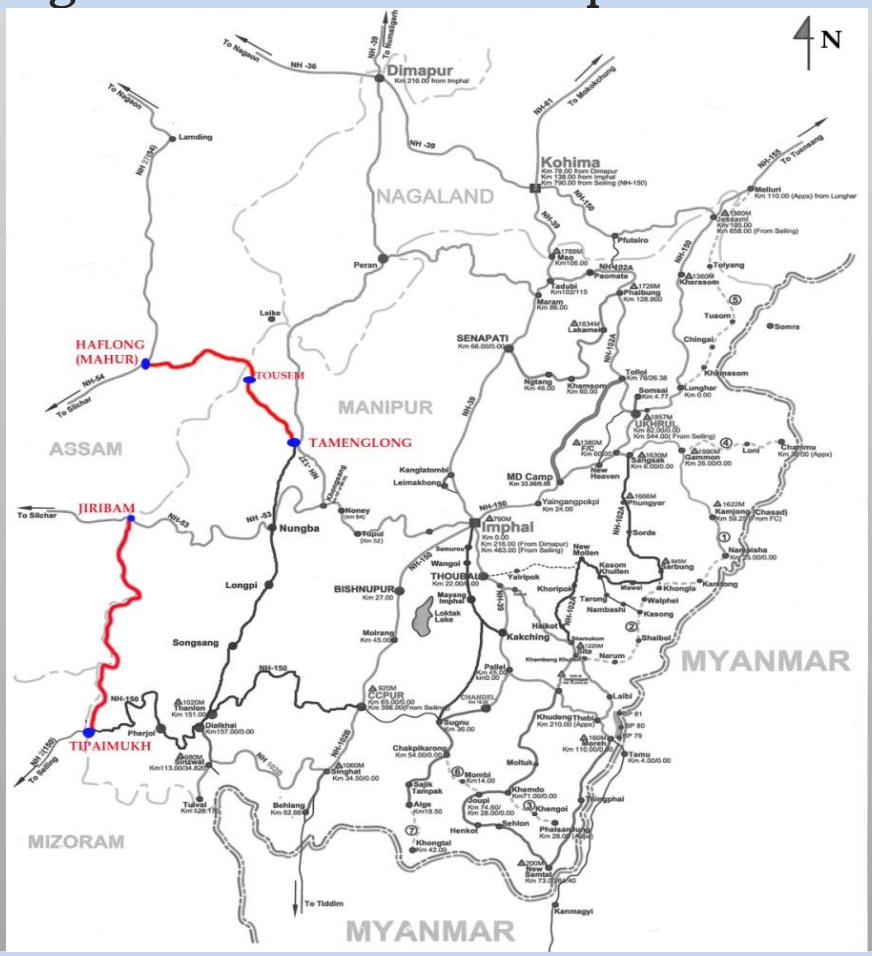
NATIONAL HIGHWAY INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED

Consultancy Services for preparation of Feasibility Study and Detailed Project Report for Two Lane with Paved Shoulders of Tamenglong-Tousem-Haflong Road in the State of Manipur and Assam.



DRAFT DETAILED PROJECT REPORT
VOL-I MAIN REPORT
PKG-10 P.LEIKUL- MAHUR(BOROWAPU) SECTION
(FROM KM 156+489 TO KM 176+581) LENGTH-20.092KM

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Chapter-1: Executive Summary

The Government of India has taken initiatives in construction, up-gradation and development of its road network along the international borders with different countries. In this context, The **National Highways and Infrastructure Development Corporation Limited (NHIDCL)** have been constituted by the Government of India in the year 2014 with the purpose of up-gradation and development of National Highways and Strategic Roads including interconnecting roads in parts of the country which share international boundaries with neighboring countries.

NHIDCL is a fully owned company of the **Ministry of Road Transport & Highways**, **Government of India**. The company promotes surveys, designs, builds, operates, maintains and upgrades the National Highways.

NHIDCL 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**.

Keeping in view the growing importance of road network of the country is physical, social and economic and environment fabric, the **National Highways and Infrastructure Development Corporation Limited** with active support of **Ministry of Road Transport & Highways, Government of India** initiated a comprehensive Detailed Project Study for the two Highways. ***M/s L.N. Malviya Infra Project Pvt.Ltd., Bhopal*** has been entrusted for providing Consultancy Services for Feasibility Study and Detailed Project Report for Two Laning with Paved Shoulder of **Tamenglong-Tousem-Laisong-Haffong Road** in the State of **Manipur and Assam** on EPC mode, vide Letter to Proceed **NHIDCL/DPR/TH&JT/Manipur/2016 dated 26.12.2016**. The commencement date for the project is 02.01.2017 and the period for completion of assignment is 09 Months. The description of the road given in **Table No. 1.1**:

Table 1.1 Details of Project Road

Sr. No.	Name of Road	Type of Road	Chainage (in Km)		Length as per Topographic Survey (in Km)	Length as per Design (in Km)
			From (in Km)	To (in Km)		
1	Tamenglong-Tousem-Laisong-Haflong	NH-137	Km 0+000	Km 182+169	182.169	177km (Approx)

As per Authority instructions project road is divided in 10 Packages in Manipur and Assam State.

This report deals with the 10th Package i.e. **P. Leikul to Mahur(Borowapu) Section** which needs to be upgraded to Two Lane with paved Shoulders and the details of this road is given in **Table No. 1.2**.

Table 1.2 Details of Project Road

Pkg No.	Name of Road	NH No.	Des. Chainage (in Km)		Length as per Design (in Km)
			From (in Km)	To (in Km)	
10	P. Laikul to Mahur(Borowapu) Section	NH-137	Km 156+489	Km 176+581	20.092 Km

1.1. Tamenglong-Tousem-Mahur Road

Project road is located in Assam and Manipur State Assam and Manipur is a landlocked The state is bordered by Bhutan and the state of Arunachal Pradesh to the north; Nagaland and Manipur to the east; Meghalaya, Tripura, Mizoram and Bangladesh to the south; and West Bengal to the west via the Siliguri Corridor, a 22 kilometres (14 mi) strip of land which connects the state to the rest of India.

The road starts from Km. 0.000 of Tamenglong- Tousem- Mahur Road on existing T – Junction with Imphal-Tamenglong Road (L/s Tamenglong, R/s Imphal) Near Tamenglong Town, Manipur and terminates on Km. 182.169 of Tamenglong- Tousem- Haflong road on existing Y – Junction with NH-54 (L/s Jatinga, R/s Lumding) Near Mahur(Borowapu), Assam.

The project road traverses through Tamenglong and Dima Hasao District in Assam and manipur. Total length of the project road section is running between Latitudes of 24.984457°" N; Longitudes of 93.503474°" E and Latitudes of 25.176069°" N; Longitudes of 93.075115°" E. The location plan of the full project road section is illustrated in **Figure 1.1.**

Figure1.1: Location Plan of full Project Road

1.1.1 P. Laikul to Mahur(Borowapu) Section

The Project Stretch starts from Ex. Km. 160+875 of Tamenglong- Tousem- Haflong Road Near P.Laikul Village, Assam and terminates on Ex. Km. 182+169 of Tamenglong- Tousem- Mahur road near Mahur(Borowapur) Village.

The project road traverses through Dima hasao District in Assam. The location plan of the full project road section is illustrated in **Figure 1.1.**

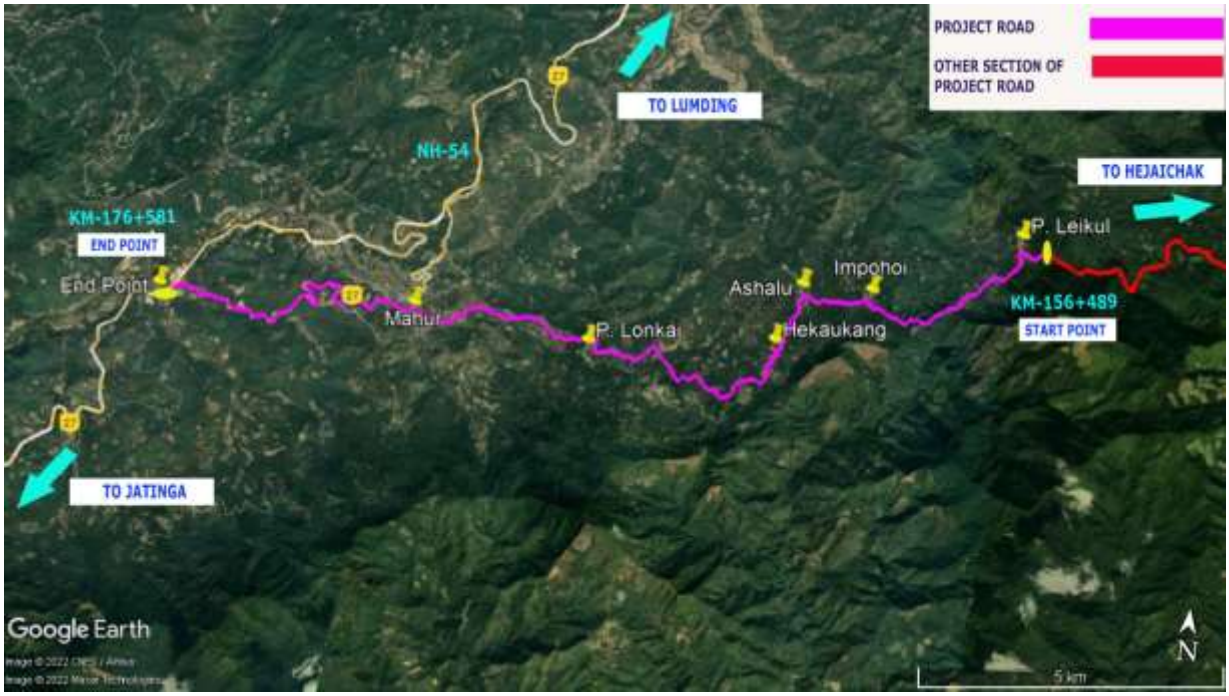


Figure1.2: Location Plan of Pkg-10 (P. Leikul to Mahur(Barawapu) Section)

Summary of the existing features of the project are shown in **Table 1.3.**

Table 1.3: Summary of the existing features of the project road

SL. No.	Particulars	Existing Details	Remarks
1.	Start Point	The project road starts from Ex. Km. 160+875 of Tamenglong- Tousem- Haflong Road Near P. leikul Village, Assam.	
2.	End Point	The project road terminates on Ex. Km. 182+169 of Tamenglong- Tousem- Mahur road near Mahur(Borowapur) Village.	
3.	Total Length	21.294 km	Design length- 20.092km
4.	Districts	1No.(Assam)	Dima hasao District

SL. No.	Particulars	Existing Details	Remarks
5.	Category of Road	PMGSY(Present)	
6.	State	Assam	Assam
7.	Terrain	Hilly Terrain	
8.	Right of Way(m)	7-10m	
9.	Carriage way	3.0m & 3.75m BT	
10.	Major/Minor Bridge	2 No.	
11.	FCW	5 No.	
12.	Pipe Culverts	81 Nos.	
13.	Slab / Cut Stone Culverts	18 Nos.	
14.	Box Culvert	5 Nos.	
15.	Burried	14 No.	
16.	Minor Junctions	51 Nos.	
17.	Major Junction	1 Nos.	
18.	Villages/Towns	18 Nos.	
19.	Existing Drainage System	NIL	
20.	Miscellaneous Services	**Fuel Stations:** One Fuel stations were observed on the road section. **Police Station:** No Police stations were observed on the Project road.	

1.2. SOCIO-ECONOMIC PROFILE

Project Description

Socio Economic Profile chapter illustrates a brief of the socio – economic profile of the project influenced area (PIA) having a length of 148 Kms. The road primarily connects State viz, Assam and Manipur. This highway segment serves as the artery, provides connectivity to existing Road & Proposed Highway in Assam & Manipur State. Also it provides interstate connectivity between Assam & Manipur and important link between two national highway that is NH-137 & NH-54.

DISTRICT DIMA HASAO

History:

Dima Hasao District district was a part of Dimasa Kachari Kingdom before 1832. The kingdom was extended from Jamuna in the North to the foot-hills of Lushai Hills in the south and from the Kopili in the west to the Angami and Katcha Naga hills beyond the Dhansiri in the east. The Dimasa Kachari kings had their capitals successively at Dimapur, Maibang, Kashpur, and, lastly, at Horitikor (Karimganj district near Badarpur). In 1830, the Dimasa king Gobinda Chandra Hasnu was assassinated by his own general Gambhir Singh, after that the British annexed the southern part of the kingdom on 14 August 1832 under the doctrine of Lapsi. The rest was ruled by last Dimasa General Tularam. In 1837, a portion of Tularam's kingdom was further annexed to the British Empire and constituted into a sub-division of Nagaon district in 1837 with Headquarter at Asalu. In 1854, on the death of Tularam, the remaining portion of his kingdom was finally annexed to the British Empire and added to the Asalu sub-division.

Geography:

The district headquarters are located at Haflong. Dima Hasao district occupies an area of 4,888 square kilometres (1,887 sq mi). comparatively equivalent to Brazil's Ilha Grande do Gurupá.[3] It is the third largest district of Assam with 4888 km2 after Karbi Anglong and Sonitpur district. Dima Hasao District is surrounded by Karbi Anglong district (E) and Nagaland on North east, Manipur on East, Nagaon Dist. on North, Karbi Anglong Dist(W) on North-west, Meghalaya on West and Cachar district on South.

Economy:

In 2006 the Indian government named Dima Hasao one of the country's 250 most backward districts (out of a total of 640). It is one of the eleven districts in Assam currently receiving funds from the Backward Regions Grant Fund Programme.

Parliamentary Constituency:

Autonomous District Lok Sabha constituency is one of the 14 Lok Sabha constituencies in Assam, a north eastern state of India. The constituency consists of two autonomous districts namely Dima Hasao and Karbi Anglong which is home of the Dimasa people and Karbi people. The political situation in the area is often volatile, and different armed fractions operate in the area.

For Details of Socio-Economic Please refer Chapter-4

1.3. TRAFFIC SURVEYS AND ANALYSIS

To comprehensively appreciate the traffic and travel characteristics on the project corridor from Tamenglong- Haflong via Tousem, Laisong. The type of surveys, locations and duration, as identified at the inception stage of the study have been followed during data collection exercise with minor modifications on account of the project corridor.

The traffic characteristics on the project road for the base year are essential for formulating improvement programs. The objectives of the traffic study are:

- Traffic estimation in terms of volume on various sections.
- Growth factor estimation for traffic forecasting.
- Capacity assessment based on traffic forecasting for next 30 years.
- Pavement and intersection design

Average Annual Daily Traffic and it Composition

The Average Annual Daily Traffic (AADT) obtained from the volume count surveys for all the locations are given in **Table no. 1.4.** To study the variation in the intensity of traffic, consultants have analyzed the variation of traffic along the project road. The following observations are made from the analysis for each location along the project stretch.

Table 1.4: Annual Average Daily Traffic (AADT)

Categories	PCU Factor	Km. 0+300 at Tamenglong town Location-1		Km. 136+650 Near Mahur town Location-2		Average of all locations	
		Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs
Car/Jeep/Van	1.0	109	109	634	634	372	372
3 Wheeler	1.0	127	127	710	710	419	419
Mini Bus	1.5	7	11	13	20	10	15
Standard Bus	3.0	5	15	13	39	9	27
LCV / Tempo	1.5	43	64	124	186	84	126
2-Axle	3.0	42	126	35	105	39	117
3-Axle	3.0	0	0	11	33	6	18
MAV (4-6)	4.5	0	0	0	0	0	0
Two Wheeler	0.5	109	54	682	341	396	198
Animal Cart	6.0	0	0	0	0	0	0
Cycle	0.5	46	23	138	69	92	46
Tractor with trolly	4.5	0	0	0	0	0	0

Tractor	1.5	0	0	0	0	0	0
Hand Cart	6.0	0	0	0	0	0	0
EME/HCV	4.5	2	9	6	27	4	18
Total Traffic		490	538	2366	2164	1431	1356

Traffic growth rate during the design life in percentage

It is learnt that the National Highways and Infrastructure Development Corporation Limited (NHIDCL) did not carried out traffic volume count on the project road. Therefore, no previous data has been provided to Consultant.

As per IRC SP 48:1998 Hill road Manual 7.5 per cent growth rate is considered for hill road.

Hence traffic growth rate is adopted 7.5% for projection of present traffic.

Vehicle Damage Factor

Summary of VDF

LOCATION	DIRECTION	LCV	Bus	2 AXLE	3 AXLE
KM - 136+650	**Mahur- Lisang**	0.001	0.157	1.207	3.531
	Lisang- Mahur	0.009	0.337	2.696	8.848
	Adopted VDF	**0.009**	**0.337**	**2.696**	**8.848**

Cumulative Mean Standard Axles (CMSA)

Summary of CMSA		
Year	**CMSA**	**Design year**
2017 to 2021	Project Clearance & Construction Period	
2022	**0.23**	1
2023	**0.49**	2
2024	**0.76**	3
2025	**1.05**	4
2026	**1.36**	5
2027	**1.70**	6
2028	**2.06**	7
2029	**2.45**	8
2030	**2.87**	9
2031	**3.32**	10
2032	**3.80**	**11**
2033	**4.32**	12
2034	**4.88**	13
2035	**5.48**	14
2036	**6.13**	15
2037	**6.82**	16
2038	**7.57**	17
2039	**8.37**	18

Summary of CMSA		
2040	**9.23**	19
2041	**10.16**	20

Adopted MSA is 20 as per IRC SP 73:2018

For Details of Traffic Surveys and Analysis Please refer Chapter-5

1.4. PAVEMENT DESIGN

As per plate No.-44 of IRC-37:2018 the Pavement Design is:-

Design crust thickness for the flexible pavement for 20 years as arrived is given below in **table 1.5**

Table 1.5

Homogenous Section (Km)			CBR (%)	MSA	Adopted Pavement Composition (mm)			
From	To	Length (in Km)		Adopted	BC	DBM	WWM	CTSB
156+489	176+581	20.092	8	20	30	50	150	200

As Per test results the average CBR Varies from 5-10%. So, the value of adopted CBR is 8% using Soil statbilization.

1.5. IMPROVEMENT PROPOSAL

TCS schedules

Proposed typical cross section for project highway is given in table 1.6 below:

Table No. 1.6: Type of Typical Cross Section

Sr. No.	Description	Design Length (Km.)	Proposed TCS Type
		HS-I (Km)	
1	Reconstruction in Two-Lane Carriageway with Paved Shoulder in Hilly Terrain with both side drain on hill side	6.200	TCS-2.11(new)
2	Two Lane Road with Paved shoulders in Hilly Terrain with Trapezoidal Drains on Hill side and Retaining wall on Valley Side in open country area	5.131	TCS-2.8
3	Reconstruction in Two-Lane Carriageway with Paved Shoulder in Hilly Terrain without retaining wall	7.761	TCS-2.9

Sr. No.	Description	Design Length (Km.) HS-I (Km)	Proposed TCS Type
4	Two Lane Road in Hilly Terrain with both side Retaining Wall	1.000	TCS-2.12(new)
	Total	**20.092 Km**	

Proposed ROW

- In Mountainous and steep terrain
  Open Area- 30-115m
  Built-up Area-15m

MAJOR & MINOR BRIDGES

Provision has been made for the following structures in the estimate. Details is given in table 1.7 below:

Table No. 1.7: Major & Minor Bridge proposals

S. No.	Type	Major Bridge	Minor Bridge	Total
1	Reconstruction	00	02	02
2	New-construction	00	03	03
	Total	00	05	05

BOX CULVERTS

A summary of all the types of culverts proposed are given in table 1.8 below:

Table No. 1.8: Culvert Proposals

S. No.	Type	Retain With Repair	Widening	Reconstruction	New construction	Total
1	Box	-	-	89	16	105
Total		**-**	**-**	**89**	**16**	**105**

Drainage and Protection works

- Hill side drain:- 25292m
- Catch water Drain:- 39442m
- PCC Breast Wall:- 19911m
- Retaining wall:- 7131m
- Hydro seeding:- 19011m
- THRIE Beam Crash barrier:- 14892m
- Special Protection 95500 sq.m.

Major & Minor Junctions

Detailed Estimates has been prepared for major and minor junctions as per site requirement.

Traffic Safety features, Road Furniture and road markings

Detailed Estimates has been prepared for traffic safety features, road furniture and road markings as per site requirement.

For Details of Improvement Proposal Please refer Chapter-8

1.6. PROJECT FACILITIES

Project facilities

Considering the overall safety of traffic and minimum hindrance to through traffic, 8 nos. pick-up bus shelters & Bus Bays , 1 no. Rest Area with Toilet Block & 1no. Truck Lay Bye have been proposed along the project road. Details are given in table 1.9 below:

Table No. 1.9

Sr. No.	Type of Facilities	Design Chainage	Side	Location
1	Bus Bay & Shelter	157+600-157+700	BS	P.Leikul
2	Bus Bay & Shelter	159+950-160+050	BS	Impoi(H&CH)
3	Bus Bay & Shelter	161+600-161+700	BS	Asalu
4	Bus Bay & Shelter	163+250-163+350	BS	Hekaukang
5	Bus Bay & Shelter	166+100-166+200	BS	N.Lonkai
6	Bus Bay & Shelter	166+850-166+950	BS	P.Lonkai
7	Bus Bay & Shelter	169+400-169+500	BS	Chudining
8	Bus Bay & Shelter	172+200-172+300	BS	Daoding
9	Truck lay bye & Shelter	157+800-157+900	One Side	-
10.	Rest Area with toilet Block	157+800-157+900	One Side	-

Service Roads

In keeping the view of low traffic and least habitation in the enrouted villages; there is no requirement of service road in the towns/villages.

Toll Plaza

No toll plaza is proposed on road section.

Landscaping

The landscaping and tree plantation along the project road shall be done as per IRC: SP: 21 -2009. In the topographic survey it is seen that their are Many trees are lying within the ROW along the alignment of project road. These trees are proposed to be cut as per actual requirement at site in a phased manner. It is proposed to have a new plantation at 4m c/c on Single ROW of project corridor.

