & 11/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-6)
Type of Sample : Air Sample
Date of Sample Collection : 08/03/2020 to 09/03/2020
Location / Source of Sample : **Chirakuta (Near Mosque)**
Latitude - 26.232215° Longitude - 90.280316°
Chainage - 004+500 Km, Distance from alignment - 100m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team C)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	79	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	41	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.9	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

S. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/61
Report Issue Date : 15/03/2020
Sample Receipt Date : 11/03/2020
Analysis Date : 11/03/2020 to 15/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/61 & 11/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-7)
Type of Sample : Air Sample
Date of Sample Collection : 09/03/2020 to 10/03/2020
Location / Source of Sample : **Tulangia Market**
Latitude - 26.368834° Longitude - 90.634974°
Chainage - 049+100 Km, Distance from alignment - 150m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	93	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	60	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.6	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/62
Report Issue Date : 16/03/2020
Sample Receipt Date : 12/03/2020
Analysis Date : 12/03/2020 to 16/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/62 & 12/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-8)
Type of Sample	: Air Sample
Date of Sample Collection	: 09/03/2020 to 10/03/2020
Location / Source of Sample	: Chalantapara-IV Latitude - 26.264214° Longitude - 90.584416° Chainage - 063+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	103	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	61	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	11.3	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/63
Report Issue Date : 16/03/2020
Sample Receipt Date : 12/03/2020
Analysis Date : 12/03/2020 to 16/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/63 & 12/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-9)
Type of Sample	: Air Sample
Date of Sample Collection	: 09/03/2020 to 10/03/2020
Location / Source of Sample	: Near Chapar Latitude - 26.268557° Longitude - 90.441831° Chainage - 022+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	89	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	57	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.7	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/64
Report Issue Date : 17/03/2020
Sample Receipt Date : 13/03/2020
Analysis Date : 13/03/2020 to 17/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/64 & 13/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-1)
Type of Sample : Air Sample
Date of Sample Collection : 10/03/2020 to 11/03/2020
Location / Source of Sample : **Deepor**
Latitude - 26.129321° Longitude - 91.620490°
Chainage - 206+800 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team A)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	78	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	49	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.8	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/65
Report Issue Date : 17/03/2020
Sample Receipt Date : 13/03/2020
Analysis Date : 13/03/2020 to 17/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/65 & 13/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-2)
Type of Sample	: Air Sample
Date of Sample Collection	: 10/03/2020 to 11/03/2020
Location / Source of Sample	: Chhayagaon, Near Chhayagaon Health Centre Latitude - 26.046380° Longitude - 91.379950° Chainage - 177+850 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	94	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	57	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	9.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	16.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/66
Report Issue Date : 17/03/2020
Sample Receipt Date : 13/03/2020
Analysis Date : 13/03/2020 to 17/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/66 & 13/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-3)
Type of Sample	: Air Sample
Date of Sample Collection	: 10/03/2020 to 11/03/2020
Location / Source of Sample	: Rangjuli Latitude - 25.967215° Longitude - 90.932838° Chainage - 128+800 Km, Distance from alignment - 100m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	82	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	48	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.8	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	15.4	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/67
Report Issue Date : 18/03/2020
Sample Receipt Date : 14/03/2020
Analysis Date : 14/03/2020 to 18/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/67 & 14/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-4)
Type of Sample	: Air Sample
Date of Sample Collection	: 11/03/2020 to 12/03/2020
Location / Source of Sample	: Dudhnoi Bypass Point Latitude - 25.988276 ° Longitude - 90.760839° Chainage - 109+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	76	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	42	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.8	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	15.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/68
Report Issue Date : 18/03/2020
Sample Receipt Date : 14/03/2020
Analysis Date : 14/03/2020 to 18/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/68 & 14/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-5)
Type of Sample : Air Sample
Date of Sample Collection : 11/03/2020 to 12/03/2020
Location / Source of Sample : **Agia**
Latitude - 26.083116° Longitude - 90.760839°
Chainage - 086+100 Km, Distance from alignment - 200m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team B)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	82	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	41	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	13.8	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/69
Report Issue Date : 18/03/2020
Sample Receipt Date : 14/03/2020
Analysis Date : 14/03/2020 to 18/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/69 & 14/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ambient Air Quality Monitoring (AAQM-6)
Type of Sample : Air Sample
Date of Sample Collection : 11/03/2020 to 12/03/2020
Location / Source of Sample : **Chirakuta (Near Mosque)**
Latitude - 26.232215° Longitude - 90.280316°
Chainage - 004+500 Km, Distance from alignment - 100m
Sample Quantity : NA
Sample Condition : OK
Sampling Method : CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer : By ITL Sampling Executive (Team C)
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	80	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	44	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	7.8	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.2	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----

I. M. Saha



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/70
Report Issue Date : 19/03/2020
Sample Receipt Date : 15/03/2020
Analysis Date : 15/03/2020 to 19/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/70 & 15/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-7)
Type of Sample	: Air Sample
Date of Sample Collection	: 12/03/2020 to 13/03/2020
Location / Source of Sample	: Tulangia Market Latitude - 26.368834° Longitude - 90.634974° Chainage - 049+100 Km, Distance from alignment - 150m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team A)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	92	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	51	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	8.9	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.1	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/AA/71
Report Issue Date : 19/03/2020
Sample Receipt Date : 15/03/2020
Analysis Date : 15/03/2020 to 19/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/71 & 15/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-8)
Type of Sample	: Air Sample
Date of Sample Collection	: 12/03/2020 to 13/03/2020
Location / Source of Sample	: Chalantapara-IV Latitude - 26.264214° Longitude - 90.584416° Chainage - 063+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team B)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	101	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	64	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	10.4	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	17.5	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	01	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/AA/72
Report Issue Date : 19/03/2020
Sample Receipt Date : 15/03/2020
Analysis Date : 15/03/2020 to 19/03/2020
Lab Sample No. & Date : ITL/PR/19-20/01/AA/72 & 15/03/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample	: Ambient Air Quality Monitoring (AAQM-9)
Type of Sample	: Air Sample
Date of Sample Collection	: 12/03/2020 to 13/03/2020
Location / Source of Sample	: Near Chapar Latitude - 26.268557° Longitude - 90.441831° Chainage - 022+000 Km, Distance from alignment - 200m
Sample Quantity	: NA
Sample Condition	: OK
Sampling Method	: CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	: By ITL Sampling Executive (Team C)
Any Other Information (if any)	: Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari

Test Results

S No.	Parameter	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM ₁₀), µg/m ³	IS 5182 Part 23:2006	105	100
2	Particulate Matter (PM _{2.5}), µg/m ³	CPCB Method Volume-1, 2011	62	60
3	Sulphur dioxide (SO ₂), µg/m ³	IS 5182 Part 2:2001	11.2	80
4	Oxide of nitrogen (NO ₂), µg/m ³	IS 5182 Part 6:2006	18.9	80
5	Carbon monoxide (CO), mg/m ³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m ³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m ³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

-----End of the report-----



Issued to:

Test Report No. : ITL/PR/19-20/01/GW/02
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/GW/02 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ground Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Chhayagaon, Near Chhayagaon High School**
Latitude - 26.054386° Longitude - 91.400932°
Chainage - 179+500 Km, Distance from alignment - 200m
Sample Quantity : 2.5 liter
Sample Condition : Sealed properly
Sampling Method : IS 3025 Part I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam.**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	Temperature, °C	IS 3025 Part 9	20.1	-	-
4	pH Value at 25°C	IS 3025 Part 11	7.41	6.5 – 8.5	No Relaxation
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	387	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	251	500 Max	2000 Max
7	Calcium (as Ca), mg/l	IS 3025 Part 40	32.4	75 Max	200 Max
8	Magnesium (as Mg), mg/l	IS 3025 Part 46	18.6	30 Max	100 Max
9	Sodium (as Na), mg/l	IS 3025 Part 45	12.5	-	-
10	Potassium (as K), mg/l	IS 3025 Part 45	7.2	-	-
11	Alkalinity (as HCO ₃), mg/L	IS 3025 Part 23	147	-	-
12	Sulphate (as SO ₄), mg/l	IS 3025 Part 24	46	200 Max	400 Max
13	Chloride (as Cl), mg/l	IS 3025 Part 32	14.2	250 Max	1000 Max
14	Nitrate (as NO ₃), mg/l	IS 3025 Part 34	2.1	45 Max	No Relaxation
15	Boron (as B), mg/L	IS 3025 Part 57	BDL	0.5 Max	1.0 Max
16	Nitrite (as NO ₂), mg/L	IS 3025 Part 34	0.04	-	-
17	Fluoride (as F), mg/L	IS 3025 Part 60	BDL	1 Max	1.5 Max
18	Dissolve Phosphate (as PO ₄), mg/L	IS 3025 Part 31	0.2	-	-
19	Total Hardness (as CaCO ₃), mg/L	IS 3025 Part 21	157.3	200 Max	600 Max
20	E. Coli, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	
21	Total Coliform, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	

I. M. M. M.



-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/GW/03
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/GW/03& 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ground Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Near Goalpara**
Latitude - 25.968344° Longitude - 91.244988°
Chainage - 159+200 Km, Distance from alignment - 150m
Sample Quantity : 2.5 liter
Sample Condition : Sealed properly
Sampling Method : IS 3025 Part I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam.**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	Temperature, °C	IS 3025 Part 9	19.5	-	-
4	pH Value at 25°C	IS 3025 Part 11	7.62	6.5 – 8.5	No Relaxation
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	438	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	285	500 Max	2000 Max
7	Calcium (as Ca), mg/l	IS 3025 Part 40	41.2	75 Max	200 Max
8	Magnesium (as Mg), mg/l	IS 3025 Part 46	20.1	30 Max	100 Max
9	Sodium (as Na), mg/l	IS 3025 Part 45	11.4	-	-
10	Potassium (as K), mg/l	IS 3025 Part 45	6.8	-	-
11	Alkalinity (as HCO ₃), mg/L	IS 3025 Part 23	156	-	-
12	Sulphate (as SO ₄), mg/l	IS 3025 Part 24	52	200 Max	400 Max
13	Chloride (as Cl), mg/l	IS 3025 Part 32	13.4	250 Max	1000 Max
14	Nitrate (as NO ₃), mg/l	IS 3025 Part 34	1.9	45 Max	No Relaxation
15	Boron (as B), mg/L	IS 3025 Part 57	BDL	0.5 Max	1.0 Max
16	Nitrite (as NO ₂), mg/L	IS 3025 Part 34	0.03	-	-
17	Fluoride (as F), mg/L	IS 3025 Part 60	BDL	1 Max	1.5 Max
18	Dissolve Phosphate (as PO ₄), mg/L	IS 3025 Part 31	0.1	-	-
19	Total Hardness (as CaCO ₃), mg/L	IS 3025 Part 21	185	200 Max	600 Max
20	E. Coli, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	
21	Total Coliform, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	

-----End of the report-----

I. M. M. M.



Issued to:

Test Report No. : ITL/PR/19-20/01/GW/04
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/GW/04 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ground Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Krishnai College**
Latitude - 26.031132° Longitude - 90.658177°
Chainage - 097+100 Km, Distance from alignment - 150m
Sample Quantity : 2.5 liter
Sample Condition : Sealed properly
Sampling Method : IS 3025 Part I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam.**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	Temperature, °C	IS 3025 Part 9	20.8	-	-
4	pH Value at 25°C	IS 3025 Part 11	7.37	6.5 – 8.5	No Relaxation
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	376	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	244	500 Max	2000 Max
7	Calcium (as Ca), mg/l	IS 3025 Part 40	34.2	75 Max	200 Max
8	Magnesium (as Mg), mg/l	IS 3025 Part 46	16.2	30 Max	100 Max
9	Sodium (as Na), mg/l	IS 3025 Part 45	11.2	-	-
10	Potassium (as K), mg/l	IS 3025 Part 45	7.4	-	-
11	Alkalinity (as HCO ₃), mg/L	IS 3025 Part 23	144	-	-
12	Sulphate (as SO ₄), mg/l	IS 3025 Part 24	46	200 Max	400 Max
13	Chloride (as Cl), mg/l	IS 3025 Part 32	12.4	250 Max	1000 Max
14	Nitrate (as NO ₃), mg/l	IS 3025 Part 34	2.1	45 Max	No Relaxation
15	Boron (as B), mg/L	IS 3025 Part 57	BDL	0.5 Max	1.0 Max
16	Nitrite (as NO ₂), mg/L	IS 3025 Part 34	0.08	-	-
17	Fluoride (as F), mg/L	IS 3025 Part 60	BDL	1 Max	1.5 Max
18	Dissolve Phosphate (as PO ₄), mg/L	IS 3025 Part 31	0.4	-	-
19	Total Hardness (as CaCO ₃), mg/L	IS 3025 Part 21	151	200 Max	600 Max
20	E. Coli, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	
21	Total Coliform, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	

-----End of the report-----

I. M. M. M.



Issued to:

Test Report No. : ITL/PR/19-20/01/GW/06
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/GW/06& 21/02/2020
Reference No. : PI/CTK118-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ground Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Near Chapar Bypass**
Latitude - 26.268666° Longitude - 90.441899°
Chainage - 022+600 Km, Distance from alignment - 150m
Sample Quantity : 2.5 liter
Sample Condition : Sealed properly
Sampling Method : IS 3025 Part I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam.**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	Temperature, °C	IS 3025 Part 9	21.1	-	-
4	pH Value at 25°C	IS 3025 Part 11	7.19	6.5 – 8.5	No Relaxation
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	405	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	263	500 Max	2000 Max
7	Calcium (as Ca),mg/l	IS 3025 Part 40	35.2	75 Max	200 Max
8	Magnesium (as Mg) , mg/l	IS 3025 Part 46	19.4	30 Max	100 Max
9	Sodium (as Na) ,mg/l	IS 3025 Part 45	12.4	-	-
10	Potassium (as K) ,mg/l	IS 3025 Part 45	5.6	-	-
11	Alkalinity (as HCO ₃), mg/L	IS 3025 Part 23	174	-	-
12	Sulphate (as SO ₄) ,mg/l	IS 3025 Part 24	36	200 Max	400 Max
13	Chloride (as Cl),mg/l	IS 3025 Part 32	13.4	250 Max	1000 Max
14	Nitrate (as NO ₃) ,mg/l	IS 3025 Part 34	2.3	45 Max	No Relaxation
15	Boron (as B), mg/L	IS 3025 Part 57	BDL	0.5 Max	1.0 Max
16	Nitrite (as NO ₂), mg/L	IS 3025 Part 34	0.05	-	-
17	Fluoride (as F), mg/L	IS 3025 Part 60	BDL	1 Max	1.5 Max
18	Dissolve Phosphate (as PO ₄), mg/L	IS 3025 Part 31	0.4	-	-
19	Total Hardness (as CaCO ₃), mg/L	IS 3025 Part 21	168	200 Max	600 Max
20	E. Coli, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	
21	Total Coliform, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	




-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/GW/07
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/GW/07 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Ground Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **(Bilasipuara)**
Latitude - 26.249090° Longitude - 90.245888°
Chainage - 000+050 Km, Distance from alignment - 150m
Sample Quantity : 2.5 liter
Sample Condition : Sealed properly
Sampling Method : IS 3025 Part I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam.**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	Temperature, °C	IS 3025 Part 9	22.2	-	-
4	pH Value at 25°C	IS 3025 Part 11	7.48	6.5 – 8.5	No Relaxation
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	426	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	277	500 Max	2000 Max
7	Calcium (as Ca), mg/l	IS 3025 Part 40	46.2	75 Max	200 Max
8	Magnesium (as Mg), mg/l	IS 3025 Part 46	14.2	30 Max	100 Max
9	Sodium (as Na), mg/l	IS 3025 Part 45	13.4	-	-
10	Potassium (as K), mg/l	IS 3025 Part 45	6.7	-	-
11	Alkalinity (as HCO ₃), mg/L	IS 3025 Part 23	168	-	-
12	Sulphate (as SO ₄), mg/l	IS 3025 Part 24	44	200 Max	400 Max
13	Chloride (as Cl), mg/l	IS 3025 Part 32	15.2	250 Max	1000 Max
14	Nitrate (as NO ₃), mg/l	IS 3025 Part 34	1.9	45 Max	No Relaxation
15	Boron (as B), mg/L	IS 3025 Part 57	BDL	0.5 Max	1.0 Max
16	Nitrite (as NO ₂), mg/L	IS 3025 Part 34	0.06	-	-
17	Fluoride (as F), mg/L	IS 3025 Part 60	BDL	1 Max	1.5 Max
18	Dissolve Phosphate (as PO ₄), mg/L	IS 3025 Part 31	0.2	-	-
19	Total Hardness (as CaCO ₃), mg/L	IS 3025 Part 21	101	200 Max	600 Max
20	E. Coli, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	
21	Total Coliform, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	

-----End of the report-----

I. M. M. M.



Issued to:

Test Report No. : ITL/PR/19-20/01/NS/01
Report Issue Date : 28/02/2020
Sample Receipt Date : NA
Analysis Date : NA
Lab Sample No. & Date : ITL/PR/19-20/01/NS/01 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Noise Level Monitoring (NM-1)
Type of Sample : Noise Level
Date of Sample Collection : Mentioned below in results table
Location / Source of Sample : **Deepor**
Latitude - 26.129321° Longitude - 91.620490° Chainage - 206+800 Km
Sample Quantity : NA
Sample Condition : NA
Sampling Method : NA
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukbari**

Test Results

Time	Results as per noise monitoring date	
	17/02/2020 to 18/02/2020	21/02/2020 to 22/02/2020
Day 6.00	40.1	42.1
7.00	42.5	41.5
8.00	41.5	42.5
9.00	48.2	46.7
10.00	46.8	47.2
11.00	51.2	51.2
12.00	53.2	50.2
13.00	51.4	53.2
14.00	54.2	51.2
15.00	53.2	52.4
16.00	54.2	51.8
17.00	51.2	52.6
18.00	46.2	48.4
19.00	44.1	46.2
20.00	41.8	43.5
21.00	43.2	42.5
Night 22.00	40.2	41.2
23.00	38.5	37.4
24.00	38.7	36.7
1.00	39.2	36.4
2.00	35.8	37.1
3.00	35.2	35.1
4.00	37.1	35.6
5.00	36.2	36.5
Maximum	52.2	53.2
Minimum	35.2	35.1
Ld	50.0	45.4
Ln	36.9	35.7
Ldn	49.2	48.5

-----End of the report-----

S. Mukherjee



Issued to:

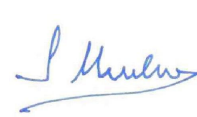
Test Report No. : ITL/PR/19-20/01/NS/02
Report Issue Date : 28/02/2020
Sample Receipt Date : NA
Analysis Date : NA
Lab Sample No. & Date : ITL/PR/19-20/01/NS/02 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Noise Level Monitoring (NM-2)
Type of Sample : Noise Level
Date of Sample Collection : Mentioned below in results table
Location / Source of Sample : **Chhayagaon, Near Chhayagaon Health Centre**
Latitude - 26.046380° Longitude - 91.379950° Chainage - 177+850 Km
Sample Quantity : NA
Sample Condition : NA
Sampling Method : NA
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

Time	Results as per noise monitoring date	
	17/02/2020 to 18/02/2020	21/02/2020 to 22/02/2020
Day 6.00	41.7	40.8
7.00	42.8	41.2
8.00	43.5	42.4
9.00	44.8	43.8
10.00	49.2	46.5
11.00	52.4	51.2
12.00	57.5	56.2
13.00	58.6	54.6
14.00	61.2	58.4
15.00	62.4	61.2
16.00	61.2	58.4
17.00	63.4	60.2
18.00	58.4	54.2
19.00	49.2	48.2
20.00	48.5	46.2
21.00	46.2	45.6
Night 22.00	44.1	44.6
23.00	43.2	42.8
24.00	40.2	41.2
1.00	38.4	37.2
2.00	39.2	36.2
3.00	37.5	35.2
4.00	36.4	36.7
5.00	37.7	36.1
Maximum	63.4	61.2
Minimum	36.4	35.2
Ld	57.5	55.0
Ln	38.9	38.3
Ldn	56.1	53.7

-----End of the report-----




Issued to:

Test Report No. : ITL/PR/19-20/01/NS/03
Report Issue Date : 28/02/2020
Sample Receipt Date : NA
Analysis Date : NA
Lab Sample No. & Date : ITL/PR/19-20/01/NS/03 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Noise Level Monitoring (NM-3)
Type of Sample : Noise Level
Date of Sample Collection : Mentioned below in results table
Location / Source of Sample : **Rangjuli**
Latitude - 25.967215° Longitude - 90.932838° Chainage - 128+800 Km
Sample Quantity : NA
Sample Condition : NA
Sampling Method : NA
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

Time	Results as per noise monitoring date	
	17/02/2020 to 18/02/2020	21/02/2020 to 22/02/2020
Day 6.00	41.1	40.5
7.00	42.2	41.2
8.00	43.5	41.6
9.00	44.2	42.5
10.00	48.2	46.2
11.00	51.2	48.2
12.00	52.4	51.2
13.00	53.4	51.8
14.00	52.4	53.4
15.00	56.2	55.2
16.00	57.4	55.6
17.00	56.2	55.4
18.00	55.2	48.2
19.00	49.2	46.2
20.00	44.2	42.1
21.00	41.5	41.2
Night 22.00	42.3	41.8
23.00	38.9	37.5
24.00	36.4	36.2
1.00	35.8	35.2
2.00	36.4	34.9
3.00	35.1	35.1
4.00	35.4	35.4
5.00	36.4	35.8
Maximum	57.4	55.6
Minimum	35.1	34.9
Ld	52.2	50.6
Ln	35.9	35.2
Ldn	51.0	49.4

-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/NS/04
Report Issue Date : 28/02/2020
Sample Receipt Date : NA
Analysis Date : NA
Lab Sample No. & Date : ITL/PR/19-20/01/NS/04 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Noise Level Monitoring (NM-4)
Type of Sample : Noise Level
Date of Sample Collection : Mentioned below in results table
Location / Source of Sample : **Dudhnoi Bypass Point**
Latitude - 25.988276 ° Longitude - 90.760839° Chainage - 109+100 Km
Sample Quantity : NA
Sample Condition : NA
Sampling Method : NA
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