1.7. Cost Estimates

The cost estimates have been prepared for reconstruction/widening of the existing two lane carriageway including strengthening of the existing pavement, strengthening / widening of existing bridge structures, construction of new bridges, rehabilitation and reconstruction/ widening of cross drainage structures, longitudinal drains, junction improvements, road furniture, street lighting, bus shelters etc.

The rates for the items of work have been taken from SOR, PWD, 2020-21 Assam.

The summary of cost estimate is presented in table 1.10 below:

Table No. 1.10:

S. No.	Item	Total Cost in Crores
A	***ROAD WORKS***	
1	*EARTHWORK UPTO SUBGRADE*	125.03
2	*GRANULAR SUB-BASE*	17.88
3	*NON BITUMINOUS BASE-COURSE*	11.75
4	*BITUMINOUS BASE-COURSE*	13.67
5	*WEARING COAT*	6.09
	SUB TOTAL (A)	**174.43**
B	***CROSS DRAINAGE STRUCTURES***	
6	*Reconstruction/ New Construction of Culverts*	47.31
7	*Reconstruction/ New Construction of Minor bridges*	19.14
8	*Reconstruction/ New Construction of Major bridges*	-
	SUB TOTAL OF CROSS DRAINAGE STRUCTURES (B)	**66.45**
C	***OTHER ITEMS***	
9	*Traffic Signs, marking and Appurtenances*	12.30
10	*Project Facilities*	3.03
11	*Drainage Works*	7.31
12	*Protection Works including Special Protection for Sinking Zone*	259.29
13	*Junction Improvement*	10.03
14	*Trees Plantation*	0.89
	SUB TOTAL OF OTHER ITEMS (C)	**292.85**
D	***Total Civil Costruction Cost (D= A+B+C)***	**533.73**
E	***Cost of Utility Shifting***	
15	*Water Supply Utilities as per PHED Estimates*	**1.02**
16	*Electrical Utilities as per APDCL Estimates*	**6.37**
	Total (E)	**7.39**
H	***Total Tender Cost (F=D+E)***	**541.12**
	Cost Per Km	**26.93**
I	***Pre Construction Activities***	
17	*Tentative Cost of Land Acquisition (for 74.0509 Ha)*	242.96
18	*Tentative Cost of Tree Felling*	5.61
	Total of Pre Construction Activities (I)	**248.57**
J	***GST/Contigencies and Centages***	

S. No.	Item	Total Cost in Crores
19	*Add Other Charges of Utility Shifting (Supervision, GST)*	1.36
20	*Add GST@ 18% on D above*	96.07
21	*Contigencies @ 1% of D above*	5.34
22	*Agency Charges @ 3% of D above +GST@18%*	18.89
23	*Supervision charges @ 3% of D above*	16.01
24	*Price Escalation @ 5% of 'D' above as per phasing of the project execution only for the period beyond 1 year of the Bid submission date*	26.69
25	*Maintenance during construction/Defect Liability Period @ 2.5% of 'D' (Calculate as per the rate prescribed in the latest Document on EPC Contract+GST@18%*	15.74
	Total of GST/Contigencies and Centages (J)	**180.10**
Total Project Cost (F+I+J)		**969.78**
Cost per Km.		**48.27**

For Details of Cost Estimate Please refer Chapter-12

1.9. Environmental, Forest & Wildlife Clearance

- Environmental Clearance, Forest Clearance and Wildlife Clearance is not required.

For Details of Environmental, Forest & Wildlife Clearance Please refer Chapter-11

Chapter-2: OVERVIEW OF MORTH/NHIDCL

Introduction

The Government of India has taken initiatives in construction, up-gradation and development of its road network along the international borders with different countries. In this context, The National Highways and Infrastructure Development Corporation Limited (NHIDCL) have been constituted by the Government of India in the year 2014 with the purpose of up-gradation and development of National Highways and Strategic Roads including interconnecting roads in parts of the country which share international boundaries with neighboring countries.

NHIDCL is a fully owned company of the Ministry of Road Transport & Highways, Government of India. The company promotes surveys, designs, builds, operates, maintains and upgrades the National Highways.

NHIDCL 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.

The National Highways and Infrastructure Development Corporation Limited (NHIDCL) was incorporated on 18th July, 2014 as a Public Sector Undertaking under the Companies Act, 2013, under the Ministry of Road Transport & Highways, Government of India, inter alia, work approved share capital of Rs. 100 crores and paid up capital of Rs. 5 lakhs with an objective to fast pace construction of National Highways and other infrastructure in the North Eastern Region and Strategic Areas of the country which share international boundaries. The effort is aimed at economically consolidating these areas with overall economic benefits flowing to the local population while integrating them in more robust manner with the mainstream. The company started its effective functioning on 22nd Sep. 2014 with first appointment of Shri. Anand Kumar, IAS (KL:1984) and Shri Sanjay Jaju, IAS (TS:1992) as Managing Director and Director (A&F) respectively.

The company has been entrusted with the task of developing and improving road connectivity of an approximate aggregate length of 10,000 kms including the international trade corridor in the North East, and 500 kms of roads in the North Bengal and North Eastern region of India to enable efficient and safe transport regionally with other South Asia Sub-regional Economic Cooperation (SASEC) member countries & promote cross border trade and commerce besides helping safeguard India's international borders.

The company envisages creating customized and specialized skills for addressing issues like complexities of geographical terrains and addressing extensive coordination requirements with security agencies. The company would 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.

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.

The endeavour of the Company would be to maintain its Office and Sub-Offices and Highways and Infrastructure developed, constructed and maintained by it in a clean manner. The Company has become part of the 'Swachh Bharat Abhiyan' with effect from 01.01.2015 and all its employees have taken oath for Swachh Bharat.

NEW DELHI: The newly constituted National Highway Infrastructure Development Corporation Limited, which is mandated to develop 10,000 km of roads in the country with a special focus on North-East, will award the first highway project in Meghalaya this month.

Prime Minister Narendra Modi has laid special emphasis on the development of the north-eastern region. His government plans to focus on constructing National Highways and good roads in the region.

The government has also allocated Rs 3,000 crore in the Union Budget 2014-15 for improving highways and state roads in the region.

The focus of this company will be to develop roads and other infrastructure of highest standard in the country with focus on the north-eastern region and border areas, a Ministry official told PTI.

The company is mandated to build 10,000 km of roads in the North-East (Assam, Meghalaya, Manipur, Nagaland, Mizoram, Tripura and Arunachal Prades . The official said that as many as five projects in Meghalaya are under various stages of development and one of the projects is likely to be awarded this month by National Highway Infrastructure Development Corporation Limited (NHIDCL).

The financial bid for the upgradation of 66 km long 2-lane stretches from Nongstoin to Domiasiat via Wahkaji has been received and the project is likely to be awarded this month, the official said.

The detailed project report (DPR) of three 2-laning projects in Meghalaya, totalling a length of over 240 km are ready and target of awarding these projects is December, 2014.

The DPR for the upgradation of Nongstoin-Rambrai-Kyrshai road up to Meghalaya-Assam border, is in progress and this project is likely to be completed by the end of this year.

Vision

The company has set a vision to become an instrument for creation and management of infrastructure of the highest standard in the country while contributing significantly towards nation building.

Mission

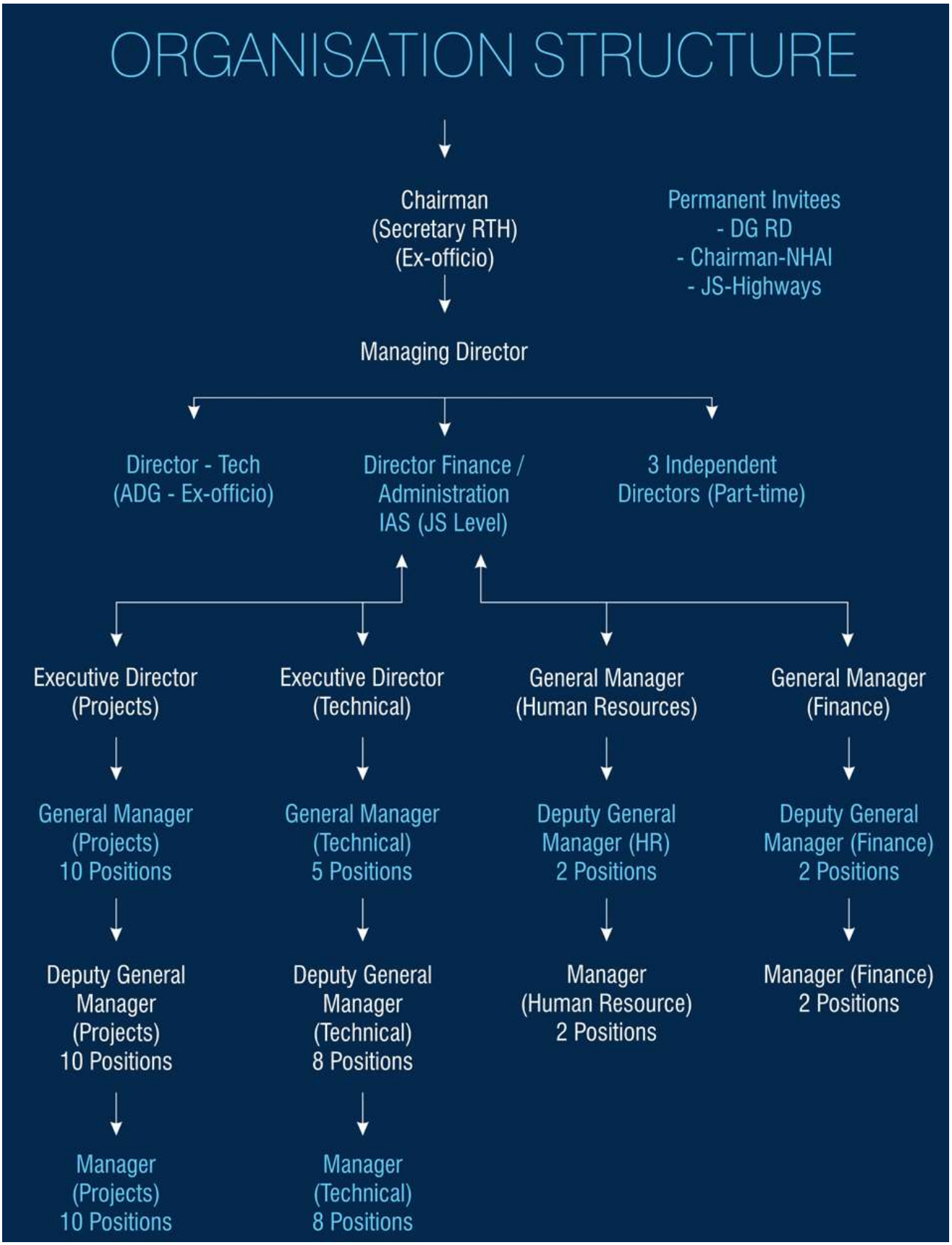
The company has a Mission to be a professional company which works in most efficient and transparent manner and designs, develops & delivers infrastructure projects in a time bound manner for maximizing benefits to all stakeholders.

Core Strategies

NHIDCL has identified seven key strategies to follow in order to become a Fortune 500 company one day. First, it is using e-Tools like e-Office, e-Tendering, e-Monitoring, e-Access for efficiency & transparency. Second, the company is revisiting various procedures and processes followed today to enhance the ease in doing infrastructure business. Third, NHIDCL is engaging itself in continuous capacity building of staff and stakeholders including contractors to keep pace with the latest developments. The capacity development of local contractors and engineers in North Eastern Region and Strategic Areas will help them become active partners in construction of Highways and other infrastructure and thereby leading to inclusive development of these areas. The endeavor of the company, as fourth strategy, is to facilitate use of new but appropriate technology in materials, design and work for enhancement in quality, durability, execution speed, cost reduction, safety standards and to address environmental concerns. As fifth strategy, NHIDCL will create a platform to create scientific and innovative temper by involving Experts and leading Research Institutions for exchange of ideas and becoming a leader in the industry. The commitment of NHIDCL remains to provide speedy Dispute Resolution Mechanism to avoid unnecessary litigations as sixth strategy and lastly, hold regular consultations with stakeholders in order to create one vision one mission as seventh strategic move.

Core Value

The Company is inculcating the value of sharing, to economize on costs. All technical resources and equipments are placed in a common pool. NHIDCL is working towards establishing itself as 'A Company with the Difference' carrying hall mark of efficiency, transparency and quality.


ORGANISATION STRUCTURE
Chairman
(Secretary RTH)
(Ex-officio)
Permanent Invitees
- DG RD
- Chairman-NHAI
- JS-Highways
Managing Director
Director - Tech
(ADG - Ex-officio)
Director Finance /
Administration
IAS (JS Level)
3 Independent
Directors (Part-time)
Executive Director
(Projects)
Executive Director
(Technical)
General Manager
(Human Resources)
General Manager
(Finance)
General Manager
(Projects)
10 Positions
General Manager
(Technical)
5 Positions
Deputy General
Manager (HR)
2 Positions
Deputy General
Manager (Finance)
2 Positions
Deputy General
Manager
(Projects)
10 Positions
Deputy General
Manager
(Technical)
8 Positions
Manager
(Human Resource)
2 Positions
Manager (Finance)
2 Positions
Manager
(Projects)
10 Positions
Manager
(Technical)
8 Positions

Project Financing and Recovery Mechanism

Project financing – NHAI proposes to finance its projects through a host of finance mechanisms for effective and perceptible development of the National Highways network in the country for which a staggering amount of Rs. 1,65,000 crores (at 1999 price level) is needed. The Govt. of India has laid down the following mandate:-

(A) Central Road Fund Act 2000 has been enacted dedicated for development and maintenance of roads. This is a non-lapsable fund and is financed by levying cess on petrol and diesel from time to time. Presently, the accrual would be about Rs. 6000 crores. The expenditure of funds accrued from this source is to be allocated in the following manner:-

i. 50% of the cess on HSD for development of rural roads

ii. Balance 50% of the cess on HSD and the entire cess collected from petrol will be apportioned as under:-

- 57.5% for development and maintenance of National Highways
- 12.5% for construction of ROB and safety works at unmanned railway crossings
- Balance 30% for development and maintenance of State roads.

(B) Assistance from external multi-lateral agencies such as the World Bank, Asian Development Bank, OECF for improvement of the National Highways. An amount of approximately Rs. 8000 crores has been arranged by NHAI from World Bank and ADB.

(C) NHAI has set up its own companies for borrowing funds from the market by issue of infrastructure bonds for financing NHDP projects.

Encouraging private sector participation in highway development through build, operate and transfer (BOT) schemes and providing a no. of incentives such as exemption of custom duties on import of " state of art " road construction equipment 10 years income tax exemption to be availed within 20 years of commissioning the facility, capital grant upto 40% of project cost make it viable and toll rates indexed to whole sale price govt. has prepared concession agreement for projects costing less than Rs. 100 Crores. and those costing more than 100 crores.

Cost Recovery Mechanism

The mechanism for recovery of the project cost is establishing toll check posts and collecting toll tariff from users. Govt. has laid down the rates of tolls for various type of vehicles. A special purpose vehicle ('SPV') will be constituted for in the individual projects on BOT basis, which would go to the market for borrowing money and then repay through toll collection the following are broadly the modes financing of NHDP:-

A) Project fully financed by NHAI and cost recovery through toll (EPC project).
B) Construction by the full private participation and collection of toll by private entrepreneur for BOT project

C) Grant by NHAI upto 40% to BOT entrepreneur from NHAI fund to Bridge the viability gap for BOT projects.

D) Annuity payment by NHAI to private entrepreneur implementing the project at their cost (BOT-Annuity projects).

For the instant project 4/6 laning of NH-36&NH-39 from Daboka to Dimapur NHAI has decide project implementation on BOT basis. NHAI administrative set-up consists of 1 no. project Director. NHAI, PIU nagaon with these support of Manager (Technical), under Chief General Manager Guwahati (NE) & R.O Assam.

Chapter-3: PROJECT DESCRIPTION

The full project road segment is identified for Improvement and Up gradation to 2- Lane with paved shoulders configuration from Tamenglong-Tousem-Laisong-Mahurfor a length of about182.169km(as per topographic survey) the road primarily connects blocksviz, Tousem- Laisongand other important Villages.

Table 3.1 Details of Project Road

Sr. No.	Name of Road	Type of Road	Chainage (in Km)		Length as per Topographic Survey (in Km)	Length as per existing (in Km)
			From (in Km)	To (in Km)		
1	Tamenglong-Tousem-Laisong-Mahur	NH-137	Km 0+000	Km 182+169	182.169	177km (Approx)

As per Authority instructions project road is divided in 10 Packages.

This report deals with the Package-10 i.e. **P.Leikul to Mahur(Borowapu) Section** which needs to be upgraded to Two Lane with paved Shoulders and the details of this road is given in **Table No. 3.2**.

Table 3.2 Details of Project Road

Pkg No.	Name of Road	NH No.	Ex Chainage (in Km)		Length as per existing (in Km)
			From (in Km)	To (in Km)	
10	P. Leikul to Mahur(Borowapu) Section	NH-137	Km 160+875	Km 182+169	21.294 Km

Pkg-10 P. Leikul to Mahur(Borowapu) Section

The Project Stretchstarts from Ex. Km. 160+875 of Tamenglong- Tousem- Haflong Road Near P.Leikul Village, Assam and terminates on Ex. Km. 182+169 of Tamenglong- Tousem- Mahur road near Mahur(Borowapu)Village.

The project road traverses through DimahasaoDistrict in Assam. Thelocationplanofthefull projectroadsectionisillustratedin **Figure3.1**,Start& End point of the Project road have been shown in figure 3.2 to 3.4.

Figure 3.1: Location Map of Tamenglong-Tousem-Laisong-HaflongRoad

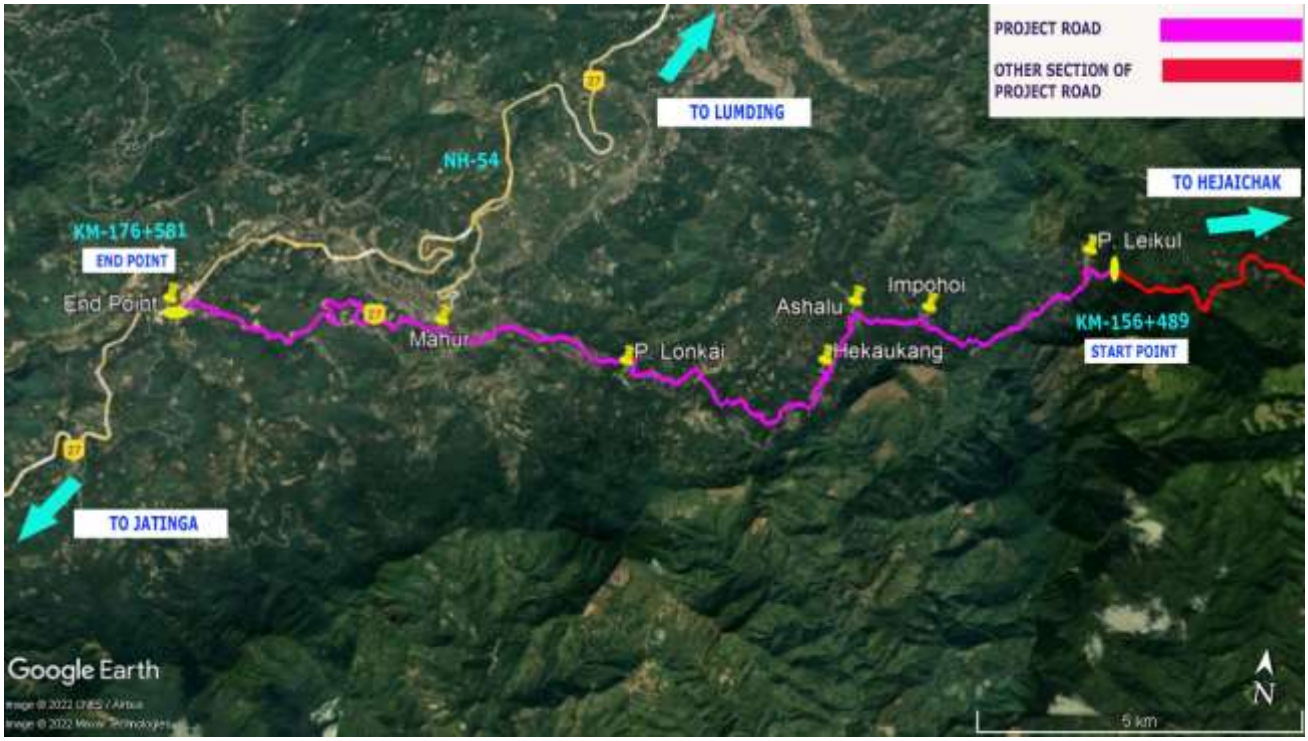


Figure 3.2: Location Map of P. Leikul to Mahur(Borowapu) Section

3.1 Start Point

The project road starts from Ex. Km. 160+875 of Tamenglong- Mahur Road Near P.Leikul Village, Assam.

Figure 3.3: Aerial View of Start Point

3.2 End Point

Project Roadterminates on Ex. Km. 182+169 of Tamenglong- Mahur road near Mahur (Barawapu) Village.

Figure 3.4: Aerial View of End Point

3.3 Importance of Road

- The population of 18 nos. Villages of DimaHasaoDistrict will get directly benefited by Implementation of Project Road.
- Project Road has a vital importance from view of connectivity with National Highway and Manipur-Assam Connectivity & Nagaland Connectivity. As the project road is directly connected to both NH-137& NH- 54which shows the growing importance of the highway. Therefore, up gradation of project road is very important in keeping the view of growing importance and commercial traffic attraction from other adjoining roads to the project road.

3.4 Junctions

The project road crosses different categories roads such as National Highways, State Highways, & Village roads. There are**1 numbers of Major Junctions and 50 numbers of Minor Junctions** exists along the project road. The details of all identified junctions will be enumerated in subsequent reports to be submitted. Some junctions located during reconnaissance survey on project road are depicted in Table no. 3.1.

Table – 3.3
List of junctions located on Project Road

S.NO.	Existing Chainage	Design Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Type of Road (BT/ER)	Detail of Destination of Junction	Remark
1	161+150	156+770	T	Village Road	RHS	ER	To P. Leikul Village	Minor Junction
2	161+250	165+870	X	Village Road	BS	ER	To P. Leikul Village	Minor Junction
3	161+325	156+950	X	Village Road	BS	ER	To P. Leikul Village	Minor Junction
4	161+400	157+010	Y	Village Road	RHS	ER	To P. Leikul Village	Minor Junction
5	161+500	157+100	Y	Village Road	LHS	ER	To P. Leikul Village	Minor Junction
6	161+740	157+330	Y	Village Road	RHS	ER	To P. Leikul Village	Minor Junction
7	163+305	158+815	Y	Village Road	LHS	BT	To Gamvom Village	Minor Junction

S.NO.	Existing Chainage	Design Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Type of Road (BT/ER)	Detail of Destination of Junction	Remark
8	164+880	160+330	Y	Village Road	LHS	ER	To Impoi(H) Village	Minor Junction
9	164+900	160+350	Y	Village Road	RHS	ER	To Impoi(CH) Village	Minor Junction
10	165+010	160+450	Y	Village Road	RHS	ER	To Impoi(CH) Village	Minor Junction
11	166+080	161+500	X	Village Road	BS	ER	To Asalu Village	Minor Junction
12	166+230	161+640	Y	Village Road	RHS	ER	To Asalu Village	Minor Junction
13	166+460	161+870	Y	Village Road	LHS	ER	To Asalu Village	Minor Junction
14	166+640	162+050	Y	Village Road	RHS	ER	To Asalu Village	Minor Junction
15	167+100	162+510	Y	Village Road	LHS	ER	To Asalu Village	Minor Junction
16	167+200	162+615	Y	Village Road	RHS	ER	To Hekaukang Village	Minor Junction
17	167+230	162+650	Y	Village Road	LHS	ER	To Hekaukang Village	Minor Junction
18	167+540	162+950	Y	Village Road	LHS	ER	To Hekaukang Village	Minor Junction
19	168+340	163+710	Y	Village Road	LHS	ER	To Nakhojau Village	Minor Junction
20	168+480	163+840	Y	Village Road	LHS	ER	To Nakhojau Village	Minor Junction
21	169+750	165+070	Y	Village Road	RHS	ER	To Pangmol Village	Minor Junction
22	171+175	166+455	X	Village Road	BS	ER	To N. Lonkai Village	Minor Junction
23	171+215	166+500	Y	Village Road	LHS	ER	To N. Lonkai Village	Minor Junction
24	171+345	166+620	Y	Village Road	RHS	ER	To N. Lonkai Village	Minor Junction
25	171+500	166+770	Y	Village Road	LHS	ER	To N. Lonkai Village	Minor Junction

S.NO.	Existing Chainage	Design Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Type of Road (BT/ER)	Detail of Destination of Junction	Remark
26	171+775	167+000	Y	Village Road	LHS	ER	To P. Lonkai Village	Minor Junction
27	171+880	167+085	Y	Village Road	LHS	BT	To P. Lonkai Village	Minor Junction
28	172+080	167+285	Y	Village Road	RHS	BT	To P. Lonkai Village	Minor Junction
29	172+295	167+500	Y	Village Road	RHS	ER	To Nirianam Village	Minor Junction
30	172+740	167+925	Y	Village Road	RHS	ER	To Nirianam Village	Minor Junction
31	172+825	168+020	Y	Village Road	RHS	ER	To Chudining Village	Minor Junction
32	173+135	168+300	Y	Village Road	RHS	ER	To Chudining Village	Minor Junction
33	173+200	168+370	Y	Village Road	RHS	ER	To Chudining Village	Minor Junction
34	173+540	168+690	X	Town Road	BS	ER	To NchureloaVillage	Minor Junction
35	175+010	170+000	Y	Town Road	RHS	ER	To Assam Rifles Camp	Minor Junction
36	175+875	170+800	Y	Town Road	RHS	ER	To Mahur Town	Minor Junction
37	175+910	170+890	Y	Town Road	LHS	ER	To Mahur Town	Minor Junction
38	176+010	170+975	Y	Town Road	RHS	ER	To Mahur Town	Minor Junction
39	176+245	171+200	Y	Town Road	LHS	ER	To Mahur Town	Minor Junction
40	176+515	171+470	Y	Village Road	LHS	ER	To Daodung Village	Minor Junction
41	176+675	171+530	Y	Village Road	RHS	ER	To Daodung Village	Minor Junction
42	176+800	171+750	Y	Village Road	LHS	ER	To Daodung Village	Minor Junction
43	176+845	171+800	Y	Village Road	RHS	ER	To Daodung	Minor

S.NO.	Existing Chainage	Design Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Type of Road (BT/ER)	Detail of Destination of Junction	Remark
							Village	Junction
44	177+595	172+515	Y	Village Road	LHS	ER	To Daodung Village	Minor Junction
45	177+800	172+690	Y	Village Road	RHS	ER	To Daodung Village	Minor Junction
46	178+325	173+200	Y	Village Road	RHS	ER	To Daodung Village	Minor Junction
47	178+735	173+500	Y	Village Road	LHS	ER	To Daodung Village	Minor Junction
48	182+169	176+581	Y	NH-54	BS	BT	L/s Jatinga R/s Maibong	Major Junction

3.5 Towns / Villages along the Project Highway

18 Numbers of villages/ town are situated near the project stretch. List of such villages is given below in table no.3.2.

Table – 3.4
List of Villages/Towns on the Project Highway

S. No.	Chainage		Length(m)	Village Name
	From	To		
1.	160875	161940	1065	P.Leikul Village
2.	161940	164560	2620	Impoi(H) Village
3.	164560	164720	160	LHS-Impoi(H) Village RHS-Impoi(CH) Village
4.	164720	165275	555	LHS-Asalu Village RHS-Impoi(CH) Village
5.	165275	165800	525	Impoi(CH) Village
6.	165800	167050	1250	Asalu Village
7.	167050	168040	990	Hekaukang Village
8.	168040	168850	810	Nakhojau Village
9.	168850	171000	2150	Pangmol Village
10.	171000	171580	580	N. Lonkai Village
11.	171580	172350	770	P. Lonkai Village
12.	172350	173350	1000	Nrianam Village

13.	173350	174020	670	Chudining Village
14.	174020	174540	520	Nchureloa Village
15.	174540	174850	310	Nkeadamglao Village
16.	174850	175700	850	Mahur
17.	175700	176500	800	Mahur Garden
18.	176500	180100	3600	Daodung & Gudairaji Village
19.	180100	182169	2069	Borowapu Village
Total			**21294**	

3.6 Existing Road alignment

The road passes Hilly terrain throughout the stretch.

Table 3.5Terrain Details

Start Ch.	*End Ch.*	*Type of Terrain*
160.875	182.169	Hilly/ Mountaneous/Steep

3.7 Pavement

Length of project road has 3.0/3.75 m Bituminous Road with 1.0 –1.5m earthen shoulder throughout the project section, which is in poor conditions except at isolated stretches in village portions. Apparently, the average embankment of the road is 1.0 m to 2.0 m. The existing condition of pavement and lane configuration is presented in Table 3.6.

Table 3.6: Summary of Existing Cross-section details

Start Ch.	*End Ch.*	*Length (in km)*	*Type*	*Width (in M)*	*Condition*
160875	175600	14.725	BT	3.0	Fair
175600	182169	6.569	BT	3.75	Poor
Total		**21.294km**			

3.8 DRAINAGE

The general condition of the roadside drains is not satisfactory. Sufficient camber is not provided to drain off the water from carriageway surface. There are no CD structures across the project alignment. The existing road has no proper provision of longitudinal drains on both sides.

3.9 EXISTING ROW:

Existing ROW of 7-10m has been observed on existing alignment.

3.10 Cross drainage structures

From 160.875 to 182.169, 125 no. CD structure has been found. It has been observed that there are 13no.locations where new culvert isto be provided.The summary and proposed improvement for existing bridges and culverts are given Improvement Proposal of this Volume.

Table 3.7 - Summary of Structures

Major Bridge	Minor Bridge	Slab Culvert	FCW	BOX	Hume Pipe Culvert	Burried
NIL	2	18	5	5	81	14

3.11 Road Length passing through Forest Area

As per information by North Cachar Hills Autonomous Council, DimaHasao District no forest land exists on proposed alignment of Tamenglong- Mahur Road.

3.12 RAIL-ROAD CROSSING:

There is no railway under pass exists at project Stretch.

3.13 ONGOING DEVELOPMENT PLANS

Road Construction is under progress by State PWD Department Under PMGSY Scheme.

3.14 ENCROACHMENTS

There are no major encroachments observed anywhere on the road. Few temporary encroachments were observed at Village portions of the road.

3.15 SERVICE ROADS

There are no service roads along the road.

3.16 LAND ACQUISITION

Land Acquisition activities under process.

3.17 TRAFFIC

This Project Road is a link between two Major National Highways i.e. NH-137 (Km. 39.5.0, L/s Khongsang, R/s Tamaei) &NH-54 (L/s Haflong, R/s Mahur). Both National Highways plays an important role in the Interstate connectivity. NH-137 (Km. 39.5.0, L/s Khongsang, R/s Tamaei) Connects Manipur & Assam State while NH-54 (L/s Haflong, R/s Mahur) connects Manipur & Mizoram State. Also, the road is being used for connecting local villages located on either side of road. The traffic mostly consists of Two wheelers and passenger vehicles like cars, three whalers etc because as on today the road is not connected the project road (Tamenglong-Tousem-Laisong-Haflong) is not fully constructed. When Project road will be constructed commercial traffic will increase on a

large scale because of interstate connectivity, other vehicles using the road are Local public buses and bicycles.

3.18 TRAFFIC SURVEY LOCATON

The traffic survey shall be conducted at

A) Classified Volume Count Survey At

1. Km 0+300 (at Tamenglong Town)
2. Km 136+650 (NearMahur town)

B) OD & Axle Load Spectrum Survey

1. At Km 0+000 (at Tamenglong Town)
2. Km 136+650 (Near Mahur town)
3. At NH-54 Near MaibongVillage (Silchar-lumding Section)

C) Axle Load Spectrum Survey

1. AtMahur Town

3.19 TRAFFIC DATA

Traffic data indicating of traffic count at key stations has been collected.

3.20 BYPASSES

No Bypasses required on project road section.

3.21 MISCELLANEOUS SERVICES

Various services available along the existing highway are as follows:-

Fuel Stations: - No Fuel stations were observed on the Project Highway section.

Police Station: -No Police Stationwereobserved on the projectRoad.

3.22 TREES WITHIN ROW

There are many trees within the ROW along both sides of the highway as the major alignment is earthen and passes through dense forest These includeGuava, Mango, Lichi, Zackfood, Banana, Mangroo, Baniyan, Supari (Plantation), Teakwood, Betal Nut, Manipuri Lily and Coconut Trees and Local Trees etc.

3.23 RESOURCES

Labour: - Enough unskilled labour is available in the region.

Material: -

Material	Location	Approx Lead (Km)
Ballast/Stone	Jiri River	20 km
	Lisong River	15 km
Sand	Jiri River	20 km

	Lisong River	15 km
Bitumen VG-40	Guwahati	380km
Bitumen/Emulsion/ PMB	Guwahati	380km
Cement	Guwahati	380km
Steel	Local Market of Mahur	75 km
	Local Market of Guwahati	380km

Note:-

Above Quarries were identified during preliminary survey & it is not approved by the concerned department. Approval of Quarries should be obtained from the concerning department.

3.24 UTILITIES

Electrical Poles: -No Electrical poles are fixed onboth side of the road.

Optical Fiber Cables (OFC):- As per local inquiry, OFC cable has been laid on both side of project highway sections.

Water Supply Main Lines: - As per local inquiry water supply exists in main settlements along the road.

Chapter-4: SOCIO ECONOMIC PROFILE

4.1 Introduction

National Highway & Infrastructure Development Corporation Limited has taken initiatives in the up-gradation and development of its road network in the State. Having a glorious history in the development of National Highways, State Highways, and Major District Roads at various locations in the state of NHIDCL.

This project is project in EPC (Engineering Procurement Construction) The engineering and construction contractor will carry out the detailed engineering design of the project, procure all the equipment and materials necessary, and then construct to deliver a functioning facility or asset to their clients. Companies that deliver EPC Projects are commonly referred to as EPC Contractors. Scheme

This report deals with. **Tamenglong-Tousem- Laisong -Haflong** which needs to be upgraded to Two Lane with paved Shoulders and the details of section is given in Table No. 5.1

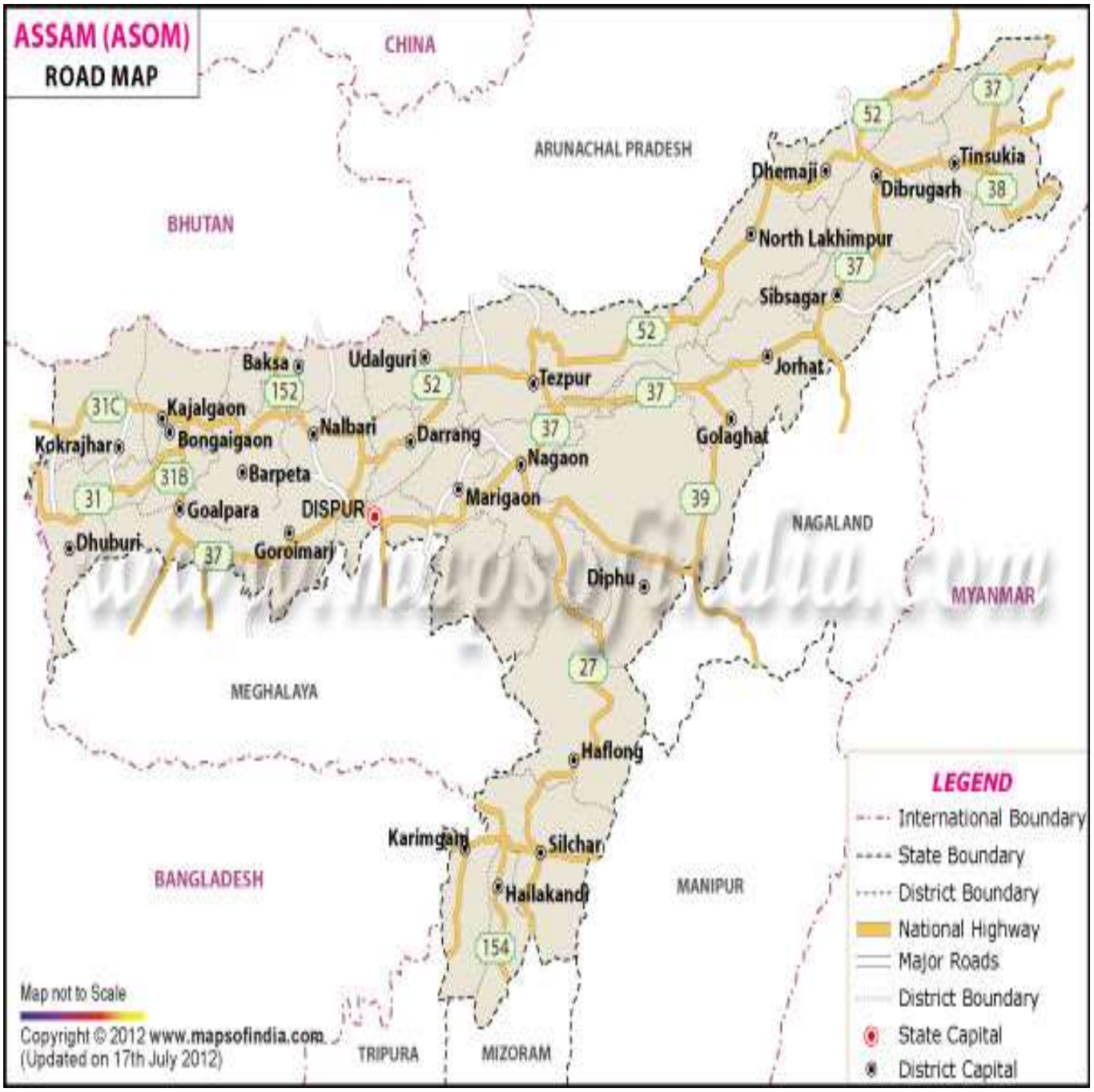
Table 5.1 Details of Project Road

Pkg No.	Name of Road	NH No.	Des. Chainage (in Km)		Length as per Design (in Km)
			From (in Km)	To (in Km)	
10	P.Laikul to Mahur(Borowapu)	NH-137	Km 156+489	Km 176+581	20.092 km

4.2 Objective

The main objective of the consultancy service is for carrying out Feasibility study for finalizing alignment, cost and proper structuring and implementation for National Highway in Tripura State. NHIDCL accordingly proposes to procure the services of feasibility/DPR Consultants for carrying out suitable study for selection of the alignment, field investigation, hydraulic studies, providing detailed structural design, evaluate detailed cost analysis, LA and R&R plan, utility shifting & relocation plan, environmental analysis and implementation of Project Under EPC Mode.

ASSAM STATE


ASSAM (ASOM)
ROAD MAP
CHINA
ARUNACHAL PRADESH
BHUTAN
Dhemaji
Tinsukia
Dibrugarh
North Lakhimpur
Sibsagar
Jorhat
Golaghat
Baksa
Udalguri
Tezpur
Kajalgaon
Bongaigaon
Kokrajhar
Nalbari
Darrang
Nagaon
Barpeta
Marigaon
Goalpara
DISPUR
Dhuburi
Goroimari
Diphu
NAGALAND
MYANMAR
MEGHALAYA
Haflong
Karimganj
Silchar
Hailakandi
BANGLADESH
MANIPUR
TRIPURA
MIZORAM
LEGEND
International Boundary
State Boundary
District Boundary
National Highway
Major Roads
District Boundary
State Capital
District Capital
Map not to Scale
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(Updated on 17th July 2012)

Historical Background

The state of Assam has a rich and ancient history, the foundation of which can be found in the Vedic and Tantric literature, Assamese folklore and Buddhist literature. There has been a confluence of people of the Indo-Aryan, Austro-Asiatic and Tibeto-Burman origin in the state and this has led to the currently existing blend of culture and tradition therein. Through the manuscripts and medieval texts found in the different regions of the state, there have been several attempts by historians to reconstruct the prototype of the history of Assam.

The history and origin of the Indian state of Assam is believed to have mythological roots. In fact, the earliest mention of the area can be found in epics like the Mahabharata and other such religious legends, apart from two medieval texts - the Kalika Purana and the Yogini Tantra. The earliest inhabitants of the region were believed to have lived in the Middle Pleistocene period, around 126,000 years ago, in the Rongram valley of Garo Hills.

Assam was originally called Pragjyotishpur or Kamrupa, during the period of the epics. The historical account of the state begins in the early part of the 4th century, with the establishment of the Varman Dynasty of Pushya Varman. This dynasty is said to have an aboriginal origin, with links to Narakasura. This was followed by the Mlechchha Dynasty of Salasthamba, which continued till the later part of the 9th century. Following this, a new ruler, Brahmapala was elected, leading to the establishment of a new dynasty called the Pala Dynasty. Due to the fall of subsequent rulers and dynasties, the kingdom of Kamrup finally came to an end in the 12th century A.D.

The rise and fall of kingdoms like the Khen Dynasty, Koch Dynasty and the Kachari and the Chutiya Kingdoms was seen in medieval Assam. During this era, a major kingdom called the Ahom Kingdom evolved, which revolutionized the entire cultural and traditional scenario of the state. The end of this era saw the invasion of the state by the Burmese and their subsequent defeat during the early part of the 19th century. Finally, after the signing of the Treaty of Yandaboo, the control of Assam came under the hands of the British, which marked the onset of British rule in the state.

The British set out to organize the administration, transport, and communication systems within Assam. Some of the major changes that came during the colonial rule include the construction of railways, establishment of tea plantation areas and discovery of coal and oil. However, in the post independence period or post-colonial rule, Assam saw the separation of territories, like the partition of Arunachal Pradesh in 1948, Nagaland in 1963, Meghalaya in 1972 and Mizoram in 1987. The population of Assam mainly comprises of the migrants from Burma and China, thus presenting a fusion of Mongol-Aryan culture.

4.2 Geography, Topology & Forests

Geography:

Assam, situated at the foothills of the eastern Himalayas, is the largest State in northeast India and lies in the middle reach of the river Brahmaputra and Barak. The State accounts for nearly 2.4% of India's total geographical area The Brahmaputra basin covers an area of 5,80,000 sq. km out of which 70,634 sq. km falls within Assam. The land has uneven topography, full of hills, plains and rivers. The State is bordering Arunachal Pradesh in the east, West Bengal, Meghalaya, Bangladesh in the west, Arunachal Pradesh, Bhutan in the north and Nagaland, Manipur, Mizoram, Meghalaya, Tripura in the south. Its longitude lies at 88.250E to 96.00E and latitude at 24.50N to 28.00N and temperature varies from 60C to 380C. The humidity that is brought into Assam by the southwest monsoons, shower an average annual rainfall of 120 inches or more on the Brahmaputra valley and the surrounding region. The monsoons are Assam's life line; creating a bio-diversity that can compete with the equatorial rain-forests (State profile, Ministry of Health and Family Welfare, 2009). The topography and the warm and humid climate are conducive to plant and vegetation growth. Assam is home to 51 forest and sub-forest types, and the confluence of diverse patterns of vegetation (Assam Human Development Report, 2003).

The Brahmaputra River flows through Assam from east to west over a length of approximately 650 kilometers. Its main branch originates in the Tibetan plateau, flowing from west to east as the Tsangpo River, and then turns south through the eastern Himalaya as the Dihang River to enter Assam, where it is joined by other branches to form the Brahmaputra. The Barak River rises in the Indian state of Nagaland at an elevation of approximately 2,300 meters and passes through the Manipur Hills of Manipur state over a river length of nearly 400 kilometers. It then flows generally westward from Lakhipur through the Cachar Plains region of Assam over a river length of approximately 130 kilometers to enter Bangladesh near Bhanga (NHC, Background paper, 2006). Each flood season, the Brahmaputra and its tributaries forsake their earlier channels to cut new swathes through the soil. As the water recedes, alluvial deposits remain in the river, giving rise to sandy islands. Some of these islands are very large, and the annually enriched soil has attracted cultivation and semi-permanent settlement. There is a distinct monsoon season in which a large part of the annual rainfall is concentrated.