Time	Results as per noise monitoring date	
	18/02/2020 to 19/02/2020	22/02/2020 to 23/02/2020
Day 6.00	38.7	38.4
7.00	40.5	41.2
8.00	41.6	40.8
9.00	48.5	46.8
10.00	51.2	49.2
11.00	50.2	50.2
12.00	52.4	51.2
13.00	51.6	50.4
14.00	54.2	52.4
15.00	53.4	52.6
16.00	52.4	51.2
17.00	53.4	53.2
18.00	50.2	54.2
19.00	46.8	52.4
20.00	43.2	44.2
21.00	44.1	42.1
Night 22.00	39.4	38.6
23.00	38.4	36.7
24.00	36.7	35.4
1.00	36.9	35.6
2.00	36.5	37.5
3.00	36.7	36.4
4.00	36.5	36.1
5.00	36.2	36.2
Maximum	54.2	54.2
Minimum	36.2	35.4
Ld	50.3	50.2
Ln	36.3	35.7
Ldn	49.4	49.2

-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/NS/05
Report Issue Date : 28/02/2020
Sample Receipt Date : NA
Analysis Date : NA
Lab Sample No. & Date : ITL/PR/19-20/01/NS/05 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Noise Level Monitoring (NM-5)
Type of Sample : Noise Level
Date of Sample Collection : Mentioned below in results table
Location / Source of Sample : **Agia**
 Latitude - 26.083116° Longitude - 90.760839° Chainage - 086+100 Km
Sample Quantity : NA
Sample Condition : NA
Sampling Method : NA
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

Time	Results as per noise monitoring date	
	18/02/2020 to 19/02/2020	22/02/2020 to 23/02/2020
Day 6.00	37.8	38.2
7.00	38.4	37.8
8.00	42.5	41.2
9.00	44.2	43.2
10.00	50.2	49.2
11.00	51.2	48.2
12.00	53.2	51.2
13.00	52.8	51.4
14.00	51.4	50.6
15.00	53.8	53.1
16.00	56.4	54.2
17.00	52.4	51.4
18.00	51.2	52.4
19.00	48.2	46.2
20.00	44.7	44.2
21.00	45.6	43.2
Night 22.00	43.2	41.2
23.00	41.2	40.2
24.00	38.5	39.5
1.00	36.4	38.5
2.00	36.8	38.4
3.00	36.9	34.5
4.00	35.2	37.2
5.00	36.5	36.7
Maximum	56.4	54.2
Minimum	35.2	34.5
Ld	50.8	49.6
Ln	37.2	37.6
Ldn	49.9	49.0

-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/NS/06
Report Issue Date : 28/02/2020
Sample Receipt Date : NA
Analysis Date : NA
Lab Sample No. & Date : ITL/PR/19-20/01/NS/06 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Noise Level Monitoring (NM-6)
Type of Sample : Noise Level
Date of Sample Collection : Mentioned below in results table
Location / Source of Sample : **Chirakuta (Near Mosque)**
 Latitude - 26.232215° Longitude - 90.280316° Chainage - 004+500 Km
Sample Quantity : NA
Sample Condition : NA
Sampling Method : NA
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

Time	Results as per noise monitoring date	
	18/02/2020 to 19/02/2020	22/02/2020 to 23/02/2020
Day 6.00	40.2	39.8
7.00	41.3	40.5
8.00	44.5	43.5
9.00	48.2	47.6
10.00	51.2	52.4
11.00	54.2	53.4
12.00	52.6	51.2
13.00	53.4	53.6
14.00	60.2	52.4
15.00	58.4	54.5
16.00	53.2	50.2
17.00	52.4	46.4
18.00	51.2	45.2
19.00	46.5	42.3
20.00	44.5	41.2
21.00	43.2	42.2
Night 22.00	41.2	40.2
23.00	38.9	37.5
24.00	37.8	37.4
1.00	38.2	36.4
2.00	36.4	36.4
3.00	36.7	35.2
4.00	36.5	36.6
5.00	37.2	36.8
Maximum	60.2	54.5
Minimum	36.4	35.4
Ld	53.1	49.8
Ln	36.9	36.1
Ldn	51.8	48.9

-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/NS/07
Report Issue Date : 28/02/2020
Sample Receipt Date : NA
Analysis Date : NA
Lab Sample No. & Date : ITL/PR/19-20/01/NS/07 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Noise Level Monitoring (NM-7)
Type of Sample : Noise Level
Date of Sample Collection : Mentioned below in results table
Location / Source of Sample : **Tulangia Market**
Latitude - 26.368834° Longitude - 90.634974° Chainage - 049+100 Km
Sample Quantity : NA
Sample Condition : NA
Sampling Method : NA
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

Time	Results as per noise monitoring date	
	19/02/2020 to 20/02/2020	23/02/2020 to 24/02/2020
Day 6.00	42.1	42.5
7.00	43.5	44.2
8.00	48.5	49.2
9.00	51.2	52.1
10.00	56.2	57.4
11.00	54.2	52.1
12.00	64.2	67.2
13.00	56.2	62.4
14.00	54.2	58.5
15.00	62.4	56.2
16.00	61.2	62.4
17.00	52.8	60.2
18.00	50.2	52.1
19.00	48.5	50.2
20.00	47.2	51.2
21.00	44.2	48.2
Night 22.00	43.2	44.2
23.00	41.2	43.2
24.00	40.1	42.5
1.00	40.2	41.2
2.00	40.2	40.2
3.00	38.4	40.2
4.00	39.2	38.4
5.00	37.5	38.1
Maximum	62.4	67.2
Minimum	37.5	38.1
Ld	56.8	58.9
Ln	39.1	40.3
Ldn	55.1	57.4

-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/NS/08
Report Issue Date : 28/02/2020
Sample Receipt Date : NA
Analysis Date : NA
Lab Sample No. & Date : ITL/PR/19-20/01/NS/08 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Noise Level Monitoring (NM-8)
Type of Sample : Noise Level
Date of Sample Collection : Mentioned below in results table
Location / Source of Sample : **Chalantapara-IV**
Latitude - 26.264214° Longitude - 90.584416° Chainage - 063+000 Km
Sample Quantity : NA
Sample Condition : NA
Sampling Method : NA
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

Time	Results as per noise monitoring date	
	19/02/2020 to 20/02/2020	23/02/2020 to 24/02/2020
Day 6.00	43.2	42.5
7.00	45.2	43.5
8.00	51.2	54.6
9.00	54.2	53.2
10.00	60.2	61.2
11.00	62.5	60.2
12.00	66.5	63.4
13.00	64.5	64.2
14.00	63.5	62.5
15.00	66.8	64.2
16.00	67.5	66.2
17.00	65.2	62.4
18.00	58.4	61.2
19.00	54.6	60.1
20.00	55.2	56.8
21.00	51.2	52.1
Night 22.00	45.2	42.2
23.00	44.2	41.2
24.00	41.2	43.2
1.00	43.2	41.2
2.00	41.2	42.1
3.00	42.1	40.2
4.00	41.2	41.5
5.00	40.2	42.5
Maximum	67.5	66.2
Minimum	40.2	40.2
Ld	62.4	61.2
Ln	41.5	41.2
Ldn	60.8	59.6

-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/NS/09
Report Issue Date : 28/02/2020
Sample Receipt Date : NA
Analysis Date : NA
Lab Sample No. & Date : ITL/PR/19-20/01/NS/09 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Noise Level Monitoring (NM-9)
Type of Sample : Noise Level
Date of Sample Collection : Mentioned below in results table
Location / Source of Sample : **Near Chapar**
Latitude - 26.268557° Longitude - 90.441831° Chainage - 022+000 Km
Sample Quantity : NA
Sample Condition : NA
Sampling Method : NA
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

Time	Results as per noise monitoring date	
	19/02/2020 to 20/02/2020	23/02/2020 to 24/02/2020
Day 6.00	41.5	42.3
7.00	42.1	43.5
8.00	48.2	46.2
9.00	51.2	50.2
10.00	60.2	59.8
11.00	62.4	63.2
12.00	63.4	64.2
13.00	62.4	61.2
14.00	62.4	60.8
15.00	61.4	60.3
16.00	62.5	64.2
17.00	60.2	61.2
18.00	58.4	59.6
19.00	56.4	58.2
20.00	54.2	54.2
21.00	51.4	52.1
Night 22.00	41.8	45.2
23.00	41.6	41.2
24.00	42.7	40.2
1.00	41.3	40.6
2.00	40.2	40.5
3.00	40.3	40.1
4.00	39.3	41.8
5.00	41.2	41.6
Maximum	63.4	64.2
Minimum	39.3	40.1
Ld	59.5	59.8
Ln	40.5	40.3
Ldn	58.0	58.3

-----End of the report-----

J. Mulya



Issued to:

Test Report No. : ITL/PR/19-20/01/NS/10
Report Issue Date : 28/02/2020
Sample Receipt Date : NA
Analysis Date : NA
Lab Sample No. & Date : ITL/PR/19-20/01/NS/10 & 25/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Noise Level Monitoring (NM-10)
Type of Sample : Noise Level
Date of Sample Collection : Mentioned below in results table
Location / Source of Sample : **Sreegram PT**
Latitude - 26.238497° Longitude - 90.375284° Chainage - 014+800 Km
Sample Quantity : NA
Sample Condition : NA
Sampling Method : NA
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharat Mala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

Time	Results as per noise monitoring date	
	19/02/2020 to 20/02/2020	23/02/2020 to 24/02/2020
Day 6.00	40.2	39.8
7.00	44.2	43.2
8.00	45.2	46.2
9.00	48.2	49.2
10.00	51.2	52.1
11.00	56.4	55.2
12.00	52.3	54.2
13.00	56.4	57.2
14.00	60.2	60.2
15.00	54.2	61.2
16.00	57.4	60.2
17.00	52.4	51.2
18.00	54.2	48.2
19.00	48.2	44.6
20.00	46.2	43.2
21.00	43.2	42.1
Night 22.00	42.5	41.2
23.00	41.2	39.2
24.00	40.5	39.5
1.00	43.2	38.5
2.00	40.2	38.4
3.00	39.2	38.4
4.00	40.1	39.2
5.00	42.1	39.5
Maximum	60.2	61.2
Minimum	39.2	38.4
Ld	53.7	55.0
Ln	40.5	38.4
Ldn	52.9	53.7

-----End of the report-----

S. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/SS/01
Report Issue Date : 27/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 27/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SS/01 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Soil Sample
Type of Sample : Soil Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Mirza From Agriculture filed, 15cm depth**
Latitude - 26.086720° Longitude - 91.581157°
Chainage - 199+150 Km, Distance from alignment - 150m
Sample Quantity : 5 kg
Sample Condition : Sealed, Ok
Sampling Method : ITL/SOP/Soil/01
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Road Project at Assam.**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Sandy Loam
2	Soil Colour	ITL/SOP/ENV/Soil/08		Yellowish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	7.49
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	1041
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	13.4
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.41
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.18
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	24.1
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	3.46
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	58.4
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	38
12	Nitrate as NO ₃	ITL/SOP/ENV/Soil/12	mg/Kg	67
13	Sulphate as SO ₄	ITL/SOP/ENV/Soil/14	mg/Kg	14.2
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	3.1
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	3.1
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	3.6
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	10.5
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	50.1
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	27.8
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	22.1

-----End of the report-----

J. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/SS/02
Report Issue Date : 27/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 27/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SS/02& 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Soil Sample
Type of Sample : Soil Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Bhatipara From Agriculture filed, 15cm depth**
Latitude - 26.063406° Longitude - 91.415962°
Chainage - 179+500 Km, Distance from alignment - 200m
Sample Quantity : 5 kg
Sample Condition : Sealed, Ok
Sampling Method : ITL/SOP/Soil/01
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Road Project at Assam.**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Sandy Loam
2	Soil Colour	ITL/SOP/ENV/Soil/08		Yellowish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	7.66
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	984
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	13.2
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.38
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.20
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	22.1
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	3.18
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	64.9
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	48
12	Nitrate as NO3	ITL/SOP/ENV/Soil/12	mg/Kg	88
13	Sulphate as SO4	ITL/SOP/ENV/Soil/14	mg/Kg	11.2
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	2.8
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	3.1
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	4.1
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	12.4
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	49.6
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	24.6
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	25.8