Topology:

Kaina is a hillock about 921 metres (3,022 ft) above sea level. It is a sacred place for Manipuri Hindus. The legend is that, Shri Govindajee appeared in the dream of his devotee, Shri Jai Singh Maharaja, and asked the saintly king to install in a temple, an image of Shri Govindajee. It was to be carved out of a jack fruit tree, which was then growing at Kaina. It is 29 km (18 mi) from Imphal.

The Dzükou Valley is in Senapati district bordering with Kohima. There are seasonal flowers and a number of flora and fauna. Dzükou derives its meaning from the Angami/Mao word that translates to "Cold Water", referring to the cold stream that flows through the valley. It is at an altitude of 2,438 metres (7,999 ft) above sea level, behind the Japfü Peak in Nagaland. The rare Dzükou lily is found only in this valley

Forests:

The forests in the state are mainly tropical evergreen, semi evergreen, and moist deciduous. Sizeable area is covered with bamboo brakes which virtually form a "Sub climax" resulting from shifting cultivation from time immemorial. The recorded forest area is 6292.681Km2 .This is 59.98% of the total geographical area of the state.

4.6 Location, Climate, Rainfall & Transport

Location:

Assam serves as a major gateway to the northeastern corner of India. Dispur, the capital of Assam, lies in the north-eastern corner of the state. Had it not been for the narrow corridor called the Siliguri corridor in West Bengal, Assam would have been isolated from the rest of India. Geographically, Assam can be divided into Brahmaputra valley in the north, Barak plain in the south, and Karbi Anglong and North Cacher hills that divides the two regions.

Climate:

Assam is temperate (summer max. at 95–100 °F or 35–38 °C and winter min. at 43–46 °F or 6–8 °C) and experiences heavy rainfall and high humidity. The climate is characterised by heavy monsoon downpours reducing summer temperatures and affecting foggy nights and mornings in winters, frequent during the afternoons. Spring (March–April) and autumn (September–October) are usually pleasant with moderate rainfall and temperature. Assam's agriculture usually depends on the south-west monsoon rains.

Rainfall:

The state is drenched in rains from May until mid-October. It receives an average annual rainfall of 1,467.5 millimetres (57.78 in). Rain distribution varies from 933 millimetres (36.7 in) in Imphal to 2,593 millimetres (102.1 in) in Tamenglong. The precipitation ranges from light drizzle to heavy downpour.

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The South Westerly Monsoon picks up moisture from the Bay of Bengal and heads toward Manipur, hits the eastern Himalaya ranges and produces a massive amount of rain. The climate is salubrious with approximate average annual rainfall varying from 933 millimetres (36.7 in) at Imphal to 2,593 millimetres (102.1 in) at Tamenglong. The temperature ranges from sub0 to 36 °C (32 to 97 °F).

4.6 Economy

Assam's economy is based on agriculture and oil. Assam produces more than half of India's tea. The Assam-Arakan basin holds about a quarter of the country's oil reserves, and produces about 12% of its total petroleum. According to the recent estimates,[212] Assam's per capita GDP is ₹ 6,157 at constant prices (1993–94) and ₹ 10,198 at current prices; almost 40% lower than that in India.[213] According to the recent estimates, per capita income in Assam has reached ₹ 6756 (1993–94 constant prices) in 2004–05, which is still much lower than India's.

4.7 Education

Assam schools are run by the Indian government, government of Assam or by private organisations. Medium of instruction is mainly in Assamese, English or Bengali. Most of the schools follow the state's examination board which is called the Secondary Education Board of Assam. Almost all private schools follow the Central Board for Secondary Education (CBSE), Indian Certificate of Secondary Education (ICSE) and Indian School Certificate (ISC) syllabuses.[citation needed].Assamese language is the main medium in educational institutions but Bengali language is also taught as a major Indian language. In Guwahati and Digboi, many Jr. basic schools and Jr. high schools are Nepali linguistic and all the teachers are Nepali. Nepali is included by Assam State Secondary Board, Assam Higher Secondary Education Council and Gauhati University in their HSLC, higher secondary and graduation level respectively. In some junior basic and higher secondary schools and colleges, Nepali teachers and lecturers are appointed.[citation needed]. The capital, Dispur, contains institutions of higher education for students of the north-eastern region. Cotton College, Guwahati, dates back to the 19th century. Assam has several institutions for tertiary education and research.

4.8 Demography

The detail analysis of Population Census 2011 published by Govt. of India for Assam state reveal that population of Assam has increased by 17.07% in this decade compared (2001-2011) to past decade (1991-2001). The density of Assam state in the current decade is 1030 per sq mile.Assam is an State of India with population of Approximate 3.12 Crores.The population of Assam state is **31,205,576.The density of Assam state is 398 per sq km. Assam State is spread over 78,438 Sq Km.**

Sno.	District	Population	Increase	Sec Ratio	Literacy	Density
1	Nagaon	2,823,768	22.00 %	962	72.37 %	711
2	Dhubri	1,949,258	24.44 %	953	58.34 %	896
3	Sonitpur	1,924,110	15.55 %	956	67.34 %	370
4	Cachar	1,736,617	20.19 %	959	79.34 %	459
5	Barpeta	1,693,622	21.43 %	953	63.81 %	742
6	Kamrup	1,517,542	15.69 %	949	75.55 %	489
7	Tinsukia	1,327,929	15.47 %	952	69.66 %	350
8	Dibrugarh	1,326,335	11.92 %	961	76.05 %	392
9	Kamrup Metropolitan	1,253,938	18.34 %	936	88.71 %	1313
10	Karimganj	1,228,686	21.90 %	963	78.22 %	679
11	Sivasagar	1,151,050	9.44 %	954	80.41 %	431
12	Jorhat	1,092,256	9.31 %	962	82.15 %	383
13	Golaghat	1,066,888	12.75 %	964	77.43 %	305
14	Lakhimpur	1,042,137	17.22 %	968	77.20 %	458
15	Goalpara	1,008,183	22.64 %	964	67.37 %	553
16	Morigaon	957,423	23.34 %	967	68.03 %	617
17	Karbi Anglong	956,313	17.58 %	951	69.25 %	92
18	Baksa	950,075	10.74 %	974	69.25 %	387

Sno.	District	Population	Increase	Sec Ratio	Literacy	Density
19	Darrang	928,500	22.19 %	954	63.08 %	586
20	Kokrajhar	887,142	5.21 %	959	65.22 %	269
21	Udalguri	831,668	9.61 %	973	65.41 %	413
22	Nalbari	771,639	11.99 %	949	78.63 %	733
23	Bongaigaon	738,804	20.59 %	966	69.74 %	676
24	Dhemaji	686,133	19.97 %	953	72.70 %	212
25	Hailakandi	659,296	21.45 %	951	74.33 %	497
26	Chirang	482,162	11.34 %	969	63.55 %	251
27	Dima Hasao	214,102	13.84 %	932	77.54 %	44

5.8 DISTRICT DIMA HASAO

History:

Dima Hasao District district was a part of Dimasa Kachari Kingdom before 1832. The kingdom was extended from Jamuna in the North to the foot-hills of Lushai Hills in the south and from the Kopili in the west to the Angami and Katcha Naga hills beyond the Dhansiri in the east. The Dimasa Kachari kings had their capitals successively at Dimapur, Maibang, Kashpur, and, lastly, at Horitikor (Karimganj district near Badarpur). In 1830, the Dimasa king Gobinda Chandra Hasnu was assassinated by his own general Gambhir Singh, after that the British annexed the southern part of the kingdom on 14 August 1832 under the doctrine of Lapsi. The rest was ruled by last Dimasa General Tularam. In 1837, a portion of Tularam's kingdom was further annexed to the British Empire and constituted into a sub-division of Nagaon district in 1837 with Headquarter at Asalu. In 1854, on the death of Tularam, the remaining portion of his kingdom was finally annexed to the British Empire and added to the Asalu sub-division.

Geography:

The district headquarters are located at Haflong. Dima Hasao district occupies an area of 4,888 square kilometres (1,887 sq mi). comparatively equivalent to Brazil's Ilha Grande do Gurupá.[3] It is the third largest district of Assam with 4888 km2 after Karbi Anglong and Sonitpur district. Dima Hasao District is surrounded by Karbi Anglong district (E) and Nagaland on North east, Manipur on East, Nagaon Dist. on North, Karbi Anglong Dist(W) on North-west, Meghalaya on West and Cachar district on South.

Economy:

In 2006 the Indian government named Dima Hasao one of the country's 250 most backward districts (out of a total of 640). It is one of the eleven districts in Assam currently receiving funds from the Backward Regions Grant Fund Programme.

Parliamentary Constituency:

Autonomous District Lok Sabha constituency is one of the 14 Lok Sabha constituencies in Assam, a north eastern state of India. The constituency consists of two autonomous districts namely Dima Hasao and Karbi Anglong which is home of the Dimasa people and Karbi people. The political situation in the area is often volatile, and different armed fractions operate in the area.

Chapter-06: Traffic Survey and Analysis

6.1 Introduction

A team has been formed under the leadership of the traffic engineer who had been carried out in accordance with the guidelines specified by IRC: 9-1972 and IRC: 102-1988.

This Road connects Tripura state with Mizoram state, also the road is being used for connecting local villages located on either side of road. The traffic mostly consists of Two wheelers and passenger vehicles like cars, three whalers etc because as on today the road is not connected the project road (Tamenglong-Tousem-Laisong-Haflong) is not fully constructed. When Project road will be constructed commercial traffic will increase on a large scale because of interstate connectivity, other vehicles using the road are Local public buses and bicycles.

6.2 Traffic Homogeneous Section

The traffic homogeneous sections have been identified based on the major traffic generators and diversion locations along the project corridor. Traffic surveys locations were selected so as to capture representative traffic volume on the homogeneous sections. With a view to capture section wise traffic flow characteristics, this project highway section has been taken as one homogeneous sections.

Homogenous Section-1: The project road starts from Km. 00.00 of Tamenglong- Haflong Road on existing Y – Junction with NH-137 (Km. 39.5.0, R/s Tamaei, L/s Khongsang) in Tamenglong Town, Manipur and terminates on Km. 182.169 of Tamenglong- Haflong near Haflong Town, Assam. The length of the homogenous section is 182.169 Km.

6.3 Collection and Review of Data

The data and information collected for the studies is broadly classified as follows:

- Review of all available reports and published information about the project road and the project influence area;
- Information on existing transportation system in the project influence area;
- Historical data of classified traffic volume on existing road network;
- Economic data and socio-economic parameters of the State/s and the project influence area including demographic data;
- Accident statistics; and
- Vehicle loading behavior (axle load spectrum);
- Influence of rail network on road traffic.

6.4 Traffic Surveys Schedule

It is very important to know the existing information on traffic flow, commodity movement, traffic pattern, and turning movements at junctions in order to assess the traffic behavior on a project road. To capture traffic flow characteristics, travel pattern, speed characteristics and other characteristics related to miscellaneous requirements on the project road, the following primary traffic surveys were conducted:

- Classified Volume Count (CVC) Survey
- Origin Destination Survey
- Axle Load Survey

Traffic survey stations were selected after detailed reconnaissance survey and in line with the TOR. All traffic surveys were carried out as per IRC guidelines given in IRC: SP 19-2001, IRC: 108-1996, IRC SP: 41-1994, IRC: 102-1998, IRC 103- 1988 Pedestrian Facilities and IRC: 09-1972. All above surveys were carried out manually by employing sufficient number of trained enumerators recording information in pre-designed formats. Enumerators were selected from locally available educated people familiar with traffic characteristics and condition of the project road. They were properly briefed and trained about the survey work before putting them on actual survey work in field. An experienced supervisor was kept in-charge for all the locations.

Proper briefing and demonstration to enumerators before the start of work was carried out with; Continuous independent checking by Supervisor/Traffic engineers in the field during the survey work; Checking of filled in survey formats by Traffic engineer; and Validation of computer data entry with raw data.

All the traffic surveys, except intersection count survey, were carried out to capture the traffic in both directions. In intersection count survey, the traffic was captured in each direction of flow through intersection.

The locations for the various surveys were so selected that all the vehicles can be viewed and interpreted easily without endangering the safety of enumerators, drivers and other road users. The most important part of all traffic surveys was to exercise adequate quality control. All the above traffic surveys were carried out as per schedule finalized after considering requirements of TOR. Traffic surveys were carried out at the locations already mentioned in Inception report. Traffic survey schedule for project road is presented in Table 6.1.

Table 6.1: First Traffic Surveys Schedules

Sr. No.	Location	Chainage (Km)	Duration
Classified Volume Count Survey			
1	At Tamenglong Town	Km-0+300	14.09.2017 to 21.09.2017
2	Near Mahur Town	Km-136+650	16.03.2017 to 23.03.2017
O-D Survey			
1	At Tamenglong Town	Km-0+300	1 day (22 sep,2017)
2	At Mahur Town	Km-136+650	1 day (24 March,2017)
3	At NH-54 Near Maibong Village (Silchar-lumding Section)	-	1 day (29 March,2017)
Axle Load Survey			
1	At Mahur Town	Km-136+650	1 day (22 sep,2017)

6.5 Methodology of Traffic Surveys

6.5.1 Classified Volume Count Survey

The objective of classified traffic volume count survey is to estimate traffic intensity on the project road. Classified volume count survey has been carried out at two locations as recommended in TOR. The classified volume count surveys have been carried out for 7 days, 24 hours at each location. The traffic was counted in number of vehicles by vehicle category-wise in each direction in a 15- minute interval over 24 hours a day for 7 Days. For the purpose of counts, a day was divided into three shifts of 8 hours each and different groups of enumerators with a supervisor were assigned for each shift. The counts were recorded in the formats prepared and approved as per IRC specifications. The vehicles were broadly classified into motorized and non-motorized vehicles, which were further sub divided into specific categories of vehicles. The detailed vehicle classification system is presented in Table 6.2.

Table 6.2: Vehicle Classification System Adopted

Motorized Traffic		Non-Motorized Traffic
2-Wheeler		Bi-Cycle
3-Wheeler		Cycle-Rickshaw
Passenger Car		Animal Drawn Vehicle (ADV)
Utility Vehicle (Jeep, Van etc.)		Hand Cart
		Other Non-Motorized Vehicle
Bus	Mini Bus Standard Bus	
LCV	LCV-Passenger	
Truck	MCV : 2-Axle Rigid Chassis	
	HCV : 3-Axle Rigid Chassis	

	MAV	Semi Articulated	
		Articulated	

The traffic count was conducted by the designated trained enumerators in three shifts in a day of eight hour each. The traffic count data was recorded at 60-minute intervals.

6.5.2 Origin – Destination (O-D) & Commodity Movement Survey

Origin and Destination of trips on the existing roads is needed to estimate the information regarding travel characteristics of different users on the project road. The traffic that will use the proposed facility if no toll charges are collected is defined as the Candidate traffic. Origin – Destination data is also needed for identifying the major influence areas of the road, as traffic growth is dependent upon the growth in economic activity in the influencing area. The Origin- Destination survey was carried out to study the travel pattern of goods and passenger traffic along the study corridor. The O-D survey was carried out for one day (12-hour, both directions) at one location. The location of origin and destination zones has been determined in relation to each individual station and the possibility of traffic diversion to the Project road from/to other routes including bypasses. Appropriate locations were selected so as to conduct interviews without affecting movement of other vehicles. The schedule & locations of Origin – Destination Survey are given in Table 6.3.

Table 6.3: Origin – Destination (O-D) Survey Schedule & Location

Sr. No	Location	Date of Survey	Duration of Survey
1.	At Tamenglong Town (Km. 0+300)	22.09.2017	One day
2.	At Mahur Town (Km. 136+650)	24.03.2017	One day
3.	At NH-54 Near Maibong Village (Silchar-lumding Section)	29.03.2017	One day

Roadside Interview Survey (RSI) Method was adopted for conducting the survey. The vehicles were stopped on random sample basis with the help of traffic police. Designated trained enumerators interviewed the drivers. A sample proportion of vehicles were interviewed from the total flow. Variable sampling flow requires a classified hourly count of all vehicles that pass in the direction being studied while interview is in progress. A volume count survey was carried out simultaneously to get the number of vehicles passing in both the directions. The O-D survey was limited Standard Bus, Mini Bus and cars in passenger vehicles category, LCV and trucks (2 axle / 3 axles, Multi – Axle Vehicle) in freight vehicle category. It was ensured that sample size is above 20% as per IRC: SP 19-2001, "Manual for Survey, Investigation and Preparation of Road Projects".

The following pertinent information on travel was collected during the interviews:

- Origin and destination of trips;
- Trip length;
- Trip purpose;
- Travel Time;
- Vehicle Occupancy;
- Type of goods and loading in case of the goods vehicles; and
- Frequency of trips.

Appropriate zoning system was adopted and coding was done for zones and type of vehicle & commodity being carried.

6.5.4 Axle Load Survey

Axle load survey has been conducted at two locations at Km. 136+650 at Mahur Town. Axle load survey in both directions of travel has been carried out in the project road stretch on a random sample basis for LCV, Trucks, and Standard Bus for 24 hours. The services of traffic police of Govt. of Tripura were utilized to regulate the flow of vehicles. The schedule & locations of axle load Survey is given in Table6.4.

Table 6.4: Axle Load Survey Schedule & Locations

Sr. No.	Location	Date of Survey	Duration of Survey
1.	At Mahur Town (Ch-136+650)	24.03.2017	One day

6.6 Equivalency Factor (PCU's)

The following PCU values are taken for Traffic analysis

Table 6.5: Passenger Car Units (PCU) for Rural Highways

Vehicle Type			Equivalency Factor
Fast Moving Vehicles	2 Wheeler		0.5
	3 Wheeler		1.0
	Car/Taxi/Jeep/Van		3.0
	Bus	Mini bus	1.5
		Standard Bus	3.0
	LCV		1.5
	Truck	2 – Axle	3.0
		3 – Axle	3.0
		Multi Axle	4.5
	Agricultural Tractor	With trailer	4.5
		Without trailer	1.5

	Heavy Construction / Earth Moving Equipment	4.5
Slow Moving Vehicles	Bicycle	0.5
	Cycle rickshaw	2.0
	Bullock cart	6.0
	Hand cart	3.0

6.7 Analysis of AADT & PCU

6.7.1 Analysis of Classified Volume Count Survey

Traffic volume count at three locations has been carried out continuously for 7 consecutive days for 24 hours on each day. 7-Day Continuous volume counts were undertaken to obtain a realistic picture of the current volume and composition of the traffic. The analysis of traffic counts provided an estimate of the Average Daily Traffic (ADT). The analysis has been carried out in terms of total number of vehicles and also in respect to Passenger Car Unit (PCU). Location wise results of analysis are discussed below:

A. At Tamenglong Town at Km. 0+300.

Survey was carried out at Km 0+300 at Tamenglong Town.

ADT recorded at this station is 409 nos. / 451 PCU. Fast moving vehicles were recorded as 68.35% of the total traffic (in PCU).

Fig 6.1 Classified Volume Count at Ch-0+300

Peak hour traffic flow of 308 nos. formed around 10.75% of the total traffic. Peak hour is identified during 10.00-11.00 hours.

There will be variation of traffic for each day. The daily and hourly variation of traffic observed at Km 0+300 is presented graphically in Figure 6.2.

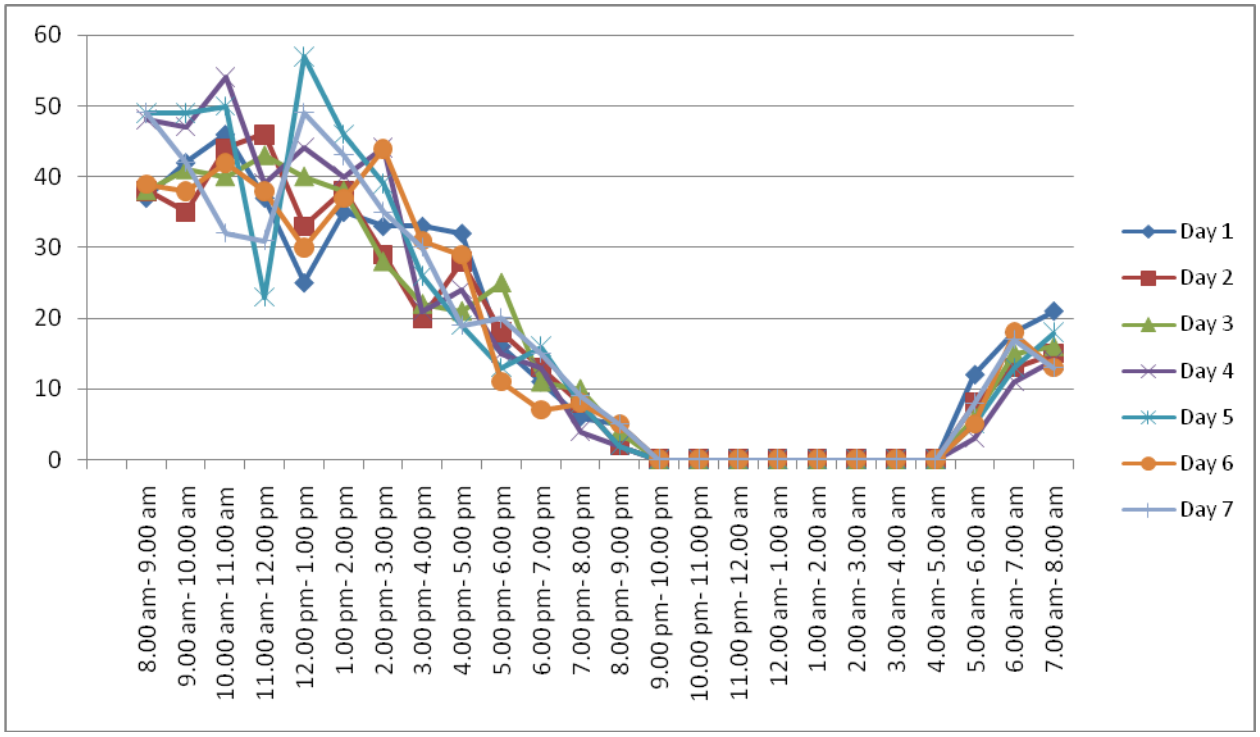

Figure 6.2: Daily and Hourly Variation at Tamenglong Town at Km 0+300

The traffic compositions observed at Tamenglong Town at Km 0+300 is presented graphically in Figure 6.3.

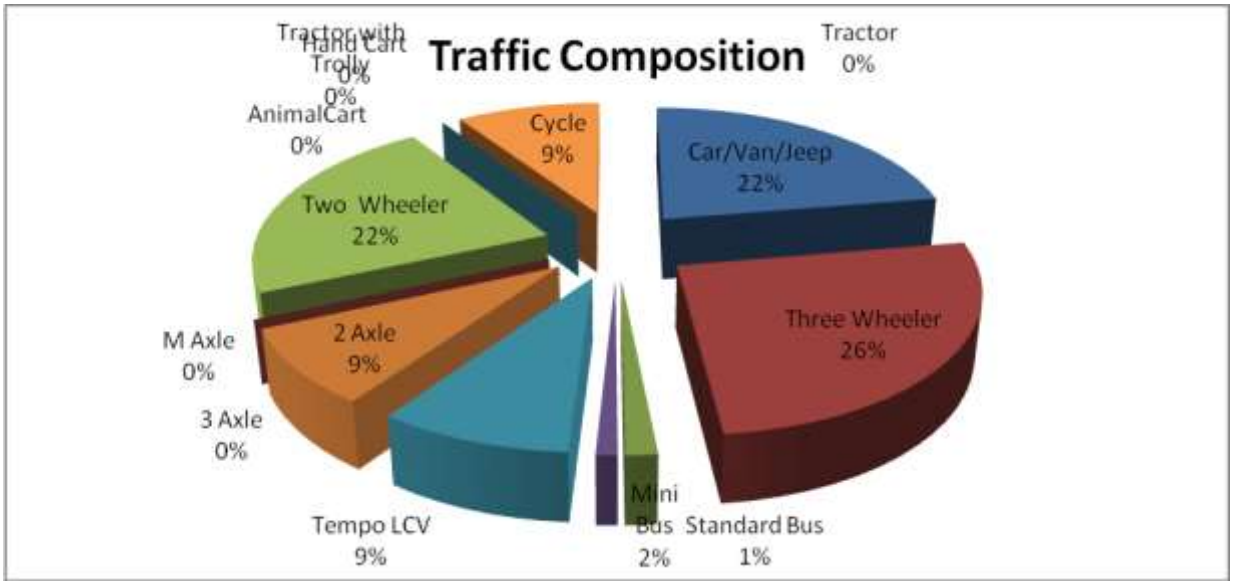

Figure 6.3: Composition of Traffic (By Volume) at Tamenglong Town at Km 0+300

Traffic Volume Count Survey

Tamenglong-Tousem-Liasang-Haflong Road

Location - 0+300 (Tamenglong)

Date-14/9/17-21/9/17

Average Daily Traffic

	Pessenger Vehicles				Commercial Vehicles				Slow Moving						EME/ HCV	Total
	Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	AnimalCart	Hand Cart	Cycle	Tractor with Trolly	Tractor		
PCU Factor	1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5	
DAY 1	97	114	7	4	41	35	0	0	82	0	0	26	0	0	3	409
DAY 2	85	105	7	4	34	39	0	0	81	0	0	31	0	0	2	388
DAY 3	97	109	7	4	31	35	0	0	77	0	0	36	0	0	2	398
DAY 4	103	106	7	4	35	33	0	0	92	0	0	40	0	0	3	423
DAY 5	89	111	5	4	36	43	0	0	93	0	0	50	0	0	2	433
DAY 6	86	96	5	3	28	29	0	0	101	0	0	46	0	0	1	395
DAY 7	80	98	7	5	45	29	0	0	112	0	0	39	0	0	2	417
Total weekly traffic	637	739	45	28	250	243	0	0	638	0	0	268	0	0	15	2863
ADT	***91***	***106***	***6***	***4***	***36***	***35***	***0***	***0***	***91***	***0***	***0***	***38***	***0***	***0***	***2***	***409***
PCU	***91***	***106***	***9***	***12***	***54***	***105***	***0***	***0***	***46***	***0***	***0***	***19***	***0***	***0***	***9***	***451***

B. Km. 136+650 Near Mahur Town

Survey was carried out at km - 136+650 Near Mahur Town.

ADT recorded at this station is 1971 nos./1804 PCU. Fast moving vehicles were recorded as 65.33% of the total traffic (in PCU). Peak hour traffic flow of 1282 nos. formed around 9.28% of the total traffic. Peak hour is identified during 9.00-10.00 hours.

Fig 6.4 Classified Volume Count at km - 136+650 Near Mahur Town

Traffic Volume Count Survey

Tamenglong-Tousem-Liasang-Haflong Road

Location -136+650
Near Mahur Town

Date-16/3/17-23/3/17

Average Daily Traffic

	Pessenger Vehicles				Commercial Vehicles				Slow Moving						EME/ HCV	Total
	Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tractor		
PCU Factor	1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5	
DAY 1	400	640	11	4	131	65	3	0	655	0	0	41	0	0	5	1955
DAY 2	582	494	9	5	75	12	1	0	449	0	0	101	0	0	8	1736
DAY 3	569	559	9	4	98	18	18	0	564	0	0	104	0	0	5	1948
DAY 4	553	878	12	5	134	21	20	0	526	0	0	154	0	0	6	2309
DAY 5	409	583	7	3	127	21	13	0	673	0	0	123	0	0	6	1965
DAY 6	585	450	14	50	42	14	0	0	540	0	0	176	0	0	0	1871
DAY 7	599	538	15	5	115	49	6	0	568	0	0	107	0	0	5	2007
Total weekly traffic	3697	4142	77	76	722	200	61	0	3975	0	0	806	0	0	35	13791
ADT	***528***	***592***	***11***	***11***	***103***	***29***	***9***	***0***	***568***	***0***	***0***	***115***	***0***	***0***	***5***	***1971***
PCU	***528***	***592***	***17***	***33***	***155***	***87***	***27***	***0***	***284***	***0***	***0***	***58***	***0***	***0***	***23***	***1804***

There will be variation of traffic for each day. The daily and hourly variation of traffic observed at km - 136+650 near Mahur Town is presented graphically in Figure 4.5.

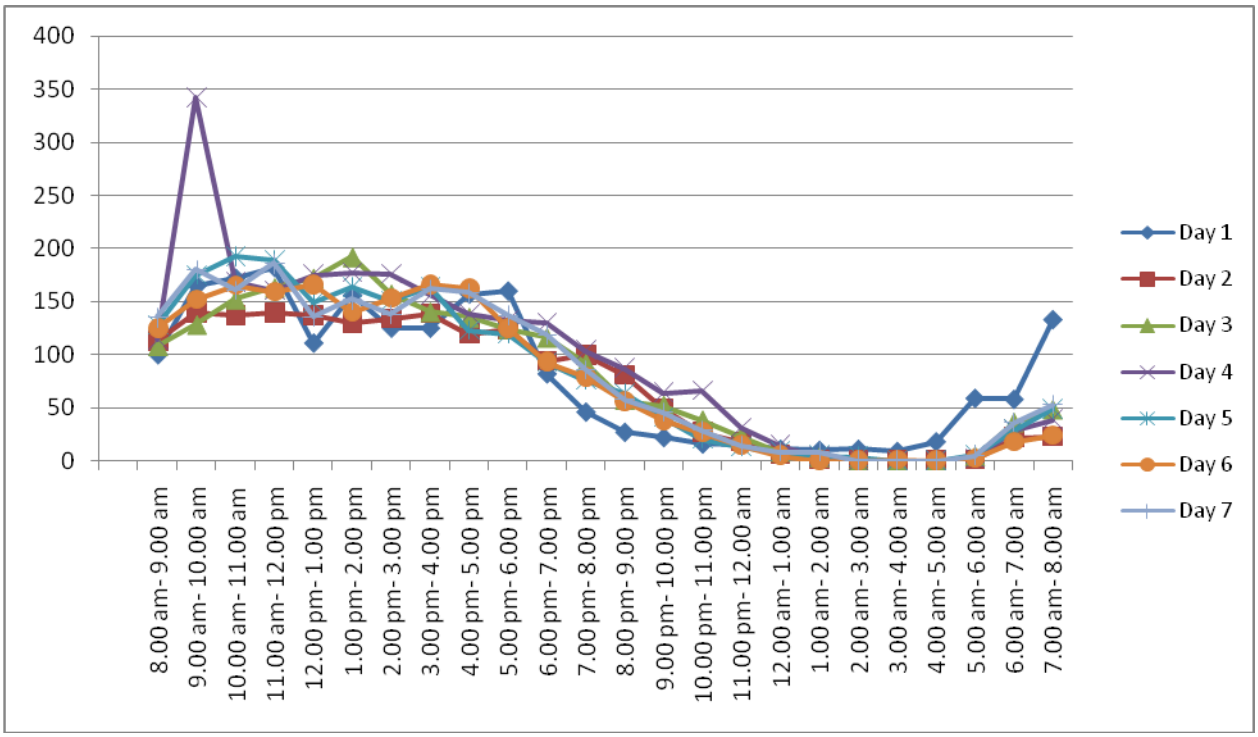

Figure 6.5: Daily and Hourly Variation at km - 136+650 near Mahur Town

The traffic compositions observed at km - 136+650 near Mahur town is presented graphically in Figure 4.6.

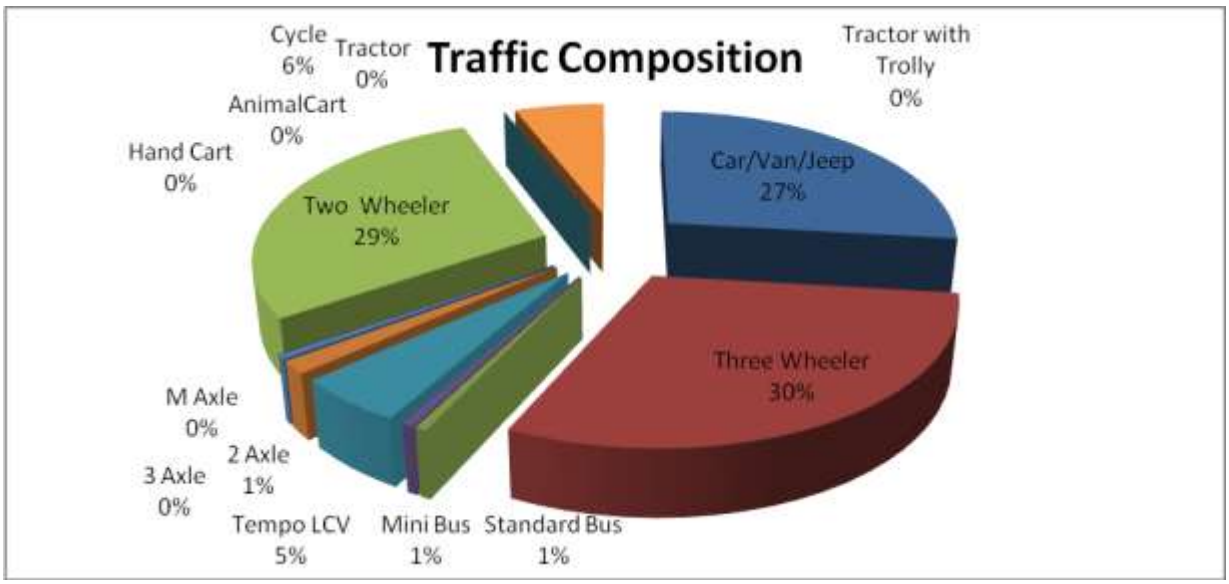

Figure 6.6: Composition of Traffic (By Volume) at km – 136+650 near Mahur Town

Summary of ADT of all two Locations

Categories	PCU Factor	Km 0+300 at Tamenglong Town Location-1		KM-136+650 Near Mahur Town		Average Daily Traffic	
		ADT		ADT			
		Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs
Car/Jeep/Van	1.0	91	91	528	528	310	310
3 Wheeler	1.0	106	106	592	592	349	349
Mini Bus	1.5	6	9	11	17	9	14
Standard Bus	3.0	4	12	11	33	8	24
LCV / Tempo	1.5	36	54	103	155	70	105
2-Axle	3.0	35	105	29	87	32	96
3-Axle	3.0	0	0	9	27	5	15
MAV (4-6)	4.5	0	0	0	0	0	0
Two Wheeler	0.5	91	46	568	284	330	165
Animal Cart	6.0	0	0	0	0	0	0
Cycle	0.5	38	19	115	58	77	39
Tractor with trolly	4.5	0	0	0	0	0	0
Tractor	1.5	0	0	0	0	0	0
Hand Cart	6.0	0	0	0	0	0	0
EME/HCV	4.5	2	9	5	23	4	18
Total Traffic		409	451	1971	1804	1194	1135

6.7.2 Peak Hour Factor (PHF)

The hourly variation of traffic illustrates the distribution of traffic over the day with respect to the time, and the peak hour factor is the maximum percentage of the total traffic that uses the project highway in one single hour of the day. It is of significance as highway capacities and design calculations are based on PHF. The peak hour factor observed at the survey location is summarized as shown in Table 6.8.

Table 6.8: Observed Peak Hour Traffic Characteristics

SR. NO.	Survey Location	Peak Hour Volume (PCU)	ADT (PCU)	PHF (%)	Peak Hour
1	Km. 0+300 At Tamenglong Town	308	409 (451)	10.75%	10.00-11.00 hours.
2	Km.136+650 near Mahur Town	1282	1971 (1804)	9.28%	9.00-10.00 hours.

6.7.3 Directional Distribution of Traffic

The directional distribution analysis, as reported in Table 6.9: below, indicates directional distribution at all three survey locations, there is an almost equal distribution in both directions of travel.

Table 6.9: Directional distribution (in PCU) at Survey Location (%)

Survey Location	Direction	Distribution of Total Vehicle
Km. 0+300 At Tamenglong Town	Tamenglong to Mahur	50.89%
	Mahur to Tamenglong	49.10%
Km. 136+650 Near Mahur Town	Mahur to Tamenglong	49.25%
	Tamenglong to Mahur	50.74%

6.8 Seasonal Variation of Traffic Volume

Seasonal variation trends were observed based on sale of automobile fuel i.e. MS (Petrol) and HSD (Diesel), and average seasonal factors are worked out to arrive at Annual Average Daily Traffic (AADT). The monthly petrol and diesel sale data was collected from a fuel stations project road and its connecting National Highway (NH-54) for the period 2016 to 2017 (1 year). The data on monthly fuel consumption at one fuel stations are presented in Table 6.9

Table 6.9A

Petrol Sales Data (in Litre)			Petrol Sales Data (in Litre)		
		Fuel Stations			Fuel Stations
Year	Month	M/s Assam Oil Petrol Pump, Maibong	Year	Month	M/s Assam Oil Petrol Pump, Maibong
2015	APR	6405	2016	APR	14145
2015	MAY	6619	2016	MAY	14232
2015	JUN	6421	2016	JUN	15133
2015	JUL	6530	2016	JUL	17165
2015	AUG	6909	2016	AUG	18035
2015	SEP	6312	2016	SEP	19160
2015	OCT	11315	2016	OCT	25634
2015	NOV	12620	2016	NOV	21324
2015	DEC	13416	2016	DEC	22420
2016	JAN	15320	2017	JAN	24300
2016	FEB	14115	2017	FEB	25343
2016	MAR	12233	2017	MAR	20300

Diesel Sales Data (in Litre)			Diesel Sales Data (in Litre)		
		Fuel Stations			Fuel Stations
Year	Month	M/s Assam Oil Petrol Pump, Maibong	Year	Month	M/s Assam Oil Petrol Pump, Maibong
2015	APR	12405	2016	APR	19145
2015	MAY	12619	2016	MAY	19232
2015	JUN	13421	2016	JUN	20133
2015	JUL	13530	2016	JUL	20165
2015	AUG	14909	2016	AUG	22035
2015	SEP	14312	2016	SEP	22160
2015	OCT	15315	2016	OCT	28634
2015	NOV	16620	2016	NOV	29324
2015	DEC	17416	2016	DEC	31420
2016	JAN	17320	2017	JAN	32300
2016	FEB	19115	2017	FEB	33343
2016	MAR	14345	2017	MAR	30300

Month	Avg. Sales (Lt.)		Avg. Seasonal Correction Factor		Peak Seasonal Correction Factor	
	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel
APR	10275	15775	1.44	1.29	1.93	1.66
MAY	10426	15926	1.42	1.28	1.90	1.65
JUN	10777	16777	1.37	1.22	1.84	1.56
JUL	11848	16848	1.25	1.21	1.67	1.56
AUG	12472	18472	1.19	1.10	1.59	1.42
SEP	12736	18236	1.16	1.12	1.56	1.44
OCT	18475	21975	0.80	0.93	1.07	1.19
NOV	16972	22972	0.87	0.89	1.17	1.14
DEC	17918	24418	0.83	0.84	1.11	1.07
JAN	19810	24810	0.75	0.82	1.00	1.06
FEB	19729	26229	0.75	0.78	1.00	1.00
MAR	16267	22323	0.91	0.91	1.22	1.17
Avg. Sales Per Month	14809	20397				

6.9 Average Annual Daily Traffic (AADT)

To derive the AADT from the ADT observed in March to account for seasonality in traffic a seasonal correction factor is used. As regular classified traffic count data is not available to assess seasonal variation in traffic on the Project road. The fuel sales data from the different fuel stations located along the project roadside are collected and used to calculate the seasonal correction factor.

Average Seasonal Correction Factor for Petrol operated vehicles =	0.91
Average Seasonal Correction Factor for Diesel operated vehicles =	0.91
Average Seasonal Correction Factor to be considered for both type of vehicles =	0.92
Peak Seasonal Correction Factor for Petrol operated vehicles =	1.00
Peak Seasonal Correction Factor for Diesel operated vehicle =	1.00
Peak Seasonal Correction Factor to be considered for both type of vehicles =	1.01

The Average Seasonal Correction Factor (ASCF) has been applied on the ADT observed at the count location to derive AADT. 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.

The annual average daily traffic (AADT) observed by normalizing the average daily traffic (ADT) at the survey location given in Table 6.10.

Table 6.10: Annual Average Daily Traffic (AADT)

Categories	PCU Factor	Km. 0+300 at Tamenglong town Location-1		Km. 136+650 near Mahur town Location-2		Average of all locations	
		Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs
Car/Jeep/Van	1.0	109	109	634	634	372	372
3 Wheeler	1.0	127	127	710	710	419	419
Mini Bus	1.5	7	11	13	20	10	15
Standard Bus	3.0	5	15	13	39	9	27
LCV / Tempo	1.5	43	64	124	186	84	126
2-Axle	3.0	42	126	35	105	39	117
3-Axle	3.0	0	0	11	33	6	18
MAV (4-6)	4.5	0	0	0	0	0	0
Two Wheeler	0.5	109	54	682	341	396	198
Animal Cart	6.0	0	0	0	0	0	0
Cycle	0.5	46	23	138	69	92	46
Tractor with trolly	4.5	0	0	0	0	0	0
Tractor	1.5	0	0	0	0	0	0
Hand Cart	6.0	0	0	0	0	0	0
EME/HCV	4.5	2	9	6	27	4	18
Total Traffic		490	538	2366	2164	1431	1356

6.10 Travel Pattern (Origin Destination Survey)

In order to understand the travel demand pattern in the region, origin & destination (O-D) Surveys were carried out at proposed survey locations i.e., at km 0+300 at Tamenglong town. The Survey were typically started in the morning & continued as per schedule. The O-D Survey elicited characteristics like origin, Destination, Frequency, Purpose & Commodity etc. both for Passenger & Goods Vehicles. The information collected during road side interviews was analyzed to obtain the trip distribution based on a zoning system suitably designed in the study.

6.10.1 Sample Size & Expansion factors

The Vehicles during the O-D surveys were interviewed on a random sample basis. Based on the sample size of different categories of vehicle interviewed during the O-D Survey expansion factors were calculated for generating the expanded form of O-D Matrix. The Following Table 6.11 Shows the Survey Location wise AADT, Sample Size & Expansion Factors for the different homogeneous section Adopted.

Table 6.11 Sample Size Collected in origin Destination Survey

MODE	Car	Mini Bus	Bus	LCV	2 axle	3 axle	MAV	Total
Km- 0+300 (At Tamenglong Town)								
OD Samples	22	2	1	9	9	0	0	43
AADT	109	7	5	43	42	0	0	206
% age	20	20	20	20	20	20	20	20
Km- 136+650 (Near Mahur Town)								
OD Samples	126	3	3	25	7	2	0	166
AADT	634	13	13	124	35	11	0	830
% age	20	20	20	20	20	20	20	20
At NH-54 Near Maibong Village (Silchar-lumding Section)								
OD Samples	1690	30	31	300	130	50	17	2248
AADT	8453	153	157	1503	648	247	84	11245
% age	20	20	20	20	20	20	20	20

Based on the sample size of different categories of vehicles interviewed during the O-D Survey, direction wise expansion factors were calculated for the expansion of O-D matrix generated from the sample data to assess the travel pattern of the vehicle plying on the project road.

6.10.2 Zoning System

To understand the spatial dimensions of the trip characteristics of the vehicles interviewed during the OD survey, a detailed zoning system was developed giving due consideration to the following factors:

- The road network catering to the traffic on the project road and its generating points
- Important towns, village, factories, and industrial centers around the project road.
- Administrative boundaries of districts and states.

Configuration of the project road in the regional road network with respect to other road.

Two major type of area (IIA): Immediate Influence area includes the cities/towns/villages and districts along the project road. In this study is consists of Major Towns of Manipur, Assam, Nagaland & Intermediate areas of Project road also include major districts contributing traffic share on the project road like Tamenglong & Dima hasao.