-----End of the report-----

I. M. M. M.



Issued to:

Test Report No. : ITL/PR/19-20/01/SS/04
Report Issue Date : 27/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 27/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SS/04 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Soil Sample
Type of Sample : Soil Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Krishnai Bypass From Agriculture filed, 15cm depth**
Latitude - 26.043699° Longitude - 90.650013°
Chainage - 096+100 Km, Distance from alignment - 150m
Sample Quantity : 5 kg
Sample Condition : Sealed, Ok
Sampling Method : ITL/SOP/Soil/01
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Road Project at Assam.**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Loamy
2	Soil Colour	ITL/SOP/ENV/Soil/08		Yellowish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	7.84
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	932
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	13.2
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.21
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.28
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	21.4
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	3.88
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	60.5
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	43
12	Nitrate as NO ₃	ITL/SOP/ENV/Soil/12	mg/Kg	78
13	Sulphate as SO ₄	ITL/SOP/ENV/Soil/14	mg/Kg	13.1
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	3.4
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	3.8
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	4.6
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	14.1
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	40.2
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	25.2
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	34.6

-----End of the report-----

J. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/SS/05
Report Issue Date : 27/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 27/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SS/05 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Soil Sample
Type of Sample : Soil Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Uttar Salmara From Agriculture filed, 15cm depth**
Latitude - 26.372177° Longitude - 90.622593°
Chainage - 047+800 Km, Distance from alignment - 100m
Sample Quantity : 5 kg
Sample Condition : Sealed, Ok
Sampling Method : ITL/SOP/Soil/01
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Road Project at Assam.**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Sandy Loam
2	Soil Colour	ITL/SOP/ENV/Soil/08		Yellowish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	7.94
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	888
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	11.4
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.43
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.19
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	26.2
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	3.8
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	58.4
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	51
12	Nitrate as NO3	ITL/SOP/ENV/Soil/12	mg/Kg	81
13	Sulphate as SO4	ITL/SOP/ENV/Soil/14	mg/Kg	10.8
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	2.8
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	3.4
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	4.1
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	11.8
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	50.6
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	28.1
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	21.3

-----End of the report-----

S. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/SS/06
Report Issue Date : 27/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 27/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SS/06 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Soil Sample
Type of Sample : Soil Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Chalantapara Bypass From Agriculture filed, 15cm depth**
Latitude - 26.270406° Longitude - 90.594141°
Chainage - 063+100 Km, Distance from alignment - 100m
Sample Quantity : 5 kg
Sample Condition : Sealed, Ok
Sampling Method : ITL/SOP/Soil/01
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Road Project at Assam.**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Loamy
2	Soil Colour	ITL/SOP/ENV/Soil/08		Yellowish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	7.77
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	808
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	13.4
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.37
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.22
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	21.2
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	3.17
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	62.4
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	44
12	Nitrate as NO3	ITL/SOP/ENV/Soil/12	mg/Kg	86
13	Sulphate as SO4	ITL/SOP/ENV/Soil/14	mg/Kg	12.4
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	2.9
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	3.9
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	4.8
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	14.2
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	44.7
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	23.7
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	31.7

-----End of the report-----

S. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/SS/07
Report Issue Date : 27/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 27/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SS/07 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Soil Sample
Type of Sample : Soil Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Near Chapar Bypass From Agriculture filed, 15cm depth**
Latitude - 26.275727° Longitude - 90.453577°
Chainage - 022+500 Km, Distance from alignment - 150m
Sample Quantity : 5 kg
Sample Condition : Sealed, Ok
Sampling Method : ITL/SOP/Soil/01
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Road Project at Assam.**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Loamy
2	Soil Colour	ITL/SOP/ENV/Soil/08		Yellowish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	7.39
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	912
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	13.8
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.35
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.27
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	19.2
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	4.12
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	58.6
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	51
12	Nitrate as NO3	ITL/SOP/ENV/Soil/12	mg/Kg	89
13	Sulphate as SO4	ITL/SOP/ENV/Soil/14	mg/Kg	12.2
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	3.2
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	4.1
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	4.6
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	13.2
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	42.0
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	21.1
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	36.9

-----End of the report-----

S. Murali



Issued to:

Test Report No. : ITL/PR/19-20/01/SS/08
Report Issue Date : 27/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 27/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SS/08 & 21/02/2020
Reference No. : PI/CTKI18-10/WO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Soil Sample
Type of Sample : Soil Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Bilasipura From Agriculture filed, 15cm depth**
Latitude - 26.251818° Longitude - 90.257814°
Chainage - 001+200 Km, Distance from alignment - 150m
Sample Quantity : 5 kg
Sample Condition : Sealed, Ok
Sampling Method : ITL/SOP/Soil/01
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Road Project at Assam.**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Sandy Loam
2	Soil Colour	ITL/SOP/ENV/Soil/08		Yellowish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	7.85
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	934
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	11.8
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.41
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.18
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	24.2
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	4.12
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	61.5
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	49
12	Nitrate as NO ₃	ITL/SOP/ENV/Soil/12	mg/Kg	82
13	Sulphate as SO ₄	ITL/SOP/ENV/Soil/14	mg/Kg	12.1
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	3.1
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	4.2
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	4.7
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	13.0
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	45.1
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	28.8
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	26.1

-----End of the report-----

S. Mukherjee



Issued to:

Test Report No. : ITL/PR/19-20/01/SW/01
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SW/01& 21/02/2020
Reference No. : PI/CTKI18-10/VO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Surface Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Deepor (from Pond)**
Latitude - 26.134822° Longitude - 91.626261°
Chainage - 207+800 Km, Distance from alignment - 100m
Sample Quantity : 2.5 Liter
Sample Condition : OK
Sampling Method : IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	7.54	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	18.4	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	756	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	20	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	512	-	-
8	Total Solids, mg/l	IS 3025 Part 15	94.2	-	-
9	Calcium (as Ca),mg/l	IS 3025 Part 40	25.3	75 Max	200 Max
10	Magnesium (as Mg) , mg/l	IS 3025 Part 46	14.2	30 Max	100 Max
11	Sodium (as Na) ,mg/l	IS 3025 Part 45	6.6	-	-
12	Potassium (as K) ,mg/l	IS 3025 Part 45	94.2	-	-
13	Total Alkalinity (as CaCO ₃) ,mg/l	IS 3025 Part 23	274	200 Max	600 Max
14	Sulphate (as SO ₄) ,mg/l	IS 3025 Part 24	104	200 Max	400 Max
15	Chloride (as Cl),mg/l	IS 3025 Part 32	16.2	250 Max	1000 Max
16	Nitrate (as NO ₃) ,mg/l	IS 3025 Part 34	2.4	45 Max	No Relaxation
17	Ammonia (as NH ₃),mg/l	IS 3025 Part 34	0.21	0.5 Max	No Relaxation
18	Iron (as Fe),mg/l	IS 3025 Part 53	0.12	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO ₄) ,mg/l	IS 3025 Part 31	1.2	-	-
20	Total Hardness (as CaCO ₃) ,mg/l	IS 3025 Part 21	512	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	8	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	18	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	6.4	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.1	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

-----End of the report-----

I. M. M. M.


Issued to:

Test Report No. : ITL/PR/19-20/01/SW/02
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SW/02 & 21/02/2020
Reference No. : PI/CTKI18-10/VO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Surface Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Kukurmara (from River)**
Latitude - 26.072944° Longitude - 91.430346°
Chainage - 182+400 Km, Distance from alignment - 200m
Sample Quantity : 2.5 Liter
Sample Condition : OK
Sampling Method : IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	7.14	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	19.4	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	362	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	235	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	11	-	-
8	Total Solids, mg/l	IS 3025 Part 15	246	-	-
9	Calcium (as Ca),mg/l	IS 3025 Part 40	35.2	75 Max	200 Max
10	Magnesium (as Mg) , mg/l	IS 3025 Part 46	13.6	30 Max	100 Max
11	Sodium (as Na) ,mg/l	IS 3025 Part 45	11.2	-	-
12	Potassium (as K) ,mg/l	IS 3025 Part 45	6.7	-	-
13	Total Alkalinity (as CaCO ₃) ,mg/l	IS 3025 Part 23	154	200 Max	600 Max
14	Sulphate (as SO ₄) ,mg/l	IS 3025 Part 24	34	200 Max	400 Max
15	Chloride (as Cl),mg/l	IS 3025 Part 32	11.8	250 Max	1000 Max
16	Nitrate (as NO ₃) ,mg/l	IS 3025 Part 34	1.2	45 Max	No Relaxation
17	Ammonia (as NH ₃),mg/l	IS 3025 Part 34	0.18	0.5 Max	No Relaxation
18	Iron (as Fe),mg/l	IS 3025 Part 53	BDL	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO ₄) ,mg/l	IS 3025 Part 31	0.4	-	-
20	Total Hardness (as CaCO ₃) ,mg/l	IS 3025 Part 21	144	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	2.4	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	11	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	7.1	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.2	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

-----End of the report-----

I. M. M. M.



Issued to:

Test Report No. : ITL/PR/19-20/01/SW/03
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SW/03& 21/02/2020
Reference No. : PI/CTKI18-10/VO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Surface Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Chhayagaon (River)**
Latitude - 26.002703° Longitude - 91.280595°
Chainage - 178+200 Km, Distance from alignment - 150m
Sample Quantity : 2.5 Liter
Sample Condition : OK
Sampling Method : IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	7.44	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	20.1	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	422	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	274	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	10	-	-
8	Total Solids, mg/l	IS 3025 Part 15	284	-	-
9	Calcium (as Ca),mg/l	IS 3025 Part 40	48.2	75 Max	200 Max
10	Magnesium (as Mg) , mg/l	IS 3025 Part 46	14.6	30 Max	100 Max
11	Sodium (as Na) ,mg/l	IS 3025 Part 45	10.2	-	-
12	Potassium (as K) ,mg/l	IS 3025 Part 45	6.4	-	-
13	Total Alkalinity (as CaCO ₃) ,mg/l	IS 3025 Part 23	164	200 Max	600 Max
14	Sulphate (as SO ₄) ,mg/l	IS 3025 Part 24	51	200 Max	400 Max
15	Chloride (as Cl),mg/l	IS 3025 Part 32	12.4	250 Max	1000 Max
16	Nitrate (as NO ₃) ,mg/l	IS 3025 Part 34	1.8	45 Max	No Relaxation
17	Ammonia (as NH ₃),mg/l	IS 3025 Part 34	0.12	0.5 Max	No Relaxation
18	Iron (as Fe),mg/l	IS 3025 Part 53	0.06	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO ₄) ,mg/l	IS 3025 Part 31	0.3	-	-
20	Total Hardness (as CaCO ₃) ,mg/l	IS 3025 Part 21	180	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	2.1	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	10	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	7.2	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.1	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

-----End of the report-----

J. M. M. M.



Issued to:

Test Report No. : ITL/PR/19-20/01/SW/04
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SW/04 & 21/02/2020
Reference No. : PI/CTKI18-10/VO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Surface Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Birpara (Pond)**
 Latitude - 26.002703° Longitude - 91.280595°
 Chainage - 166+100 Km, Distance from alignment - 050m
Sample Quantity : 2.5 Liter
Sample Condition : OK
Sampling Method : IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	7.14	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	19.6	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	512	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	333	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	12	-	-
8	Total Solids, mg/l	IS 3025 Part 15	345	-	-
9	Calcium (as Ca),mg/l	IS 3025 Part 40	52.4	75 Max	200 Max
10	Magnesium (as Mg) , mg/l	IS 3025 Part 46	21.1	30 Max	100 Max
11	Sodium (as Na) ,mg/l	IS 3025 Part 45	12.4	-	-
12	Potassium (as K) ,mg/l	IS 3025 Part 45	8.4	-	-
13	Total Alkalinity (as CaCO ₃) ,mg/l	IS 3025 Part 23	208	200 Max	600 Max
14	Sulphate (as SO ₄) ,mg/l	IS 3025 Part 24	58	200 Max	400 Max
15	Chloride (as Cl),mg/l	IS 3025 Part 32	12.8	250 Max	1000 Max
16	Nitrate (as NO ₃) ,mg/l	IS 3025 Part 34	1.6	45 Max	No Relaxation
17	Ammonia (as NH ₃),mg/l	IS 3025 Part 34	0.17	0.5 Max	No Relaxation
18	Iron (as Fe),mg/l	IS 3025 Part 53	0.05	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO ₄) ,mg/l	IS 3025 Part 31	0.1	-	-
20	Total Hardness (as CaCO ₃) ,mg/l	IS 3025 Part 21	218	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	05	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	17	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	6.3	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.1	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

-----End of the report-----

J. M. M. M.


Issued to:

Test Report No. : ITL/PR/19-20/01/SW/05
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SW/05 & 21/02/2020
Reference No. : PI/CTKI18-10/VO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Surface Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Dudhnoi (River)**
 Latitude - 25.972523° Longitude - 90.797844°
 Chainage - 115+100 Km, Distance from alignment - 150m
Sample Quantity : 2.5 Liter
Sample Condition : OK
Sampling Method : IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	7.08	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	20.1	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	441	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	287	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	10	-	-
8	Total Solids, mg/l	IS 3025 Part 15	297	-	-
9	Calcium (as Ca),mg/l	IS 3025 Part 40	45.2	75 Max	200 Max
10	Magnesium (as Mg) , mg/l	IS 3025 Part 46	16.2	30 Max	100 Max
11	Sodium (as Na) ,mg/l	IS 3025 Part 45	13.2	-	-
12	Potassium (as K) ,mg/l	IS 3025 Part 45	5.8	-	-
13	Total Alkalinity (as CaCO ₃) ,mg/l	IS 3025 Part 23	176	200 Max	600 Max
14	Sulphate (as SO ₄) ,mg/l	IS 3025 Part 24	42	200 Max	400 Max
15	Chloride (as Cl),mg/l	IS 3025 Part 32	13.4	250 Max	1000 Max
16	Nitrate (as NO ₃) ,mg/l	IS 3025 Part 34	1.8	45 Max	No Relaxation
17	Ammonia (as NH ₃),mg/l	IS 3025 Part 34	0.11	0.5 Max	No Relaxation
18	Iron (as Fe),mg/l	IS 3025 Part 53	0.08	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO ₄) ,mg/l	IS 3025 Part 31	0.2	-	-
20	Total Hardness (as CaCO ₃) ,mg/l	IS 3025 Part 21	180	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	2.8	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	12	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	7.5	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.1	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

-----End of the report-----

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Issued to:

Test Report No. : ITL/PR/19-20/01/SW/06
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SW/06 & 21/02/2020
Reference No. : PI/CTKI18-10/VO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Surface Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Chalantapara IV(River)**
Latitude - 26.239294° Longitude – 90.269932°
Chainage - 068+800 Km, Distance from alignment - 150m
Sample Quantity : 2.5 Liter
Sample Condition : OK
Sampling Method : IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	7.27	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	19.6	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	371	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	241	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	09	-	-
8	Total Solids, mg/l	IS 3025 Part 15	250	-	-
9	Calcium (as Ca),mg/l	IS 3025 Part 40	34.6	75 Max	200 Max
10	Magnesium (as Mg) , mg/l	IS 3025 Part 46	15.2	30 Max	100 Max
11	Sodium (as Na) ,mg/l	IS 3025 Part 45	12.4	-	-
12	Potassium (as K) ,mg/l	IS 3025 Part 45	5.8	-	-
13	Total Alkalinity (as CaCO3) ,mg/l	IS 3025 Part 23	151	200 Max	600 Max
14	Sulphate (as SO4) ,mg/l	IS 3025 Part 24	31	200 Max	400 Max
15	Chloride (as Cl),mg/l	IS 3025 Part 32	12.8	250 Max	1000 Max
16	Nitrate (as NO3) ,mg/l	IS 3025 Part 34	1.4	45 Max	No Relaxation
17	Ammonia (as NH3),mg/l	IS 3025 Part 34	0.15	0.5 Max	No Relaxation
18	Iron (as Fe),mg/l	IS 3025 Part 53	0.06	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO4) ,mg/l	IS 3025 Part 31	0.3	-	-
20	Total Hardness (as CaCO3) ,mg/l	IS 3025 Part 21	149	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	2.4	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	10	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	7.2	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.2	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

-----End of the report-----

J. M. M. M.



Issued to:

Test Report No. : ITL/PR/19-20/01/SW/07
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SW/07 & 21/02/2020
Reference No. : PI/CTKI18-10/VO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Surface Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Tulangia Bazar (River)**
Latitude - 26.367993° Longitude - 90.634457°
Chainage - 048+800 Km, Distance from alignment - 100m
Sample Quantity : 2.5 Liter
Sample Condition : OK
Sampling Method : IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	7.51	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	19.3	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	294	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	191	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	10	-	-
8	Total Solids, mg/l	IS 3025 Part 15	201	-	-
9	Calcium (as Ca),mg/l	IS 3025 Part 40	27.4	75 Max	200 Max
10	Magnesium (as Mg) , mg/l	IS 3025 Part 46	12.4	30 Max	100 Max
11	Sodium (as Na) ,mg/l	IS 3025 Part 45	10.2	-	-
12	Potassium (as K) ,mg/l	IS 3025 Part 45	4.5	-	-
13	Total Alkalinity (as CaCO ₃) ,mg/l	IS 3025 Part 23	106	200 Max	600 Max
14	Sulphate (as SO ₄) ,mg/l	IS 3025 Part 24	34	200 Max	400 Max
15	Chloride (as Cl),mg/l	IS 3025 Part 32	11.2	250 Max	1000 Max
16	Nitrate (as NO ₃) ,mg/l	IS 3025 Part 34	1.2	45 Max	No Relaxation
17	Ammonia (as NH ₃),mg/l	IS 3025 Part 34	0.16	0.5 Max	No Relaxation
18	Iron (as Fe),mg/l	IS 3025 Part 53	0.04	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO ₄) ,mg/l	IS 3025 Part 31	0.4	-	-
20	Total Hardness (as CaCO ₃) ,mg/l	IS 3025 Part 21	119	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	2.5	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	11	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	6.9	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.1	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

-----End of the report-----

I. M. M. M.



Issued to:

Test Report No. : ITL/PR/19-20/01/SW/07
Report Issue Date : 26/02/2020
Sample Receipt Date : 21/02/2020
Analysis Date : 21/02/2020 to 26/02/2020
Lab Sample No. & Date : ITL/PR/19-20/01/SW/07 & 21/02/2020
Reference No. : PI/CTKI18-10/VO/GEMPL/1/R1
Date : 10/02/2020

Nature and Description of Sample : Surface Water
Type of Sample : Water Sample
Date of Sample Collection : 18/02/2020
Location / Source of Sample : **Near Bamunpara Pt IV (River)**
Latitude - 26.239294° Longitude - 90.269932°
Chainage - 004+600 Km, Distance from alignment - 150m
Sample Quantity : 2.5 Liter
Sample Condition : OK
Sampling Method : IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer : By ITL Sampling Executive
Any Other Information (if any) : **Environmental Baseline Monitoring for Bharatmala Road Project at Assam. Bilasipara to Jalukabari**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	7.32	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	19.8	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	288	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	187	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	12	-	-
8	Total Solids, mg/l	IS 3025 Part 15	199	-	-
9	Calcium (as Ca),mg/l	IS 3025 Part 40	23.4	75 Max	200 Max
10	Magnesium (as Mg) , mg/l	IS 3025 Part 46	12.5	30 Max	100 Max
11	Sodium (as Na) ,mg/l	IS 3025 Part 45	11.2	-	-
12	Potassium (as K) ,mg/l	IS 3025 Part 45	5.1	-	-
13	Total Alkalinity (as CaCO ₃) ,mg/l	IS 3025 Part 23	101	200 Max	600 Max
14	Sulphate (as SO ₄) ,mg/l	IS 3025 Part 24	29	200 Max	400 Max
15	Chloride (as Cl),mg/l	IS 3025 Part 32	11.8	250 Max	1000 Max
16	Nitrate (as NO ₃) ,mg/l	IS 3025 Part 34	1.1	45 Max	No Relaxation
17	Ammonia (as NH ₃),mg/l	IS 3025 Part 34	0.16	0.5 Max	No Relaxation
18	Iron (as Fe),mg/l	IS 3025 Part 53	0.05	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO ₄) ,mg/l	IS 3025 Part 31	0.2	-	-
20	Total Hardness (as CaCO ₃) ,mg/l	IS 3025 Part 21	110	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	2.1	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	10	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	7.2	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.2	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

-----End of the report-----

I. M. M. M.


PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

CHAPTER – 11 ECONOMIC ANALYSIS

11.0 ECONOMIC ANALYSIS

11.0.1 INTRODUCTION

The economic evaluation is being carried out within the framework of social cost benefit analysis. The essential objective of public expenditure is to maximize the returns on investment in economic terms. This objective is accomplished by determining the appropriate improvement proposal that leads to the minimum total transport costs in the case of road up-gradation projects.

The economic analysis is based on incremental costs and incremental benefits, i.e. comparing the total transport cost "with the project" and "without the project" which is the base case or the do minimum case. All costs and benefits considered in the study is valued in monetary terms and expressed in economic prices for avoiding distortion in the input prices of labour, materials and equipment due to market imperfection.

The concept behind the approach is that if the project is implemented, the benefits will be the decreased transport (VOC & time cost) cost when compared to the costs of the alternative forgone, i.e. the base case or without project situation. The results would be expressed in terms of Economic Internal Rate of Return (EIRR) and Net Present Value (NPV). The Economic Analysis is being carried out using HDM IV. The project is divided into homogeneous traffic sections for modelling of the economic analysis.

HDM Model Input Data

The following values are considered as input data for the HDM Model.

Analysis period: The analysis period starts from 2023. Analysis period for EIRR estimation is considered as 23. Analysis period is inclusive of construction period as well as benefit period. A discount rate of 12% is considered.

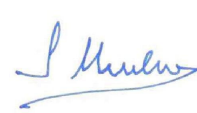
Project Costs

The project costs include costs of road works and bridges/structures, land acquisition and environment costs and costs towards utility shifting etc.

Conversion Factor: Conversion factor has not been considered to take care of contingencies and other risk factors.

Road and Pavement Characteristics: Road and pavement characteristics that are used as model input include road length, carriageway width, width of paved shoulders, existing pavement composition, sub-grade CBR, roughness of the existing road (IRI), structural number and cracking, raveling and other pavement distress parameters.

Cost Inputs for HDM: Construction cost for economic analysis includes Land Acquisition, environment and utility shifting cost along with civil construction cost.




PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Construction Cost Phasing

The construction periods is considered to be 3 years starting from start of 2023. The phasing of construction cost is presented as follows:

First Year: 40%, Second Year: 30% & Third Year: 30%

Routine and Periodic Maintenance Costs: In the "without project" situation, routine maintenance strategy it considered patching, crack sealing edge repair, drainage clearance and markings, traffic signs gets complete every year. Periodic maintenance considers thin overlay in every 5th year.

In the "with project" situation, routine maintenance strategy it considered that patching, crack sealing edge repair, drainage clearance and markings, traffic signs gets complete every year. Periodic maintenance considers thin overlay in every 7th year.

Traffic Volume and Composition: AADT on the project road is taken for each section of the roads. Also generated port traffic has been considered.

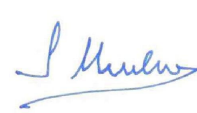
Value of Cargo Time and Passenger time: HDM generates average speeds of vehicles in "without" and "with" project conditions. Based on this, the time savings by vehicle type are calculated.

Economic Internal Rate of Return (EIRR)

The aim of the economic analysis is to find EIRR to understand the benefits received with respect to the cost incurred. The cut-off rate for EIRR is 12%. The analysis shows that the EIRR is well above the cut off rate (12%). Details of the summary have been mentioned in Annexure. The summary is presented below.

Case No	Description	Economic Internal Rate of Return (EIRR)	Net Economic Benefits (NPV) In Rs. Mn
1	Base Costs & Benefits	13.1%	785

The project is beneficial as the return is above 13.1%




Consultancy Services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana (Lot-1) Package 1A (**Bilasipura-Chapar-Tulungia-Jogighopa-Gendera-Paikan-Dudhnoi-Guwahati Road (Length 225.000 km) in the State of Assam**)

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Alternative: Improvement Case - With Project vs Alternative: Base Case - Without Project
No Sensitivity Analysis Conducted

	Increase in Road Agency Costs			Savings in M VOC	Savings in M Travel Time Costs	Savings in NMT Travel & Operating Costs	Reduction in Accident Costs	Net Social / Exogenous Benefit	Net Economic Benefit (NPV)
	Capital	Recurrent	Special						
Undiscounted	5,805.74	8.76	-9.19	11,679.42	19,802.93	1,631.35	0.00	0.00	27,308.38
Discounted	7,317.08	1.38	-28.78	2,845.73	4,798.98	430.12	0.00	0.00	785.15

Economic Internal Rate of Return (EIRR) = 13.1% (No. of solutions = 1)

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CHAPTER-12 ROAD SAFETY AUDIT

12.1 INTRODUCTION

Road Safety Audit (RSA) is a formal procedure for assessing accident potential and safety performance in the provision of new road schemes and schemes for the improvement and maintenance of existing roads.

However, its systematic application can also ensure that a growing awareness about good road safety principles is achieved throughout in highway planning, design, construction and maintenance organization. The essential elements of the definition are that it is:

- a) A formal process and not an informal check
- b) Carried out by persons who are independent of the design and construction, IRC: SP:88-2010
- c) Carried out by persons with appropriate expertise, experience and training, and
- d) Restricted to road safety issues.

Road engineers will apply quality assurance techniques by established procedures and regularly check the details of their own work. This regular checking includes checking safety aspects. This type of assessment, however, is not 'road safety auditing' because it is not done with a 'fresh pair of eyes' and it probably is not applying road safety engineering skills and experience required for the task. Road safety audit, on the other hand, is a 'step-by-step' process, performed at all stages. An independent road safety audit of the design is sought, to permit independent road safety engineering advice to be input, for the benefit of the future road users. Presently, it has become practice of involving safety engineers during the life of project, liaising informally with professionals of all disciplines at all stages, from feasibility/concept stage to completion. In turn, quality assurance can be applied to the providers of road safety audit services.

Road safety is now recognized as a major socio-economic concern in India. Increasing traffic volumes, the rapid growth in two and three wheeled traffic, higher speeds due to construction improvement / rehabilitation of roads has increased safety problem. A Road Safety Audit (RSA) is the safety performance examination of a road section through experienced road safety expert. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users. The road safety audit investigates general safety conditions, focuses on specific concerns or users. This also includes pedestrian safety as well as safety of transport use.

J. Mulya



12.2 ROAD SAFETY AUDIT AND QUALITY ASSURANCE

Road safety audit is an important aspect of Quality Assurance (QA), applied to the implementation of a road project. It is a management process in which the provider of goods or services assures the customer or client of the quality of those goods or services, without the customer or client having to check each time.

Quality assurance is done by the implementation, in the organization, of a set of procedures designed to ensure that agreed standards are met. Quality assurance procedures for the design and implementation of new road or traffic projects are to input road safety engineering expertise into the design. Often the client and the customer are the same person or organization. In case of roads, the client for whom the road is designed and built is usually the highway authority, whereas the customer is the road user. A road safety audit is undertaken for the highway authority to ensure that the customer is afforded level of protection from unsafe design and construction.

'Getting it right the first time' is the underlying theme of quality assurance. Road safety audits seek to ensure the road operates 'right the first time' once it opens and that the road users make fewer mistakes. Quality assurance is a continuous process. So, far as the safe design of roads is concerned, quality assurance starts with a safety culture in an organization. While designing a road, engineers will apply quality assurance techniques by established procedures and regularly check the details of their own work. This regular checking includes checking safety aspects. This type of assessment, however, is not 'road safety auditing' because it is not done with a 'fresh pair of eyes' and it probably is not applying road safety engineering skills and experience required for the task. Road safety audit, on the other hand, is a 'step-by-step' process, performed at all stages. An independent road safety audit of the design is sought, to permit independent road safety engineering advice to be input, for the benefit of the future road users. Presently, it has become practice of involving safety engineers during the life of project, liaising informally with professionals of all disciplines at all stages, from feasibility/concept stage to completion. In turn, quality assurance can be applied to the providers of road safety audit services.

12.3 OBJECTIVE OF ROAD SAFETY AUDIT

Road safety audit must assess projects on the basis of road user knowledge, attributes and skills, day/night and wet and dry road conditions. Safety audit is only a study of safety aspects and an auditor may indicate road safety problems inherent in designs that conform to our road standards. This is due to the fact that our road standards are an expression of a socio-economic balance between road safety, accessibility, environment and economy.

The goal of road safety audit is to ensure that all new road projects – and major operating and maintenance activities on existing roads-are assessed from the standpoint of road




**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

safety, so that any parameters of the project that are unsuitable from the standpoint of road safety are Corrected in time. The benefits of conducting road safety audit are that:

- The likelihood of accidents on the road network can be reduced.
- The severity of accidents can be reduced.
- Road safety is given greater prominence in the minds of road designers and traffic engineers.
- The need for costly remedial work is reduced and
- The total cost of a project to the community, including accidents, disruption and trauma, is minimized.

The cost of road safety audit and the consequent cost of changing a design are significantly less than the cost of remedial treatments after works are constructed. It is easier to change the lines/alignment or so on a plan than to move concrete structures. With less remedial work included in a highway authority's work program, budgets can be kept down or the same money can be utilized more effectively.

12.4 ROAD SAFETY AUDIT: WHAT IS DONE AND NOT DONE

ROAD SAFETY AUDIT IS:

- a) Minimizing the likelihood of crashes occurring through safety-conscious planning and design.
- b) Ensuring that, if a crash occurs, then the likelihood of the injury is minimized (such as provision of anti-skid surfacing and crash barriers).
- c) Ensuring that safety related design criteria (e.g. critical sight distances) have been met.
- d) Managing risks, such that the risk of major safety problems occurring is less than the risk of minor problems occurring.
- e) Reducing the whole-life cycle costs of a design (unsatisfactory designs are expensive to correct after they are built).
- f) Minimizing the risk of crashes on the adjacent road network (particularly at intersections) as well as on the new road scheme.
- g) Enhancing the importance and relevance of road safety engineering in highway design work and to enhance consideration for the safety of all categories of road users in all new and existing schemes.

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**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

ROAD SAFETY AUDIT IS NOT:

- a) A way of assessing or rating a project as good or poor.
- b) A means of ranking or justifying one project against others in a works program.
- c) A way of rating one option against another.
- d) An accident investigation.
- e) A redesign of a project.
- f) Something to be applied only to high cost projects or only to projects involving safety problems.
- g) The Name you use to describe informal checks, inspections or consultations.
- h) An opportunity to raise subjective concerns.

12.5 SAFETY AUDITORS

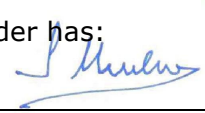
To be effective, the safety audit needs to be carried out by specialists, who are independent of the design process. In this way auditors will be taking a fresh look at the project without the distraction of having been involved in their design. Road safety audit involves one set of professionals checking the work of other professionals. Crucial factor is that auditors should be independent and impartial. Road safety auditor must not question the justification for a project but must bring to light its consequences on road safety and endeavor to ensure that the project as presented in the brief is as safe as possible. Auditors need to be objective in their assessments, yet sensitive to the fact that no one likes criticism. Designers and clients need to consider audit recommendations objectively as brought out from the audit outcome.

Expertise and experience in road safety engineering are the essential ingredients in any road safety audit team. This should be linked to an understanding of:

- Traffic engineering and traffic management and
- Road design and road construction techniques.

A person who has an understanding of road user behavior and human perception is also likely to be able to develop road safety audit skills. This understanding is in fact a desirable skill because of the interactive nature of road user behavior with the road environment. An audit team leader must not only have knowledge and skills in road safety engineering, but also should have received training and participated in a number of audits. It is expected that the safety auditors will apply due diligence in identifying the deficiencies and evolving audit recommendations which should be supported with reasons.

The Authority, which engage safety auditors should ensure that the team leader has:




**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

- Adequate road safety engineering experience for the stage of the audit.
- Successfully completed a recognized audit training course.
- At least five years' experience in a relevant road design, road construction or traffic engineering field and
- Undertaken at least three road safety audits including design stage etc.

It is not practical or necessary to have a multi-member team conducting an audit. An audit of a low budget project, a road safety audit by more than two persons may not be justified. For large projects, three persons are needed whereas for small projects two persons will be required.

12.6 ORGANIZATIONS INVOLVED IN ROAD SAFETY AUDIT

Road Safety Audit Road Safety Audit is based on the principle of an independent review. Road safety audit process reveals that three parties will be involved in this process- Client, Designer and Auditor. For the Public Private Partnership projects (PPP) the client would be both the Govt., and the Concessionaire with their respective obligations as provided in the Concession Agreement. One fundamental idea is that disagreements between the designer and the auditor are resolved not by the designer but by the client. So it is an interaction between different parties, whose roles are predefined at specific stages. In India, for large and small projects client may be National Highways Authority of India (NHAI)/Ministry of Road Transport and Highways/ National Highways and Infrastructure Development Corporation (NHIDCL /concerned Public Works Departments (PWD). Designer may be one consultant and Auditor may be another consultant/Govt. institution approved by the Authority. Main functions of the key players in road safety audit are shown in **Table- 12.1**.

12.6.1 ROLE OF DESIGNER

Designer is responsible for planning/designing the project. Designer bears the responsibility for ensuring that a road safety audit is conducted and that the necessary measures are agreed on the basis of the auditor's recommendations and/or the client's decisions. The designer is also responsible for ensuring that the audit input information is unambiguously defined and that all circumstances are described in an easily understandable manner. For existing roads, it is the responsibility of operating organization of the relevant highway authority which requests the auditor to prepare accident analysis of the project and which arranges for the road operator to be notified about the results of the audit. The project manager, or design engineer should be responsible for initiating the safety audit process for each scheme and for responding to the audit. The role of the designer is thus to:

- Attend commencement and completion meetings.
- Bring out the action proposed in response to the audit report and its recommendations and to document these proposed actions.