Board Influence Area (BIA): Board Influence Area included the states of Assam, Manipur, Meghalaya, Nagaland, Arunachal Pradesh, Sikkim, Meghalaya and the influence of rest of India is also taken into account.

The zoning system adopted for data collection was based on 13 traffic analysis zones (TAZ).

6.10.3 Regional Distribution

Based on the zoning system devised for this study, the sample data has been expanded using factors based on the total AADT.

The traffic on stretch is analyzed keeping in view the movement of traffic in surrounding road network mainly focusing the traffic generating points like Khongsang, Imphal, Jiribam, Silchar, Lumding and considering various factor such as distance, toll location, terrain etc. So, based on the devised OD matrices, the regional distribution of the toll able vehicles have been worked out of the proposed toll plaza location in Table 6.12, which indicates the traffic generated from the different traffic zones.

Table 6.12: Regional Distribution of traffic (in %) at km 0+300 at Tamenglong Town (O-D)

Region/Modes	Cars	LCV/ Tempo	2-Axle	3-Axle	Bus
Project Road (Tamenglong Town ,Namtiram-II, Phelong, Namtira,m, Azuram, Mandu,New Tousem, Old Tousem, Poklong, Katangnam, Villages)	9.2	5.1	0	0	0
Khongsang, Imphal	25.2	30.2	100	100	100
Dimapur(Nagaland)	25.7	24.5	0	0	0
Jiribam	24.4	22	0	0	0
Other Towns of Manipur	15.5	18.2	0	0	0
Tripura	0	0	0	0	0
Meghalaya	0	0	0	0	0
Arunachal Pradesh	0	0	0	0	0
Assam	0	0	0	0	0
Other States	0	0	0	0	0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 6.13: Regional Distribution of traffic (in %) Km.136+650 at Mahur Town (O-D)

Region/Modes	Cars	LCV/ Tempo	2-Axle	3-Axle	Bus
Project Road (Tunje, Bamdi, Hajaichak, Lisang, Tulpui, Imphohoi, Asalu, Lonkai N,, Hekokang, Naptop Leikek Villages, & Mahur Town)	25.6	21.2	21.4	28.1	19.2
Silchar	10.8	18.2	23.2	20.2	13.8
Guwahati	15.7	21.5	24.6	22.1	23.2
Other Towns of Assam	15.9	8.7	5.8	6.0	12.0
Nagaland	12.8	8.3	9.3	8.2	18.0
Manipur State	10.1	11.2	10.3	10.1	9.2
Tripura State	1.8	4.6	1.4	1.4	1.8
Meghalaya State	4.1	4.3	2.5	2.6	2.8
Arunachal Pradesh State	0	0	0	0	0
Mizoram State	0.8	1.1	1.5	1.3	0
Other States	2.4	0.9	0	0	0
Total	**100**	**100**	**100**	**100**	**100**

Table 6.14: Regional Distribution of traffic (in %) At NH-54 Near Maibong Village (Silchar-lumding Section) (O-D)

Region/Modes	Cars	LCV/ Tempo	2-Axle	3-Axle	Bus
Project Road (Tamenglong to Mahur Town)	5.6	4.2	2.4	2.1	1.2
Manipur State(Imphal & Other Districts)	15.1	23.2	26.3	25.1	31.2
Silchar	20.8	18.2	23.2	20.2	13.8
Other Towns of Assam	5.9	8.7	5.8	6.0	4.6
Nagaland	2.8	1.3	2.3	3.2	1.8
Tripura State	21.8	14.6	11.4	17.4	16.8
Meghalaya State	4.1	4.3	2.5	2.6	2.8
Arunachal Pradesh State	0	0	0	0	0
Mizoram State	21.5	24.6	26.1	23.4	27.8
Other States	2.4	0.9	0	0	0
Total	**100**	**100**	**100**	**100**	**100**

As per OD Survey & Zoning Analysis, it can be predicted that the Traffic may be diverted on Project Road from 2 Survey Locations.

The Diverted Traffic on Project Road is calculated below:-

MODE	Car	Mini Bus	Bus	LCV	2 axle	3 axle	MAV	Total
Km- 136+650 (Near Mahur Town)								
AADT	634	13	13	124	35	11	0	830
% Diverted	10.1	9.2	9.2	11.2	10.3	10.1	10.1	
Diverted Traffic	64	1	1	12	4	1	0	86
At NH-54 Near Maibong Village (Silchar-lumding Section)								
AADT	8453	153	157	1503	648	247	84	11245
% Diverted	15.1	31.2	31.2	23.2	26.3	25.1	25.1	
Diverted Traffic	1276	49	49	349	170	62	21	1976
Total Diverted Traffic	**1340**	**50**	**50**	**361**	**174**	**63**	**21**	**2059**

6.11 Axle Load Survey

Axle Load Survey was carried out along with O-D Survey at on the Survey Stations, near the 7-day traffic Volume count survey location. The Survey was conducted to assess the cumulative No. equivalent standard axles based on the survey of goods vehicles follows and axle weight distribution and calculate the vehicle damage factor which causes damage to the pavement.

6.11.1 Vehicle damage Factor

The Axle Load Surveys Were conducted at all Prioritized locations, the spectrum of axle loads and the no. of equivalent 8.16T standard axles for the different categories of commercial vehicles have been determined on the basis of the axle load survey .

The equation for computing equivalency factor for single, tandem & tridem axles given below is used as directed in the IRC-37:2018 for converting different axle load repetitions into equivalent standard axle load repetitions.

- Single axle with single wheel on either side = {axle load in KN / 65}4
- Single axle with dual wheel on either side = {axle load in KN / 80}4
- Tandem axle with single wheel on either side = {axle load in KN / 148}4
- Tridem axle with dual wheel on either side = {axle load in KN / 224}4

The VDF of the different types of vehicles weighed at the above location.

Summary of VDF

LOCATION	DIRECTION	LCV	Bus	2 AXLE	3 AXLE
KM - 136+650	**Mahur- Jiri River**	0.001	0.157	1.207	3.531
	Jiri River- Mahur	0.009	0.337	2.696	8.848
	Adopted VDF	**0.009**	**0.337**	**2.696**	**8.848**

6.12 Traffic Demand Assessment

The traffic assessment of the project road is incomplete without assessment of the generated traffic on the corridor. And for a Toll road project it is very important to ascertain all the factors that will contribute to the traffic on the project road after improvement.

. Diverted Traffic

. Induced Traffic

Generally the project road will play the vital role in connectivity of two states i.e. Manipur & Assam. Now, Assam & Manipur connectivity is mainly depends on only one national Highway i.e NH- 53 other than this National Highway no other major roads exists till date. But as on today a very less or negligible traffic move to Assam from Tamenglong Town, as the existing road is in poor condition & maximum stretches is Earthen Road which is not accessible in rainy season. Also, one Bridge at barak river(Ch-15+325) has been collapsed recently.

So, induced traffic can be assumed after construction of road. Hence, it will be a large scale Increase in traffic after finalization of this project.

6.13 TRAFFIC ESTIMATION AND FORECAST

6.13.1 General

As the project road is executed on EPC basis, an estimation of the traffic expected to use the tolled highway and its future growth are important elements assess the project's economics as they are generally the main /sole source of revenue for the project. This chapter details various aspects of the project road traffics and its growth potential.

6.13.2 Project Road Traffic

The traffic that is likely to use the project road was estimated on the basis of the traffic and travel characteristics data gathered through primary as well as secondary surveys. The traffic on the project road would normally consist of the following components

- Normal Traffic
- Diverted Traffic
- Induced/New Generated Traffic

6.13.2.1 Normal Traffic

Normal traffic is the traffic which is playing on the project road, which has been assessed on the Basis on the traffic surveys carried out and described in previous section, and its project growth.

6.13.2.2 Diverted Traffic

Diverted traffic is generally dictated by the presence of the alternative route at a cheaper generalized cost.

6.13.2.3 Induced Traffic

Induced/new generated traffic is the one which would be generated, over and above normal growth, because of lowering of transport costs or new developments in the immediate influence area of the project road.

6.13.3 Traffic Projections

6.13.3.1 Projections of Traffic Normal Traffic @7.5% growth rate

The traffic projected on normal traffic census is done for the period up to year 2045 based upon 5% growth rates. The total projected traffic at each survey location is show in Table-4.14 for projections for traffic on project road.

6.13.3.2 Projection of including diverted and induced traffic

The traffic projected on normal traffic census is done for the period up to year 2045 based upon suitable growth rates as considered for normal traffic projections. The total projected traffic at each survey location is show in Table-4.15 for projections for traffic including diverted traffic on project road.

Table 6.14: Projection of Normal AADT @growth rate 7.5%

		Growth Rate	Pessenger Vehicles				Commercial Vehicles				Slow Moving Vehicles						EME/ HCV	ADT	PCU
			Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	AnimalCart	Hand Cart	Cycle	Tractor with Trolly	Tractor			
Year			1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5		
Construction Period	2017		282	318	8	7	64	29	4	0	300	0	0	70	0	0	4	1086	1031
	2018	7.5%	303	342	9	8	69	31	4	0	323	0	0	75	0	0	4	1168	1108
	2019	7.5%	326	368	10	9	74	33	4	0	347	0	0	81	0	0	4	1256	1190
	2020	7.5%	350	396	11	10	80	35	4	0	373	0	0	87	0	0	4	1350	1278
	2021	7.5%	376	426	12	11	86	38	4	0	401	0	0	94	0	0	4	1452	1374
1	2022	7.5%	404	458	13	12	92	41	4	0	431	0	0	101	0	0	4	1560	1475
2	2023	7.5%	434	492	14	13	99	44	4	0	463	0	0	109	0	0	4	1676	1583
3	2024	7.5%	467	529	15	14	106	47	4	0	498	0	0	117	0	0	4	1801	1698
4	2025	7.5%	502	569	16	15	114	51	4	0	535	0	0	126	0	0	4	1936	1825
5	2026	7.5%	540	612	17	16	123	55	4	0	575	0	0	135	0	0	4	2081	1960
6	2027	7.5%	581	658	18	17	132	59	4	0	618	0	0	145	0	0	4	2236	2104
7	2028	7.5%	625	707	19	18	142	63	4	0	664	0	0	156	0	0	4	2402	2257
8	2029	7.5%	672	760	20	19	153	68	4	0	714	0	0	168	0	0	4	2582	2424
9	2030	7.5%	722	817	22	20	164	73	4	0	768	0	0	181	0	0	4	2775	2602
10	2031	7.5%	776	878	24	22	176	78	4	0	826	0	0	195	0	0	4	2983	2795
11	2032	7.5%	834	944	26	24	189	84	4	0	888	0	0	210	0	0	4	3207	3004

		Growth Rate	Pessenger Vehicles				Commercial Vehicles				Slow Moving Vehicles						EME/ HCV	ADT	PCU
			Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	AnimalCart	Hand Cart	Cycle	Tractor with Trolly	Tractor			
Year			1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5		
12	2033	7.5%	897	1015	28	26	203	90	4	0	955	0	0	226	0	0	4	3448	3227
13	2034	7.5%	964	1091	30	28	218	97	4	0	1027	0	0	243	0	0	4	3706	3467
14	2035	7.5%	1036	1173	32	30	234	104	4	0	1104	0	0	261	0	0	4	3982	3723
15	2036	7.5%	1114	1261	34	32	252	112	4	0	1187	0	0	281	0	0	4	4281	4000
16	2037	7.5%	1198	1356	37	34	271	120	4	0	1276	0	0	302	0	0	4	4602	4297
17	2038	7.5%	1288	1458	40	37	291	129	4	0	1372	0	0	325	0	0	4	4948	4619
18	2039	7.5%	1385	1567	43	40	313	139	4	0	1475	0	0	349	0	0	4	5319	4965
19	2040	7.5%	1489	1685	46	43	336	149	4	0	1586	0	0	375	0	0	4	5717	5334
20	2041	7.5%	1601	1811	49	46	361	160	4	0	1705	0	0	403	0	0	4	6144	5729

Table 6.15: Projection of AADT including diverted and induced traffic @Growth Rate of 7.5%

		Growth Rate	Pessenger Vehicles				Commercial Vehicles				Slow Moving Vehicles						EME/ HCV	AADT	PCU
			Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	AnimalCart	Hand Cart	Cycle	Tractor with Trolly	Tractor			
Year			1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5		
Construction Period	2017		282	318	8	7	64	29	4	0	300	0	0	70	0	0	4	1086	1031
	2018	7.5%	303	342	9	8	69	31	4	0	323	0	0	75	0	0	4	1168	1108
	2019	7.5%	326	368	10	9	74	33	4	0	347	0	0	81	0	0	4	1256	1190
	2020	7.5%	350	396	11	10	80	35	4	0	373	0	0	87	0	0	4	1350	1278
	2021	7.5%	376	426	12	50	86	38	4	0	401	0	0	94	0	0	4	1491	1491
Adding Diverted Traffic			1340	0	50	50	361	174	63	21	0	0	0	0	0	0	0	2059	2912
1	2022	7.5%	1744	458	63	104	453	215	67	21	431	0	0	101	0	0	4	3661	4513
2	2023	7.5%	1471	492	68	112	487	405	72	23	463	0	0	109	0	0	4	3706	4970
3	2024	7.5%	1581	529	73	120	524	435	77	25	498	0	0	117	0	0	4	3983	5340
4	2025	7.5%	1700	569	78	129	563	468	83	27	535	0	0	126	0	0	4	4282	5741
5	2026	7.5%	1828	612	84	139	605	503	89	29	575	0	0	135	0	0	4	4603	6170
6	2027	7.5%	1965	658	90	149	650	541	96	31	618	0	0	145	0	0	4	4947	6630
7	2028	7.5%	2112	707	97	160	699	582	103	33	664	0	0	156	0	0	4	5317	7125
8	2029	7.5%	2270	760	104	172	751	626	111	35	714	0	0	168	0	0	4	5715	7656
9	2030	7.5%	2440	817	112	185	807	673	119	38	768	0	0	181	0	0	4	6144	8230
10	2031	7.5%	2623	878	120	199	868	723	128	41	826	0	0	195	0	0	4	6605	8846

		Growth Rate	Pessenger Vehicles				Commercial Vehicles				Slow Moving Vehicles						EME/ HCV	AADT	PCU
			Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	AnimalCart	Hand Cart	Cycle	Tractor with Trolly	Tractor			
Year			1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5		
11	2032	7.5%	2820	944	129	214	933	777	138	44	888	0	0	210	0	0	4	7101	9509
12	2033	7.5%	3032	1015	139	230	1003	835	148	47	955	0	0	226	0	0	4	7634	10219
13	2034	7.5%	3259	1091	149	247	1078	898	159	51	1027	0	0	243	0	0	4	8206	10985
14	2035	7.5%	3503	1173	160	266	1159	965	171	55	1104	0	0	261	0	0	4	8821	11809
15	2036	7.5%	3766	1261	172	286	1246	1037	184	59	1187	0	0	281	0	0	4	9483	12693
16	2037	7.5%	4048	1356	185	307	1339	1115	198	63	1276	0	0	302	0	0	4	10193	13641
17	2038	7.5%	4352	1458	199	330	1439	1199	213	68	1372	0	0	325	0	0	4	10959	14666
18	2039	7.5%	4678	1567	214	355	1547	1289	229	73	1475	0	0	349	0	0	4	11780	15764
19	2040	7.5%	5029	1685	230	382	1663	1386	246	78	1586	0	0	375	0	0	4	12664	16945
20	2041	7.5%	5406	1811	247	411	1788	1490	264	84	1705	0	0	403	0	0	4	13613	18215

Chapter-6: Engineering Survey & Investigation

6.1 ROAD INVENTORY AND ROAD CONDITION:

An inventory of the project road has been carried out by visual observations supplemented with sample measurements using tape etc. Kilometer wise features like terrain, land-use, surfacing type and width, shoulder, sub grade, local soil type, curve details, intersectional details, retaining structures details, location of water bodies, height of embankment or depth of cut, ROW, CD structures, road side arboriculture, existing utility services, general drainage conditions etc., were recorded. The road inventory has been referenced to the existing km posts established along the roadside.

The Project Stretch starts from Ex. Km. 160.875 of Tamenglong- Mahur Road Near P.Leikul Village, Assam and terminates on Ex. Km. 182.169 near Mahur (Borawapu) Village of Tamenglong- Mahur Road, Assam.

6.2 TERRAIN :

The terrain along the road is Hilly. Table 6.1 shows width of formation and carriageway.

Table: 6.1 Terrain Details

Ex Ch From (Km)	*Ex Ch To (Km)*	*Length(km)*	*Type (P/R/H)*
160875	182169	21.294	Hilly
Total		21.294	

6.3 LAND USE:

The land use along the project road is predominantly agricultural & Builtup. Table 6.2 shows width of formation and carriageway.

Table: 6.2 Land use

S. No.	Ex Chainage		Length (in m)	Land Use
	From	To		
1.	160875	161100	225	Agricultrure
2.	161100	161800	700	Builtup
3.	161800	164550	2750	Agricultrure
4.	164550	165200	650	Builtup
5.	165200	165800	600	Agricultrure
6.	165800	166700	900	Builtup
7.	166700	166850	150	Agricultrure
8.	166850	167850	1000	Builtup
9.	167850	171000	3150	Agricultrure
10.	171000	172050	1050	Builtup
11.	172050	172700	650	Agricultrure
12.	172700	173350	650	Builtup
13.	173350	174550	1200	Agricultrure

S. No.	Ex Chainage		Length (in m)	Land Use
14.	174550	177700	3150	Builtup
15.	177700	182169	4469	Agricultrure

6.4 CARRIAGEWAY WIDTH:

The project road is road is mainly single lane Bituminous Track. Table 6.3 shows width of formation and carriageway.

Table: 6.3 Carriageway width

S. No.	Chainage		Length	Road Type	Carriageway Width
	From	To			
1	160875	175600	14.72 5	BT	3.0
2	175600	182169	6.569	BT	3.75

6.5 SURFACING TYPE:

The project road has 3.0 m Bituminous Track with 1.0 –1.5m earthen shoulder throughout the project section, which is in Fair conditions.

6.6 SHOULDER:

Apparently, the average shoulder of the road is 1.0 m to 1.5 m on existing Road.

6.7 EMBANKMENT HEIGHT:

Higher embankment exists at approaches to the bridges and at hilly portion. The condition of the embankment is poor.

6.8 VILLAGES AND TOWNS:

The villages and towns through which the project road passes are listed in Table 6.4

Table 6.4 List of Villages along to project road

S. No.	Chainage		Length(m)	Village Name
	From	To		
1.	160875	161940	1065	P.Leikul Village
2.	161940	164560	2620	Impoi(H) Village
3.	164560	164720	160	LHS-Impoi(H) Village RHS-Impoi(CH) Village
4.	164720	165275	555	LHS-Asalu Village RHS-Impoi(CH) Village
5.	165275	165800	525	Impoi(CH) Village
6.	165800	167050	1250	Asalu Village
7.	167050	168040	990	Hekaukang Village

8.	168040	168850	810	Nakhojau Village
9.	168850	171000	2150	Pangmol Village
10.	171000	171580	580	N. Lonkai Village
11.	171580	172350	770	P. Lonkai Village
12.	172350	173350	1000	Nrianam Village
13.	173350	174020	670	Chudining Village
14.	174020	174540	520	Nchureloa Village
15.	174540	174850	310	Nkeadamglao Village
16.	174850	175700	850	Mahur
17.	175700	176500	800	Mahur Garden
18.	176500	180100	3600	Daodung & Gudairaji Village
19.	180100	182169	2069	Borowapu Village
Total			**21294**	

6.9 ROAD JUNCTIONS:

There are 1 Major Junction & 50 Minor Junctions on the project road. List of all Junctions & Intersection area as follows: -

Table 6.5: Major Junctions

Sr. No.	Existing Chainage	Category of Road	Type of junction	Remarks
1	182+169	NH-54(L/s Jatinga R/s Maibong)	**Y**	

Table 6.6: Minor Junctions

S.NO.	Existing Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Detail of Destination of Junction
1	161+150	T	Village Road	RHS	To P. Leikul Village
2	161+250	X	Village Road	BS	To P. Leikul Village
3	161+325	X	Village Road	BS	To P. Leikul Village
4	161+400	Y	Village Road	RHS	To P. Leikul Village
5	161+500	Y	Village Road	LHS	To P. Leikul Village
6	161+740	Y	Village Road	RHS	To P. Leikul Village

S.NO.	Existing Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Detail of Destination of Junction
7	163+305	Y	Village Road	LHS	To Gamvom Village
8	164+880	Y	Village Road	LHS	To Impoi(H) Village
9	164+900	Y	Village Road	RHS	To Impoi(CH) Village
10	165+010	Y	Village Road	RHS	To Impoi(CH) Village
11	166+080	X	Village Road	BS	To Asalu Village
12	166+230	Y	Village Road	RHS	To Asalu Village
13	166+460	Y	Village Road	LHS	To Asalu Village
14	166+640	Y	Village Road	RHS	To Asalu Village
15	167+100	Y	Village Road	LHS	To Asalu Village
16	167+200	Y	Village Road	RHS	To Hekaukang Village
17	167+230	Y	Village Road	LHS	To Hekaukang Village
18	167+540	Y	Village Road	LHS	To Hekaukang Village
19	168+340	Y	Village Road	LHS	To Nakhojau Village
20	168+480	Y	Village Road	LHS	To Nakhojau Village
21	169+750	Y	Village Road	RHS	To Pangmol Village
22	171+175	X	Village Road	BS	To N. Lonkai Village
23	171+215	Y	Village Road	LHS	To N. Lonkai Village
24	171+345	Y	Village Road	RHS	To N. Lonkai Village
25	171+500	Y	Village Road	LHS	To N. Lonkai Village
26	171+775	Y	Village Road	LHS	To P. Lonkai Village
27	171+880	Y	Village Road	LHS	To P. Lonkai Village
28	172+080	Y	Village Road	RHS	To P. Lonkai Village
29	172+295	Y	Village Road	RHS	To Nirianam Village
30	172+740	Y	Village Road	RHS	To Nirianam Village
31	172+825	Y	Village Road	RHS	To Chudining Village
32	173+135	Y	Village Road	RHS	To Chudining Village
33	173+200	Y	Village Road	RHS	To Chudining Village
34	173+540	X	Town Road	BS	To NchureloaVillage
35	175+010	Y	Town Road	RHS	To Assam Rifles Camp
36	175+600	Y	Town Road	RHS	To NH-54(Old NH)
37	175+750	T	Town Road	RHS	To Mahur Town
38	175+815	Y	Town Road	LHS	To Mahur Town
39	175+875	Y	Town Road	RHS	To Mahur Town
40	175+910	Y	Town Road	LHS	To Mahur Town
41	176+010	Y	Town Road	RHS	To Mahur Town
42	176+245	Y	Town Road	LHS	To Mahur Town

S.NO.	Existing Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Detail of Destination of Junction
43	167+515	Y	Village Road	LHS	To Daodung Village
44	176+675	Y	Village Road	RHS	To Daodung Village
45	176+800	Y	Village Road	LHS	To Daodung Village
46	176+845	Y	Village Road	RHS	To Daodung Village
47	177+595	Y	Village Road	LHS	To Daodung Village
48	177+800	Y	Village Road	RHS	To Daodung Village
49	178+325	Y	Village Road	RHS	To Daodung Village
50	178+735	Y	Village Road	LHS	To Daodung Village

6.10 TOPOGRAPHIC SURVEYS:

GPS survey is being carried out and GPS control points are established along the alignment, In addition, auto leveling carried out between SOI GTS BMs and GPS control beacons.