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

- Implement the decisions given by the client on the proposed action by amending the original design and
- Feed the experience back into the designer's organization and to avoid similar design problems recurring.

TABLE-12.1: MAIN FUNCTIONS OF THE KEY PLAYERS IN ROAD SAFETY AUDIT

Key Player	Main Functions
Project Owner (Govt. and/or Concessionaire)	• Expresses a commitment to road safety • Provides funding and resources • Considers safety audits and reviews as an essential quality control requirement • Commissions audits and reviews at appropriate times • Selects road safety audit team • Facilitates the response to the recommendations of audits and reviews and arranges implementation of recommendations that are accepted • Attends commencement and completion meetings
Design Team	• Attends commencement and completion meetings • Provides relevant information to safety team • Acts upon and documents response to recommendations of audit
Safety Audit Team	• Identifies safety issues in the proposed design • Makes constructive recommendations to enhance safety • Documents safety issues and recommendations • Holds commencement and completion meetings with the client and design team

12.6.2 ROLE OF CLIENT

Client is one who allots the project to the designer and owns the project. As the party responsible for the basic conditions of the project, it is the task of the client to decide in cases where the designer and auditor disagree. Disagreements are presented to the client who conveys its decision to the designer and the auditor. Road operator assumes this responsibility in case of existing roads. The client should be responsible for ensuring that clear terms of reference are laid down to cover the whole range and scope of audit and for commissioning audits at appropriate stages. The role of the client is thus to:

- Select an appropriate auditor.
- Provide all the relevant and necessary documents and
- Hold a commencement meeting with the auditor and the client.

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**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

12.6.3 ROLE OF AUDITOR

Auditor's responsibility is to carefully review the presented project material in its entirety, in the light of best road safety expertise and from the viewpoints of all relevant road users. Auditor also indicates all circumstances that cause misgivings concerning road safety. Persons designated as Road Safety Auditors work with, and have experience of, road accident analyses and road accident reduction. Auditors must be familiar with road planning, design and construction work and must undertake to keep their expertise up-to-date.

Auditors should comply with the terms of reference. They should comment only on the safety implications of schemes and provide constructive recommendations as to how any potential difficulties can be resolved. The role of the auditor is thus to:

- Review all the documents and audit the drawings and designs.
- Inspect the site (including during night time).
- Repeat these two steps.
- Prepare a report.
- Hold a completion meeting with the designer or client or both and
- Participate in the meeting organized by the client sequel to designer's reactions in the Auditor's Report.

12.7 WAYS OF ORGANIZING A ROAD SAFETY AUDIT

There are many ways of organizing a road safety audit. However, the two essential attributes of road safety auditor are that the person should be skilled and independent. Practically, two options are there for conducting a road safety audit:

- Audit by specialist auditors.
- Audit by those within the original design team or by other road designers.

In case of audit by specialist auditors, team needs to be a separate entity from the normal road design functions of an organization and team members should not, except for the purpose of an audit, be involved with the design of the project. There needs to be a clear understanding, prior to commencement of an audit, about how the audit findings and recommendations will be dealt with. Someone has to consider the safety recommendations and resolve the inevitable trade-offs i.e., project cost, road capacity, likelihood of severity of accidents, etc. In every case where an audit recommendation is rejected, the reasons must be stated and documented. Other ways of dealing with audit recommendations can include:

- A requirement that each recommendation must be formally considered by the client with a view to its acceptance in a normal course and the work cannot proceed to the next stage

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

until formal written approval has been issued by the client based on the recommendations of the audit team.

- The audit recommendations are considered by the designers, or by the project manager. This has the risk that the safety concerns may be rationalized away, in the atmosphere of keeping the project moving with minimal changes.

Instead of using specialist auditors, another designer or design team could undertake the audit. This approach may be applicable in organisations, which have sufficient road design work to have two or more separate design teams. This separation provides a level of independence. But this arrangement does not provide for the one essential ingredient in any road safety audit experience in road safety engineering. Using auditors from within the same organization also has its limitations. It may be considered that the original designer can audit his or her own designs, on the basis that this is better than nothing. However, this option does not meet requirement of independence. Experience shows that no matter how concerned a designer or design team is about road safety, it is almost inevitable that they will be too close to the issues in the design to apply the 'fresh pair of eyes' needed to inquire into design policies, approaches or details. A more effective way to organize a road safety audit is to engage specialist auditor(s) who is (are) independent and possess requisite road safety engineering skills and experience. The independence of the RSA Team is vital to ensure that the design team does not influence the recommendations of the Safety Audit and, therefore, compromise safety at the expense of other issues. This, however, does not mean that there should not be any interaction between the Design Team and the Safety Auditors. A meeting between Safety Auditors at the start and at the end of the audit process would be useful and Safety Auditors could be asked to provide advice on safety issues during the design. However, the independence of the Audit Team is critical and should not be compromised.

12.8 STAGES OF ROAD SAFETY AUDIT (RSA)

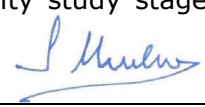
As per the scope of works RSA needs to be performed in the following stages:

- During Feasibility Study Stage (Planning stage)
- On completion of Preliminary Design Stage
- On completion of Detailed Design Stage

This report is related to safety audit report at feasibility study stage (planning stage). The audit team reviewed proposed design from road safety perspective and checked the following aspects. RSA related to construction stage and monitoring existing road stage is not discussed here.

12.9 ASPECTS TO BE CHECKED

Broadly following items have been checked or reviewed during the feasibility study stage based on site data, existing road and proposed designs:




**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

- Safety and operational implications of proposed alignment and junction strategy with particular references to expected road users and vehicle types likely to use the road.
- Width options considered for various sections.
- Departures from standards, if any and accordingly actions taken.
- Provisions of pedestrians, cyclists and intermediate transport.
- Safety implications of the schemes beyond its physical limits, i.e., how the scheme fits into its environs and road hierarchy.

Road Safety Audit is a formal procedure that uses extensive safety engineering knowledge to identify safety deficiencies in road sections. A broad experience in road, traffic and safety engineering needs to be acquired to ensure that a Road Safety Auditor has the knowledge and ability to refer back to the basic principles in road safety, and propose appropriate mitigation measures. Following points are generally adequately clarified during a road safety audit:

- Confusion or ambiguity due to design layout for road users that could lead to potential road traffic accidents.
- Insufficient information for road users.
- Improper visibility or an obstruction to road view s of road users.
- Hazards in layout create or obstacles to road users that could contribute to an increased risk of injuries.

In the above cases safety of the scheme may be compromised and remedial measures may be required to remove this potential or actual deficiency. Road users need to perceive and process vast amounts of sensory and visual information to negotiate a road layout. On the other hand role of designer is to provide a safe road environment that should:

- Provide adequate information for road users of the layout and conditions ahead.
- Provide adequate warning of hazards or unusual layouts ahead.
- Provide positive control of road users' passage through conflict points or unusual sections.
- Provide a road performance that can nullify road user's errors or inappropriate behavior.
- Provides clear, concise and phased release of road user information.
- Provides a consistent standard of road design and traffic control.
- Provides adequate warning of hazards.

Desirable minimum Design Standards should be used wherever possible and advance information and warning should be used to inform road users of the layout ahead. However, driver overload must be avoided as it may cause road users to focus too much on the unimportant data and shed vital information. Conflicting information, an over abundance of road signs or a lack of delineation can cause overload. Therefore a "safer" road environment can be defined as a layout that:




**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

It is important that a road improvement caters for all road users. Often the needs of the motorist are incorporated within a scheme whilst the needs of the vulnerable user are ignored. The vulnerable road users that need to be considered are: pedestrians – the old, young and those with mobility or sight impairment; cyclists – children, commuters and leisure users and motorcyclists.

Each vulnerable road user has different needs from the road network. In the habitation environment the pedestrian is likely to be the principal user and designs must incorporate safe crossing locations, adequate visibility to and from the crossings and appropriate lighting. In addition to the needs of vulnerable road users, particular attention should be paid to the needs of trucks, buses or other specialist vehicles.

Safe road design varies from the urban to the rural road network; and a number of external factors can create a situation in which a safe road in one location becomes unsafe due to external factors. These factors can include traffic volumes, population density, noise, or road user familiarity. The function of a road should be clear to all road users, and a well planned and defined road hierarchy can assist in providing a safe road network. The design speed can also be an important factor in influencing the safety of a road and should be appropriate to the location, local road users and level of private access control.

One important aspect to the safety of junctions is that layout as well as control method need to be simple and clear, with defined priorities for all road users. The assumption that 'straight on' traffic has priority is widely accepted and it needs to be remembered that alterations to this, despite reinforcement with signs and lines can still be confusing if visual clues such as fences, kerbing or lighting remain unchanged. It is important to attempt to make any minor approach perpendicular to the main road. Y-junctions with acute angles should be avoided. These angled junctions pose problem for road users, including restriction of forward and side visibility. Similarly, it is advisable to avoid intersections on the inside of bends as foliage often encroaches into sight lines after several years. Roundabouts used as a form of junction control have their own rules and design requirements. One of the primary requirements in good roundabout design is that the radius is tighter on the entry than the exit. This ensures a slow entry and lower circulating speed. Visibility is a key requirement for all junction types, all road users need to see and be seen by others. Care should be taken with fixing street furniture and vegetation within visibility splays. Vulnerable road users often experience difficulties during crossing at junctions. It is important that their needs are provided for and that safe crossing places are implemented where required.

The relationship between cross-sectional elements (carriageway, shoulders, etc.) and safety is affected by the type and volume of traffic, and also by the surrounding environment. Lane widths can be critical in affecting safety, where they are too narrow vehicles may collide on horizontal curves, and there may also be inadequate space for two wheeled vehicles. Where lane widths are too wide the alignment may encourage excess speed. On high speed links there is a safety benefit to be gained by the provision of a hard shoulder and central reserve gaps should be of adequate width, depending on the size of vehicles turning. Vehicles




**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

parked on the carriageway affect the road environment, layout and consequently safety. Safety problems experienced with parked vehicles are:

- Parked vehicles causing physical obstructions which are sideswiped or run into.
- Parked vehicles causing sudden braking or nose-to-tail shunts.
- Parked vehicles which deflect oncoming vehicles into adjacent vehicle paths.
- Parked vehicles blocking visibility for any road user.
- Parked vehicles between which pedestrians emerge.

To reduce the risk of parked vehicles contributing to an accident it is important that designs should minimize parking in main traffic lanes. Trees and foliage can greatly enhance the environmental impact of the street scene. However, left un-maintained, they can also restrict visibility considerably. In addition to this, saplings grow into large trees, which can provide an unforgiving road hazard in the event of a road traffic accident.

With the above discussions and study / analysis of the project road sections safety issues that have been conceived are presented in **Table-12.2**.

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

TABLE- 12.2: ROAD SAFETY ISSUES

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
A1. General	Departure from Standards	The horizontal alignment consists of 2 lane configuration.	The proposed alignment has been designed based on IRC: SP: 84-2014 & 2019. Alignment passes through rural and built up area with design speed of 80-100kmph. (Refer Horizontal Alignment Plan Drawing CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/PP and Horizontal Alignment Report CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/HAR	Ruling=100 kmph, Limiting = 80 Kmph.