The topographic survey includes:

- GPS control points at 5 km intervals which will be auto-leveled from Survey of India (SOI) GTS BM's to GPS control point BM's using auto levels (in accordance with IRC SP19)
- Additional intermittent benchmarks established on permanent structures like Culverts, Km stones, or on permanent structures enroute, etc.
- A total station traverse is being carried out with stations between 250m apart. Field checks will be carried out for mutual bearing, mutual distance and heights.
- The detailed survey is being carried out using a total station instrument with a strip width of 30 m, widened at horizontal curves and ROB locations. All topographical features will be picked up during the survey. Points will be picked up 50 m apart and cross sections taken at same intervals. Where existing roads / railways cross the alignment the surveys will be extended to 100 m either side of the alignment proposed. Culvert location will be surveyed as part of the detailed survey.
- Hard copies of the survey will be made and will be used by senior surveyor and the survey teams to verify the accuracy in the field of the detailed survey.
- The survey will be received in digital format in XYZ format compatible with Mx software together with hard copies

6.11 Benchmark List

S.No.	Easting	Northing	Elevations	Description
1	521833.426	2786665.574	1001.814	GPS8A
2	521673.706	2786594.313	1001.135	TBM1

S.No.	Easting	Northing	Elevations	Description
3	521495.535	2786652.4	1010.207	TBM2
4	521469.779	2786448.701	982.848	TBM3
5	521327.657	2786218.989	971.102	TBM4
6	521258.435	2786210.382	973.433	TBM5
7	520923.991	2786048.259	968.731	TBM6
8	520611.065	2785694.128	945.841	TBM7
9	520104.241	2785373.775	933.366	TBM8
10	519655.865	2785347.319	921.415	GPS7A
11	519464.2	2785397.107	913.835	TBM9
12	519247.111	2785503.595	903.138	TBM10
13	519098.225	2785618.112	893.595	TBM11
14	518802.29	2785522.407	875.821	TBM12
15	518614.999	2785525.566	868.705	TBM13
16	518329.205	2785503.854	863.313	TBM14
17	518104.445	2785586.646	857.984	TBM15
18	517937.396	2785209.86	580.196	TBM16
19	517835.516	2784884.973	848.48	TBM17
20	517761.165	2784650.036	851.478	TBM18
21	517700.255	2784612.341	852.66	GPS6
22	517606.7	2784422.661	847.506	TBM19
23	517511.943	2784083.262	834.437	TBM20
24	517296.99	2784119.793	824.352	TBM21
25	517064.384	2783909.265	814.548	TBM22
26	516905.926	2783781.224	833.21	TBM23
27	516709.718	2783881.677	836.904	TBM24
28	516517.15	2784084.181	832.86	TBM25
29	516123.587	2784005.739	827.732	TBM26
30	515951.783	2784247.723	814.718	GPS5A
31	515835.169	2784348.169	808.099	TBM27
32	515794.967	2784420.365	805.646	TBM28
33	515443.242	2784233.041	807.691	TBM29
34	515283.418	2784270.846	801.319	TBM30
35	515074.428	2784311.089	794.57	TBM31
36	514958.995	2784314.522	795.763	TBM32
37	514792.99	2784266.984	799.797	TBM33
38	514765.579	2784527.464	803.781	TBM34
39	514517.618	2784439.949	772.845	TBM35
40	514104.837	2784486.846	735.917	TBM36
41	513689.29	2784728.606	695.194	TBM37
42	513478.648	2784690.761	669.297	GPS4A
43	513378.837	2784657.577	661.608	GPS4
44	513178.163	2784694.287	648.64	TBM38
45	512943.242	2784777.221	632.996	TBM39

S.No.	Easting	Northing	Elevations	Description
46	512711.393	2784764.683	618.096	TBM40
47	512423.187	2784575.146	598.961	TBM41
48	512018.42	2784525.763	570.286	TBM42
49	511673.251	2784608.139	552.896	TBM43
50	511234.282	2784689.483	566.273	TBM44

6.12 CONDITION SURVEY:

Detailed field studies carried out to collect pavement/shoulder/drainage conditions are briefly discussed hereunder and the findings are presented in Annexure.

6.13 PAVEMENT CONDITION SURVEYS:

The survey on general pavement condition was primarily a visual exercise undertaken by means of slow drive-over survey, and supplemented with measurements wherever necessary. Visual assessment was carried out from a vehicle, with speed not exceeding 15 km/hr and stopping at various locations at suitable intervals at 200m and wherever necessary, depending on variations in pavement conditions. At the points of stoppage, simple measurements using measuring tape and straight edge were carried out to quantify pavement deficiency on a representative basis. Aspects of pavement conditions assessed include surface defects, rut depth, cracking, potholes, patched areas, shoulder condition etc. An overall assessment of performance serviceability of the road was also done to qualitatively rate the existing pavement and shoulder condition.

The pavement condition was recorded under the following sub-heads:

- Shoulder-
- Composition / Condition / material Loss
- Riding Quality (Good / Fair / Poor / Very Poor)
- Pavement Condition (surface distress type & extent)
- Cracking (%)
- Raveling (%)
- Potholes (%)
- Patching (%)
- Rut depth (mm)
- Edge break (m)
- Pavement edge Drop (mm)
- Embankment Condition (Good / Fair / Poor)
- Road Side Drain (Non Existing / Partially Functional / Functional)
- Drainage condition

For determining the pavement condition for each km. of road, the yardstick as given in Table 6.7 has been used to designate the pavement condition.

Table 6.7: Yardstick of Pavement Condition

Sl. No.	Condition	Pot holes (%)	Cracking (%)	Patching (%)	Raveling (%)
1	Fair	>5 ≤10	> 10 ≤ 20	> 0.5 ≤ 2.0	> 2.0 ≤ 5.0
2	Poor	>10	>20	>2	>5.0

6.14 SUMMARY OF CONDITION SURVEY RESULTS:

Based on the yardsticks, the overall condition of the pavement has been analysed and it varies between Poor to Fair.

Table 6.8 Surface Condition of the Carriageway

Start Ch.	*End Ch.*	*Length (in km)*	*Type*	*Width (in M)*	*Condition*
160875	175600	14.725	BT	3.0	Fair
175600	182169	6.569	BT	3.75	Poor
Total		**21.294 km**			

Condition	*Length(km)*	*% of total length*
Fair	14.725	69.15 %
Poor	6.569	30.85 %
Total	**21.294 km**	100%

6.15 SHOULDER CONDITION:

The project road has 3.0 m Earthen Track with 1.0 –1.5m earthen shoulder throughout the project section, which is in poor conditions except at isolated stretches in village portions. Apparently, the average embankment of the road is 1.0 m to 2.0 m.

6.16 DRAINAGE CONDITION:

The general condition of the roadside drains is not satisfactory. Sufficient camber is not provided to drain off the water from carriageway surface. There are no CD structures across the project alignment. The existing road has no proper provision of longitudinal drains on both sides.

6.17 TRIAL PITS:

The investigations were carried out along the existing road using two types of trial pits made as under:

- Large Test Pit-1.0m x 1.0m
- At Large pit locations following tests were conducted:
- Pavement Composition
- Characterisation (grain size and Atterberg limits)
- Laboratory moisture-density characteristics
- Laboratory CBR (un-soaked and 4-day soak compacted at three energy levels) and swell.

6.18 EXISTING PAVEMENT CRUST COMPOSITION

Test pits of approx. 1.5 m x 1.5 m size staggered on both sides of the pavement were excavated initially up to sub grade top at every 1.0 km along the project road. The pits were excavated on shoulders extending about 250mm into the pavement for the following observations:

Type of the pavement layers was visually observed and thickness of each layer was measured on all the three exposed face of the pavement layers to determine average value and recorded. The details of the same are in tabular form. Approx. 40 kg of disturbed soil sample was collected from mach test pit for testing index properties of the soil and soaked CBR on re - moulded sample in the laboratory. The crust composition of the existing pavement is summarized as below in Table 6.9.

Table 6.9 Summary of the Existing Pavement Crust Composition

Thickness of Surface Course (mm)	Base Course Thickness (mm)	Sub Base Course Thickness (mm)	Total Thickness (mm)
20	**250**	**150**	**420**

6.19 Sub grade Soil Investigations

Investigations of existing sub grade soil were carried out to assess the adequacy of the existing pavement layers apropos to present sub grade strength so that the strengthening and reconstruction requirement can be established for the design traffic loadings. Objectives of investigations also included evaluation of the characteristics of existing sub grade soil by means of laboratory tests.

The requirements of TOR were met through the following steps:

- The characteristics of the existing soil, two samples from every five km of the Project road or closer where change in soil type is encountered;
- The determination of sub grade CBR (soaked) every three km of the Project road or closer where change in soil type is encountered;
- Benkelman Beam Deflection measurements on the Project road – one set of ten readings in 250m for every three km of the Project road;
- Analysis of field and laboratory test results;
- Providing specific recommendation for existing Pavement; and
- Evaluation of problematic sub soil, if any.

6.19.1 Sub grade Characteristics and Strength

Test pits of size about 1.0 m x 1.0 m were excavated manually at pavement shoulder interface, extending through the pavement layers down to the sub grade level. Sub grade soil sample (about 40 kg) was taken from each pit and sealed properly for detailed laboratory test.

Following test were carried out on the sub grade soil sample in the laboratory.

- Atterberg's limits — As per IS: 2720, Part- V - 1985
- Grain size analysis — As per IS: 2720, Part- IV- 1985
- MDD (heavy compaction) — As per IS: 2720, Part- VIII- 1983
- Optimum Moisture Content — As per IS: 2720, Part- VIII- 1983
- CBR (4 days soaked) — As per IS: 2720, Part- XVI- 1987

6.19.2 Laboratory Test on Subgrade Samples

As Per test results the CBR Varies from 5-10%. So, the value of adopted CBR is 8%.

6.20 Hydrological and Hydraulic Investigations

Hydrological Data

The hydraulic condition of each structure was assessed thoroughly by visual observations and details are collected from the local offices of PWD, Manipur and BRO department, wherever available to collect the available hydrological data.

For the existing major and minor bridges the Topographic maps obtained from Survey of India has been utilized for the Hydrological Calculations.

Topographic maps, obtained from Survey of India, on 1:50,000 scales, have been utilized for the hydrological study in the corridor, accordingly for entire project Corridor, are prepared and attached as Annexure 5.5 "Abstract of Hydraulic Calculations".

6.20.1 Hydrological Design Methodology

For the calculation of discharge of the stream by the Area-Velocity method, topographical survey including leveling surveys have been carried out across and along the water courses to determine the cross-section and the slope. A number of cross-sections have been taken at regular intervals on both upstream and downstream side of the structure, including one at the proposed location of the structure in accordance with IRC specifications.

The following assumptions have been made during peak discharge calculation:

For locations where water spreads over the banks, the cross-sections were extended up to the HFL, in order to calculate the effective cross-section of flow.
The longitudinal section to determine the bed slope have been taken at an approximate regular interval of 100 m following the channel course extending on both the upstream and the downstream sides of the structure. Caution is taken by following the curved flow line for longitudinal gradient, rather than a straight line.

6.20.1.1 Assessment of Peak Discharge

The peak discharge and the HFL have been calculated by the following methods.

Dickens Method to find discharge from catchment, and Area velocity methods at the bridge site, the upstream and the downstream sections.

Dickens Method

Dickens's Formula is proposed as Empirical formulae in entire road stretch, which is as below.

$$Q = CM^{(0.75)}$$

Where,

Q = the peak run-off in cu.m/sec.
M Is the catchment area in sq.km and
C = 11-14, where the annual rainfall is 60-120 cm;
14-19, in Madhya Pradesh; and
32, in Western Ghats.

Area – Velocity Method (Manning's Formula)

$$Q = A \times V$$

= A x [(1/n) x (R)2/3 x (S)1/2]

Where, Q = the discharge in cumecs ;
A = Area of the cross section in sq. m.;
V = Velocity in m/sec;
R = Hydraulic mean depth in m. = A / P;
P = Wetted perimeter of the stream in m.;
S = Bed slope of the stream; and
n = Rugosity Co-efficient.

The Design Discharge has been taken as the maximum of peak discharges at different cross sections.

6.20.1.2 Hydraulic Analysis for Design HFL

In hydraulic analysis, the Design HFL has been calculated corresponding to the Design Discharge by Manning's Equation at the bridge site, as described above.

6.20.1.3 Afflux Calculation

When the waterway area of the opening of a bridge is less than the unobstructed natural waterway area of the stream, i.e. when bridge contracts the stream, afflux occurs. The afflux will be calculated using Molesworth's formula as given below: -

$$h = \left(\frac{V2}{17.88} + 0.01524 \right) \{ (A/a)2 - 1 \}$$

Where, h = Afflux in meters;
V = Average velocity of water in the river prior to construction in m/sec;
A = Unobstructed sectional area of the river at proposed site in sq m; and
a = Constricted area of the river at the bridge in sq m.

6.20.1.4 Scour Depth Calculation

To provide an adequate margin of safety for design of foundation, a further increase by 30% has been made over the design discharge as per IRC: 78-2000, thus obtaining the final design discharge for the design of foundation.

By IRC: 5-1998 / IRC: 78-2000

As per IRC: 5-1998 or IRC: 78-2000, the mean depth of scour below the highest flood level, Dsm, will be given by the following equation:

Dsm = 1.34 x (Db2 / Ksf) 1/3

Where, Db = the discharge in cumecs per meter width and Ksf = Silt Factor.

The value of 'Db' shall be the total design discharge divided by the effective linear waterway between abutments.

For most of the bridges, the silt factor, Ksf, has been calculated as per guidelines given in IRC-78: 2000 (Clause 703.2) otherwise it has been assumed as 1.5 due to absence of soil distribution curve.

6.20.1.5 Maximum Depth of Scour for Design of Foundation

The maximum depth of scour below the Highest Flood Level (HFL) for the design of piers (dsmp) and abutments (dsma), having individual foundations without any floor protection are as follows:

In the vicinity of pier: dsmp = 2 x Dsm
In the vicinity of abutment: dsma = 1.27 x Dsm

For the design of floor protection works for rafts or open foundations, the following values of maximum scour depth may be adopted:

In a straight reach: 1.27 x Dsm
In a bend: 1.50 x Dsm

For the RCC Box type structures proper scour protection is given in the form of floor apron and flexible apron both on the up-stream and downstream sides. No scour will be allowed to occur in the RCC Box type structures.

6.20.1.6 Additional Balancing Culvert on Main Carriage Way

Additional balancing culvert on Main Carriage Way has been provided if it is required for planning of adequate drainage system. Also additional culvert of 1.2m diameter HP (NP-4) for field channel (farm) shall be provided at bypasses to allow the water to pass from one side to other side, if the lands on both side of the road belong to the same owner.

6.20.2 Recommendations / Findings

6.20.2.1 Bridge locations

The detailed hydrological & hydraulic calculations of bridges have been presented in Annexure. The Results has been presented in Table 6.10 below.

Table 6.10 Summary of CD Structures

Sl. No.	Existing Chainage as per Survey drawing (Km)	Design Chainage (Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	Span Arrangement and Total Ventway (No. X Length) (m)	Width (m)		PROPOSAL				Remarks
					Total (m)	Carriageway (m)	Recommendation on widening / Reconstruction etc.	Type of Structure	Span No.X Length	Width(in m)	
1	157490	161940	BOX	1X3X3	3.5	_	Reconstruction	T-Beam Girder	3x16	18.00	MNB
2	165260	169935	BOX	2X3X4	7.2	_	Reconstruction	BOX	2X4X4	18.00	MNB
3	170210	_	-	-	-	-	New Reconstruction	T - Beam Girder	3X16	18.00	MNB

4	170435	_	_	_	_	_	New Construction	T - Beam Girder	1X25	18.00	MNB
5	174710	_	-	-	-		New Construction	T - Beam Girder	1X25	18.00	MNB

Chapter-07: Design Standards

7.1 Summary

Following is a summary of the recommended design standards proposed to be adopted for the project road other than service road and intersections:

Table 8.1: Design Standards

Sr. No.	Element	Terrain		
		Rural (Non Urban)	Urban Area	Hilly
1	Width of Carriageway (m)	Intermediate Lane : 5.5 2-Lane : 7.0	2-Lane : 7 2-Lane+ Paved Shoulder : 10	2-Lane : 7 2-Lane+ Paved Shoulder : 10
2	Shoulders (Earthen)	2-Lane : 2.50		2-Lane : Valley Side 1.0
		2-Lane+Paved Shoulders 12.0		2-Lane+ Paved Shoulders : Valley Side 1.0
3	Formation Width (m)	Intermediate Lane : 10.0 2-Lane : 14.0	2-Lane+Paved Shoulder : 13.0 (inclusive 2X1.5m of Drain/Foot path)	Intermediate Lane: : 10 2-Lane+ Paved Shoulders : 11
4	Camber/ Cross Fall	Bituminous : 2.5% Concrete Pavement : 2.5% Earthen Shoulder : 3.5% (min)	Bituminous :2.5 % Concrete Pavement :2.5 %	Bituminous: : 2.5% Concrete Pavement : 2.5% Earthen Shoulder : 3.5% (min)
5	Design Speed (km/h)	Plain Rolling Ruling 100 Mm: 80	Ruling : 65 Minimum : 40	Ruling : 65 Minimum : 40

7.2 Geometric Design

7.2.1 General

Geometric design of a highway is the process whereby the layout of the road in specific terrain is designed to meet the needs of the road users keeping in view

the road function, type and volume of traffic, potential traffic hazards and safety as well as convenience of the road users. The principal areas of control for fulfilment of this objective are the horizontal alignment, vertical alignment and the road cross-section.

The Consultants have referred to the latest IRC publications and MoRT&H circulars regarding design standards to be applied for state highways in India. After careful review of all available data and requirements of the project road the proposed Design Standards for adoption on the project road have been recommended.

7.2.2 Design Speed

The project road passes through plain, rolling and hilly terrain. For geometric design of the highway, design speed is used as an index which links road function, traffic flow and terrain. An appropriate design speed should correspond to general topography and adjacent land use. The speed selected for design should also cater to travel needs and behaviour of the road users. Rural highways, except expressways, are normally designed for speed of 80 km/hr, however depending on terrain and whether the design is for new alignment or reconstruction of an existing facility, the design speed is determined to the site requirement.

The ruling design speed corresponding to the type of terrain as per IRC:SP 73-2018, are as follows:

Table 8.2: Design Speed Standards

Terrain	IRC SP:73:2018
Plain/Rolling	80-100
Mountainous	40-60

Assuming a diverse mix of traffic on the project roads, a ruling design speed of 80-100 km/h for plain, rolling terrain and 40-60 km/h for hilly terrain is proposed to be adopted with some exceptions. Use of speed regulatory sign is proposed at locations such as hairpin bends, urban areas and other sharp curves where design speed cannot be maintained.

7.2.3 Levels of Service (LOS)

The Level of Service (LOS) characterizes the operating conditions on the roadway in terms of traffic performance measures related to speed and travel time, freedom to manoeuvre, traffic interruptions, and comfort and convenience. The levels of service range from level-of-service A (least

congested) to level-of-service F (most congested). The Highways Capacity Manual (HCM) provides the following levels of service definitions:

Table 8.3: Standards for Level of Service

Level of Service (LOS)	General Operating Conditions
A	Free flow
B	Reasonably free flow
C	Stable flow
D	Approaching unstable flow
E	Unstable flow
F	Forced or breakdown flow

Considering the importance of the highway Level of Service (LOS) 'B' is proposed.

7.2.4 Cross Sectional Elements

7.2.4.1 Roadway Width for Multilane Highways

Adequate roadway width will be provided for the requisite number of traffic lanes besides the shoulders and a central median dividing the traffic flow directions. As specified in the IRC 73-2018, in general, for multilane highways, the shoulder width should be 1.5 m and lane width 3.5 m per lane. Based on a comparative review of international standards and safety, the values proposed to be adopted for the roadway elements by the Consultants for the project highway are as follows:

Table 8.4: Road Cross Section

Item	Two-Lane with Earthen Shoulder	Two-Lane with Paved Shoulder	
		Plain/Rolling Terrain	Hilly Terrain
Carriageways	2 X 3.5 m	2 X 3.5 m	2 X 3.5 m
Paved shoulder	N.A.	2 X 1.5m	2 X 1.5
Unpaved shoulder Plain/ rolling terrain Hilly terrain : Hill Side Valley Side	2 X 2.5 m 2 X 1.0 m 2 X 2.0 m	2 X 2	 - 1x1.0m
Total Formation width Plain/rolling terrain	12 m 10 m	14m	 11m

Item	Two-Lane with Earthen Shoulder	Two-Lane with Paved Shoulder	
Hilly terrain			
Total Formation width in Urban Area(inclusive Foot path/Drain)	13 m (Inclusive of 2X1.5m of Footpath/Drain)	14m	11m

As the proposed road is a national highway, total carriageway width of 7.0 m i.e. two lane with 1.5m Paved shoulders & 2.0m earthen shoulders has been proposed with the formation width of 14m in plain/rolling terrain and 7.0m carriageway with 1.5m paved shoulder and 1.0m shoulder Valley side has been proposed with the formation width of 11m in hilly terrain.