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Cross sectional Variation	Two Lane	TCS-1D: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN RURAL AREA(RECONSTRUCTION OVER EXISTING PAVEMENT) Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Earthen Shoulder = 2 x1.5m Kerb Shyness=2 x 0.5m Median = 1.5 m Roadway Width=22.5m TCS-2: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Earthen Shoulder = 2 x1.5m Kerb Shyness=2 x 0.5m Median = 4.0 m Roadway Width=25.0m TCS-2A: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH WITH BOTH SIDE RETAINING WALL AND STONE PITCHING ALONG THE BERM Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Earthen Shoulder = 2 x1.5m Kerb Shyness=2 x 0.5m Median = 4.0 m Roadway Width=25.0m	(Refer Typical Cross Section Drawing CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/TCS)

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Cross sectional Variation	Two Lane	TCS-2C: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS STRETCH WITH BOTH SIDE RETAINING WALL Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Earthen Shoulder = 2 x1.5m Kerb Shyness=2 x 0.5m Median = 4.0 m Roadway Width=25.0m TCS-4F: 4 LANE CARRIAGEWAY WITH BOTH SIDE SERVICE ROAD IN BUILT-UP AREA (RECONSTRUCTION OVER EXISTING PAVEMENT) Carriageway = 2 x 7.0m Paved Shoulder = 2 x 2.5m Kerb Shyness=2 x 0.5m Railing = 2 x 0.25m Median = 1.5m Service Road = 2 x 5.5m Cover Drain = 2 x 1.0m Roadway Width=35.00m	(Refer Typical Cross Section Drawing CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/TCS)

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Cross sectional Variation	Two Lane	TCS-4F1: 4 LANE CARRIAGEWAY WITH BOTH SIDE SERVICE ROAD IN RURAL AREA (RECONSTRUCTION OVER EXISTING PAVEMENT) Carriageway = 2 x 7.0m Paved Shoulder = 2 x 2.5m Kerb Shyness=2 x 0.5m Railing = 2 x 0.25m Median = 1.5m Service Road = 2 x 5.5m Earthen Shoulder = 2 x 1.0m Roadway Width=35.00m TCS-4F2: 4 LANE CARRIAGEWAY WITH RIGHT SIDE SERVICE ROAD IN RURAL AREA (RECONSTRUCTION OVER EXISTING PAVEMENT) Carriageway = 2 x 7.0m Paved Shoulder = 1 x 2.5m+1X1.5m Kerb Shyness=2 x 0.5m Railing = 1 x 0.25m Median = 1.5m Service Road = 1 x 5.5m Drain=1x1m Earthen Shoulder = 1 x 1.5m Roadway Width=28.75m	(Refer Typical Cross Section Drawing CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/TCS)

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Cross sectional Variation	Two Lane	TCS-5D: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN FOREST STRETCH WITH BOTH SIDE R.C.C RETAINING WALL Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Earthen Shoulder = 2 x1.5m Kerb Shyness = 2 x 0.5m Median =1.5m Roadway Width=22.5m TCS-5E: 4 LANE CARRIAGEWAY WITH RIGHT SIDE SERVICE ROAD IN FOREST STRETCH (RECONSTRUCTION OVER EXISTING PAVEMENT) Carriageway = 2 x 7.0m Paved Shoulder = 1 x 2.5m+1X1.5m Kerb Shyness=2 x 0.5m Railing = 1 x 0.25m Median = 1.5m Service Road = 1 x 5.5m Drain=1x1m Earthen Shoulder = 1 x 1.5m Roadway Width=28.75m	(Refer Typical Cross Section Drawing CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/TCS)

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Cross sectional Variation	Two Lane	TCS-6B: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN VUP/SVUP APPROACHES WITH BOTH SIDE SERVICE ROAD Carriageway = 2 x 7.0m Paved Shoulder = 2 x 1.5m Kerb Shyness=4 x 0.5m Crash Barrier=2x0.5m+2x0.25m Median = 1.5m Service Road = 2 x 5.5m Earthen Shoulder = 2 x 1.0m Roadway Width=35m TCS-6B1: 4 LANE DIVIDED CARRIAGEWAY WITH PAVED SHOULDER IN FLYOVER APPROACHES WITH BOTH SIDE SERVICE ROAD WITH DRAIN Carriageway = 2 x 10.5m Crash Barrier=2x0.5m Median = 1.0m Crash Barrier=2x0.5m Service Road = 2 x 5.5m Drain = 2 x 1.0m Roadway Width=37m	(Refer Typical Cross Section Drawing CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/TCS)

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Drainage	631m Masonary Drain	RCC Covered Drain = 11869m	
	Climatic Conditions	Generally Temperature varies from 10°C to 44°C. The average annual rainfall is 1927 mm		
	Landscaping	Absence of proper turfing on embankment slope.	Turfing is being provided on embankment slope to prevent erosion of soil. The area of Turfing is calculated as 114792sqm	Trees and vegetations on the site should be properly trimmed and removed if required so that these should not interfere with the overhead services, clear view of signs and efficiency of roadway lighting. A regular program of pruning of the offending trees shall be under-taken as a part of the maintenance operation. Trees shall be selected based on the soil, temperature, rainfall, water level and should be deep rooted to avoid any damage to the pavement crust.

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Service Apparatus	Existing utilities like Electric poles, Transformer, OFC, Telephone Pole etc. are found along the existing road.	The existing utilities in the proposed alignment corridor are to be relocated at proposed utility corridor within the proposed ROW.	It will be safe during maintenance.
	Lay-byes	No Bus Bay and truck lay-byes have been observed along the project road.	Bus bay with passenger shelter has been proposed for smooth movement of traffic Bus-bay with passenger shelter = 1 Location (Both Side) For typical details of Bus Bay with passenger shelter refer drawing no: CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/MISC- 07	
	Footpaths	No footpath has been found	RCC Cover Drain cum Footpath has been proposed at built-up area.	
	Pedestrian Crossings	Pedestrian crossings are not observed along the existing road.	Pedestrian crossings are provided at major intersections and other locations like schools, religious structure etc. where substantial conflicts exist between Vehicular and Pedestrian movement.	Installation of proper traffic sign/signal near pedestrian crossings is mandatory.
	Access	Existing situation shows maximum access to the private property.	Private access should be minimized directly from the proposed carriageway by providing drain cum footpath at built up location	Private access needs be minimized to maintain the design speed of the corridor as well safe passage to traffic and persons

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Emergency vehicles	Emergency vehicle have not been found along the existing corridor.	It is proposed to provide Emergency vehicles to operate within a certain time frame along the project road.	

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Public Transport	Existing traffic survey shows that 2 wheeler/car/Bus are act major public transport along the existing road.	After improvement of road to 4-lane configuration trucks and public transport like bus and minibus etc. will ply more on the proposed road along with motorized and non-motorized other vehicles.	Refer Volume I: Main Report Chapter 7: Traffic Report
	Future Widening	Existing Row=11m-50m	Proposed ROW required = 35m-50 m	
	Staging of Contracts	Existing length is 20.053km.	Design Length is 17.737km.	
	Adjacent Development	Existing shoulders are generally in poor condition for major stretches of the road. Inadequate traffic signs are observed along the project corridor.	Proposed earthen shoulder on both sides of the carriageway can be used for the movement of slow moving vehicle during emergency as well as parking for stalled vehicle. Installation of traffic sign for road safety purpose is being proposed.	
A3. Junction	Minimize potential conflicts	For Package-1: There are 39 nos. minor junction. Existing junctions are with absence of road signage as well as proper pavement markings.	For Package-1: All Major Intersection has been developed with grade separated structure (VUP, SVUP & Flyover) with service road and All Minor Intersection has been developed with Service Road and Access to Main carriageway through Service Road.	Junctions should be developed with proper traffic sign and markings.
A4. Non-Motorized road users provisions	Adjacent Land	Existing Scenario shows Pedestrians, Cyclists and non-motorized vehicles are plying on the existing road	For smooth movement of non-motorized road users, pedestrians and cyclist, paved shoulder has been proposed on both side of the carriageway.	

**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Pedestrians	due to damage road shoulder and insufficient of footpath in built-up areas and causing conflicts with fast moving vehicles which decrease the design speed.	Refer TCS Drawing No: CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/TCS	
	Cyclists			
	Non-motorized vehicles			
A5. Signs and Lighting	Lighting	Insufficient Lighting shall be found in Bridge location & built-up areas.	Lighting shall be provided on built up area and bus bays locations.	
	Signs/ Markings	Insufficient signs and marking are found in the existing road.	Traffic Signs and Road Markings are provided on the proposed road for safe guidance of traffic. For typical details of road sign and marking, CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/MISC-02 & CET/4146/NHIDCL/NH-17/B-G ROAD/FDPR/MISC-03 respectively.	
A6. Construction and Operation	Build-ability	Guidelines for safety during construction need to be followed as per IRC: SP-55. Traffic control devices have to be provided as per requirements during construction time. Few of these are: barricading, signs and delineators.		
	Operational			
	Network Management			

[Signature]



**PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass,
Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)**

CHAPTER 13 CONCLUSION AND RECOMMENDATION

The Project Road starts near Chirakuta and ends at Jalukbari interchange in Guwahati. The total length of the existing road stretch is 209.998km (based on Topographic Survey).

The Package-1 starts near Chirakuta and ends near Mowatari, before Chapar Bypass (Ex.Ch.5.580km to Ex.Ch.25.633km).The existing length of Package-1 is 20.053km (As per Topographic Survey).The Design length of the package-1 is 17.737km (Design Ch.0.000km to Ch.17.737km). The Package-1 is comes under Dhubri district of Assam. The Project Road passes through plain terrain

Details of Package-1

10 nos. minor bridge (Reconstruction= 7nos, Retain & additional 2 lane bridge=1 no, New Construction=2nos) has been proposed.

54 nos. of RCC box culverts (Reconstruction=8 nos & New Construction=46nos) has been proposed in the project section.

2 nos VUP & 5 nos SVUP has been proposed.

1 no VOP has been proposed

1 no ROB has been proposed

3 nos Viaduct has been proposed

Flyover of 455m length has been proposed.

Foot over bridge (FOB) has been proposed at 4 locations.

1 no Toll Plaza has been proposed.

RCC Cover Drain of 11869 has been proposed at built up area.

RE Wall of 1558m length has been proposed.

Service Road has been proposed at built up area. The length of Service Road is 18457m.

Retaining Wall, Toe Wall & Breast Wall of 12580m, 4296m & 430m length has been proposed.

Stone Pitching has been proposed of 5306m length.

Ground Improvement by Sand piling has been proposed of 2150m length.

Bus bay with Passenger Shelter has been proposed at 1 location (Both Side)

Following Pavement Thickness shall be considered on the existing as well as widening and bypass portion.

PKG-1: Near Chirakuta to Near Mowatari, before Chapar Bypass, Ex.Ch.5.580km to Ch. 25.633km(Design Ch. 0.000km to Ch. 17.737km)

Flexible Pavement:

Main Carriageway
<u>For Widening/ Reconstruction/RE Wall/Bypass</u>
BC -40 mm
DBM -60 mm
Aggregate Layer- 100 mm
CT Base-100 mm
CT Sub-Base- 200 mm
Total -500 mm
Service Road
BC -40 mm
Aggregate Layer- 100 mm
CT Base-100 mm
CT Sub-Base- 200 mm
Total -440 mm

Provision of Traffic Guidance and Safety (like road signs, marking, Thrie-metal beam crash barrier, lighting etc.) has been kept for improvement of the project road.