7.2.4.2 Lane Width

Lane width has a significant influence on the safety and comfort of the road. The capacity of a roadway is markedly affected by the lane width. In general, safety increases with wider lanes up to a width of about 3.5 m. **The lane width as per IRC:SP 73-2018 is 3.5 m.**

7.2.4.3 Shoulders

Shoulders are a critical element of the roadway cross section. Shoulders provide recovery area for errant vehicles; a refuge for stopped or disabled vehicles; and access for emergency and maintenance vehicles. Shoulders can also provide an opportunity to improve sight distance through cut sections.
IRC:SP 73-2018 recommends a paved outer shoulder of 1.5 m together with an earthen shoulder of 2.0 m for multilane highways. For mountainous terrain, the recommended earthen shoulder width is 1.0 m valley side.

7.2.4.4 Pavement Camber (Cross-fall)

IRC:SP 73-2018 recommends the following camber for various surface types:

Table 8.5: Provision for Cross-fall

Surface type	Camber
High Type Bituminous Surfacing	1.7% - 2.0 %
Thin Bituminous Surfacing	2.0 % - 2.5 %
Water Bound Macadam, Gravel	2.5 % - 3.0 %

Earth	3.0 % - 4.0 %

Considering the bituminous surfacing (bituminous concrete) the Consultants propose to provide a camber of 2.5 % for the main carriageway as well as paved shoulders and 3.5 % for the unpaved shoulder (granular).

7.2.4.5 Embankment Slopes

The side slope shall not be steeper than 2H:1V unless soil is retained by suitable soil retaining by structure.

7.2.5 Typical Cross-sections

The proposed cross-section in rural sections consists of two lane with paved shoulder configuration during the service life of the project. Concentric widening is proposed to minimize land acquisition issues and to ensure maximum utilisation of existing carriageway.

7.2.6 Horizontal Alignment

7.2.6.1 General

For balance in highway design, all geometrical elements should be determined for consistent operation under the design speed in general. A horizontal alignment should be as smooth and consistent as possible with the surrounding topography. To achieve that, an appropriate blending with the natural contours is preferable to the one with long tangents through the terrain.

7.2.6.2 Sight Distances

Sight distance is a direct function of the design speed. Safe Sight distances corresponding to various design speeds are given below:

Table 8.6: Sight Distance Criteria

Design Speed Km/h	Minimum Sight Distance(m)	Overtaking Sight Distance(m)
100	360	640
80	240	470
60	180	340
40	90	165

It is desirable to design the highway for more liberal values for operational convenience. An appropriate allowance would be considered to take care of the effect of adverse incidents. The value recommended by IRC & guidelines are proposed to be adopted in design.

7.2.6.3 Horizontal Curve

The minimum horizontal curve radius is the limiting value of curvature for a given design speeds and is determined from the maximum rate of super elevation and the side friction factor. As per the IRC: 73 - 2018 the minimum ruling radii of Horizontal curve for National Highways corresponding to different terrain conditions are as follows:

Table 8.7: Horizontal Radii Criteria

Type of Terrain	Minimum Radii of Horizontal Curve	
	Two Lane	
	Ruling Minimum	Absolute Minimum
Plain & Rolling	400	250
Mountainous	150	75

Absolute minimum and ruling minimum radii are corresponding to the minimum design speed and the ruling design speeds respectively.

On new roads, horizontal curves are designed with liberal radius provision that blends well the overall geometry and topography. However, for locations with constraints and to make use of available roadway, it is proposed to keep minimum radius in accordance with the IRC recommendations

7.2.6.4 Transition (Spiral) Curves

The purpose of a transition (spiral) curve is to provide a smooth and aesthetically pleasing transition from a tangent and a circular curve. In addition the transition curves provide the necessary length for attainment of super-elevation runoff.

It is proposed to adopt transition curve lengths provided above for minimum recommended moves.

7.2.6.5 Super-elevation

The IRC: SP 73-2018 design standards propose a maximum super-elevation rate of 7 % for plain and rolling terrains, and 10% for the mountainous terrain.

The limiting value of the super-elevation on the project road in both plain/rolling and hilly terrain is proposed to be 7%.

7.2.7 Vertical Alignment

7.2.7.1 General

The vertical alignment should produce a smooth longitudinal profile consistent with standard of the road and of the terrain. Horizontal and Vertical curvature should be so combined that the safety and operational efficiency of the road is enhanced.

7.2.7.2 Gradients

The IRC: SP 73-2018 geometric design standards propose ruling vertical grades of 3.3% to 5.0% for plain and rolling terrains; and 5.0% to 6.0% for hilly terrain.

Table 8.9 : Vertical Gradient

Terrain	Ruling (%)	Limiting (%)
Plain/Rolling	2.5%	3.3%
Hilly	5.0%	6.0%
Steep	6.0%	7.0%

To ensure adequate drainage, roadways typically have a minimum longitudinal grade of 0.5% to 0.6%, depending on the terrain. The minimum longitudinal grades as per IRC: SP 73-2018 design standards are 0.5% for lined side ditches, and 1.0% for unlined side ditches.

7.2.7.3 Vertical Curves

As per IRC: SP 73-2018 design standards, the minimum lengths of vertical curves are 60 m and 50 m for design speeds of 100 km/h and 80 km/h respectively The length of a vertical curve is calculated using the following equation:

L = K x A,

Where L = Length of vertical curve in metres;
K = Coefficient, a measure of the flatness of a vertical curve; and
A = Algebraic difference of grade lines (%)

Summit or Crest Curves

According to AASHTO (2001) design guidelines, the minimum K values for stopping sight distance requirements are 52, 26 and 7 for design speeds of 100 km/hr, 80 km/h and 50 km/hr respectively.

According to TAC (1999) design guidelines, the minimum K valves for stopping sight distance requirements are 45 to 80, 24 to 36 and 6 to 16 for design speeds of 100 km/hr, 80 km/hr and 50 km/hr respectively.

As per IRC-SP-23-1993 design Guidelines the Consultant propose minimum summit curve K values of 75, 45, and 25 for design speeds of 100 km/hr, 80 km/hr, 65 km/hr respectively.

Valley or Sag Curves

The minimum K values for valley or sag curves, in accordance with AASHTO (2001) design guidelines are 45, 30 and 13 for design speeds of 100 km/hr, 80 km/hr and 50 km/hr respectively. The minimum K values for valley or sag curves, in accordance with TAC (1999) design guidelines are 37 to 50, 25 to 32 and 7 to 16 for design speeds of 100 km/hr, 80 km/hr, 50 km/hr and 40 km/hr respectively.

As per IRC-SP-23-1993 design Guidelines the Consultant propose minimum valley curve K values of 42, 26 and 15 for design speeds of 100 km/hr, 80 km/hr, 65 km/hr respectively.

7.3 Bridges and Cross Drainage Structures

7.3.1 General

The bridge having total length more than 60 m is termed as major bridge and bridge length between 6 m to 60 m as minor bridge. The culvert is the structure having length less than 6 m between inner faces of dirt wall or extreme vent way boundaries measured at right angles thereto.

7.3.2 Design Standards

7.3.2.1 Bridges and Culvert

For major and minor bridges the minimum overall width between the outermost faces of the bridge shall be equal to 16m comprising of 12m carriageway and footpath on each side. Width of culverts shall be equal to 12m.

7.3.2.2 Pipe Culvert

The existing pipe culverts that are hydraulically adequate and functional will be widened to full formation width. Pipe culverts having less than 0.90 m dia pipe will be replaced. Based on proposed finish levels if pipe culverts do not have adequate cushion, they shall be encased all round in M15 grade cement concrete with 200 mm thick slab and in M20 grade cement concrete over top of the pipe.

7.3.2.3 Various Codes and Publication to be adopted

The bridges shall be designed as per various IRC codes and special publications wherever required. For conditional cases, if IRC code does not specify anything then relevant BIS code will be followed. The following IRC codes shall be adopted for bridge design.

IRC: 5-1998 General features of design

IRC: 6-2014	Loads and Stresses
IRC: 18-2000	Design criteria for PSC Road Bridges
IRC: 21-2000	Cement concrete plain and reinforced
IRC: 22-2008	Composite Construction
IRC: 40-2002	Brick, stone and block masonry
IRC: 45-2015	Design of well foundation of bridges
IRC: 54-2000	Lateral and Vertical clearances at underpasses
IRC: 78-2000	Foundation and substructure
IRC: 83-1999	(Part I)Metallic Bearings
IRC: 83-1987	(Part II) Elastomeric Bearings
IRC: 83-2002	(Part III) POT PTFE Bearings
IRC: 89-1997	Guidelines for river training and control works
IRC: SP: 13:2004	Guidelines for the design of small bridges and culverts
IS 2911-2010	code of practice for design and construction of pile foundations

7.3.2.4 Design Live Load

The two-lane with paved shoulder carriageway shall be designed with loading combination of Class A, Class 2A, Class 3A and 70R two-lane load or IRC 70 R single lane whichever produces severe effects.

7.3.2.5 Vertical Load

The various components of bridge will be designed for self weight of structure as well as live load with buoyancy effect through pore pressure as well as uplift at base of foundation with appropriate factors depending upon the founding strata.

7.3.2.6 Longitudinal Forces

The bridge will be designed for longitudinal forces on account of tractive and braking action, wind force, seismic force as well as forces due to longitudinal movement of superstructure generated due to creep, shrinkage or temperature. All longitudinal forces will be considered as stipulated in various IRC codes.

7.3.2.7 Seismic Zone

The project road is located in a seismic zone V. It is proposed to design the bridges for seismic forces as mentioned in modified clause 222 of IRC: 6-2000.

7.3.2.8 Condition of Exposure

Since the project road is away from marine environment, a moderate condition of exposure will be adopted.

7.3.2.9 Grade of Concrete

The following minimum grade of concrete will be adopted for major and minor bridges as well as ROB, Flyover and Underpass.

Sr. No.	Type of Concreting	Major Bridge/	Minor Bridge and Culverts
1	Plain Cement Concrete (PCC)	M-20	M-20
2	Reinforced Cement Concrete (RCC)	M-35	M-35/M-30

7.4 Miscellaneous

7.4.1 Road Signs

Road signs are proposed to be placed according to IRC: 67:2012. The signs are to be placed on embankment such that extreme edge of sign would be 2.0m away from the edge of the carriageway. The location of each sign is to be decided in accordance with the guidelines therein.
The sheeting shall be provided of Super High Intensity Micro Prismatic sheets Type IX as per ASTM D 4956 for all types of road sign boards as well as Over Head Signs.

7.4.2 Road Markings

Road markings will be made for centre and edge lines using reflective thermoplastic paints. Appropriate road markings will also be provided at junctions and crossings.

7.4.3 Traffic Barriers

Traffic barriers are protective devices that are placed between traffic and a potential hazard off the roadway, with the intention of reducing the severity of a collision when an errant vehicle leaves the travelled portion of the roadway. Barriers are to be provided at high embankments, sharp curves and bridge approaches. The barrier is to be located in unpaved shoulders.

7.4.4 River Training work

River training works will be provided in accordance with IRC 89-1997 and designed as per forces and loads stipulated for respective components as per the site specific requirements.

7.5 Special Protection of Sinking Zone

SELF DRILLING ANCHOR BARS:

1. INTRODUCTION:

Self-drilling hollow injection anchor bolt is an advanced anchor system, which is composed by hollowanchor bar, nut, plate, coupler, drill bit, centralizer and anchor bars can be cut & lengthened by coupling according to the demands. This anchor system can be integrated with the functions of drilling, grouting and anchoring. It also can ensure the anchoring for complex ground conditions.

- It is safe, reliable, and time saving.
- Installation & operation are simple.
- Choice of drill bits for different ground conditions.
- Grouting works synchronize with drilling or after drilling. Grout can fill fractures effectively.
- Anchor bars can be cut and lengthened according to the demands. It applies to narrow spaces.
- It provides higher bonding stress than smooth steel pipe depending on continuous wave and T-thread.

For projects facing such ground conditions, self-drilling anchors should be considered as the main productivity solution. Self-Drilling Anchors from are designed for optimized installation, tailored to the project's needs.

By drilling a hole in collapsing soil or loose rock, with a sacrificial drill bit and a hollow rod, and after the drilling operation injecting cementitious grout or resin into the hollow rod and surrounding cavity, self-drilling anchors are a top productivity solution.

Self-drilling anchor bolts from consists of:

- A hexagonal nut
- A bearing plate
- Extension couplings, if the anchor consists of several anchor rod sections
- Hollow anchor rod(s)
- A sacrificial drill bit

2. Applications of

Self-Drilling Anchors

Slope stabilization

Self-Drilling Anchors are used to stabilize unstable rock/soil formations. The unconsolidated or weathered ground conditions favor the SDA technique for a fast and simple method of installationcompared to the traditional methods.

3. SDA Anchor Components

i).Hollow anchor rods

The anchor rod features a hollow bore for flushing, or simultaneous drilling and grouting, and has a left-hand thread for connection to standard drill tooling. It is manufactured from API standard thick wall steel tubing, cold rolled to a standard ISO rope thread profile. The rolling process refines the crystalline structure of the steel, increasing the yield strength, and producing a durable drill rod suitable for a wide range of applications. The standard rope thread of the anchor rod produces an excellent bond between the rod and grout, as well as enabling connection to the drilling rigs and a wide range of drill steel accessories.

ii). Extension couplings

The coupling features a patented design that enables direct end to-end energy transmission between each bar, reducing losses and ensuring maximum percussive energy at the drill bit. To enable the correct seating of each bar within the coupler, all bars are chamfered with precision to enable the bar ends to have face-to-face contact.

iii). Bearing plates

The bearing plates are forged steel plates with a centre hole, allowing articulation of seven degreesin all directions.

iv). Hexagonal nuts

The hexagonal nuts are manufactured from high precision steel with chamfered edges on both ends from high precision steel, and tempered to meet the stringent demands on anchor specifications and the daily operations of underground work. All nuts exceed the ultimate strength of the bar.

v). Shanks

Rotary percussion is the preferred method of installation. Either a hydraulic or air hammer is suitable. To transfer the rotation and percussion from the hammer to the bar's system, there is a need for a shank adapter.

vi). Grout coupling

After using standard flushing media (water or air), grouting must be done. For connecting the grouting hose from the pump with the anchor bar, the grout coupling is used. The grout coupling will be removed and reused after the grouting process is done.

vii) Sacrificial drill bits

The sacrificial drill bit is the most crucial part of the anchoring system and is responsible for the productivity of the installation. Intech Anchoring offers a large range of drill bits to suit the changing geology encountered during projects. In order to improve on performance and cost efficiency, data is collected from projects around the world and incorporated into the design with the goal to improve penetration rate and bit quality and to reduce manufacturing and application costs.

The selection of drill bits

A successful installation of the SDA system depends on the selection of the most suitable drill bit. Compared to conventional drill bit types offered globally for maximum standing performance for rockor soil, the criteria for SDA drill bits are defined by consideration of the following factors:

- Geology
- Geometry

4) BRIEF INSTALLATION METHODOLOGY OF SDA

The following steps are involved in the installation of nails:
i). Scaling works:

All the loose debris & unwanted materials are to be properly removed from the surface of slope and in thelocation of SDA applications.

ii). Identifications:

Identification and marking the nail locations on the slope surface based on the spacing specified indrawing (refer fig 1)

Figure 1: Marking of drill locations on the slope

Sacrificial drill bit of required size, shall be attached at the front of nail (refer fig 2)

Figure 2: Drill bit for self drilling anchors (typical cross bit)

iii) Drilling shall be done for the specified length and diameter as mentioned in the drawing. Grouting operation shall be carried out simultaneously with the drilling and installation of self-drilling anchor (refer fig 3-4) The usual water-cement ratio ranges from 0.40 to 0.50

Figure 3: Drilling operation on the slope

Figure 4: Grouting operation

iv. If required, coupler joint can be provided to match the required nail length. The coupler joint shall be firmly fixed to its full thread centralizers shall be installed at the outer end after full penetration of nail in to the surface as per the requirement (Fig -5)

Figure 5: Centralizers at the outer end of nail

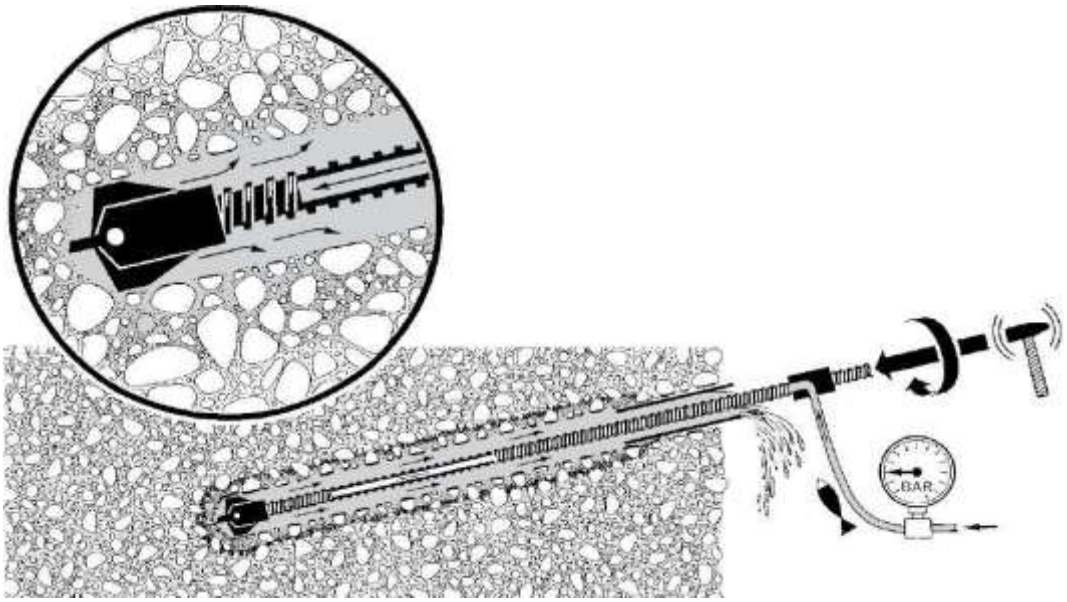

Figure 6: Drilling of SDA

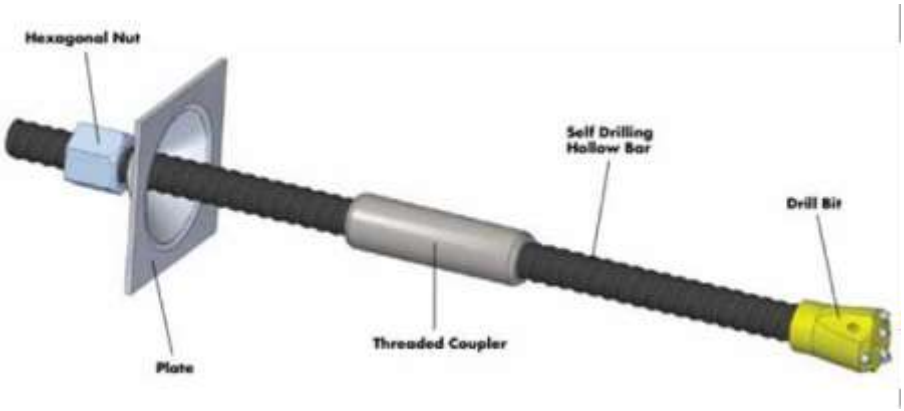

Figure 7: Components of SDA

vii) Bearing plate with sufficient thickness of steel plates are installed having a central hole requiredat the face of SDA. The main function of this plate is to transfer the tension load of SDA to the ground.

viii) After this the hexagonal nuts made of high strength steel with properly made by all edges tosatisfy the demands of anchor specifications is to be installed.

SDA installation, rotary percussion process the rotation, and percussion transfer from thehammer to hollow bar system using the shank connector.

HYDROSEEDING ON SLOPE AFTER NAILING:

Soil Reinforcement Geocomposite is a Hydroseeding method that was widely accepted by, many agency and landscape engineers due to its high performance. Hydroseeding is a complementary application used together with other kinds of geosynthetic products such as the 3D Geocomposite mat. The slurry consists of fertilizer, signal grass seeds, mulching material. It

outperforms and is more cost-effective than conventional erosion control methods.

As compared to conventional turfing, hydroseeding is more effective, installation friendly and it has deeper root zone with better coverage. Employing the most superior erosion control blanket and the quality service; 3D Geocomposite mat is able to provide the outstanding Slope Protection solution.

Advantages:

- Used predominantly for erosion control purpose, hydroseeding hold moisture and protect against soil loss from rain through the binding of seed, mulch, tackifiers and other soil conditioners for immediate slope protection.
- Most economical method of establishing desired turf compare to traditional sodding and hand seeding method.
- Hydroseeding is much healthier, greener and longer lasting because the root establishment is deeper.
- Thicker and more uniform coverage that consists of Fibromat Erosion Control Blanket creatingthe ideal growing environment.

Steps of Hydroseeding

Step 1: Prepare site: Fill any rills or gullies caused by previous erosion.

Step 2: Hydroseed Mix: Fill the hydro-seeder tank with water, and add the normal mix of seed, fertilizer, fiber mulch, etc.

Step 3: Add Silt Stop: Slowly add the Silt Stop polymer as the final additive to the hydroseed mix while the agitator is running to ensure mixing. Allow 5 minutes of mixing before beginning to apply.

Step 4: Apply Hydroseed : Apply the hydroseed mixture over the top of the dressed slope. Proper application should result in complete coverage with no bare soil visible.

The matting and polymer will help hold the seed and fertilizer in place and prevent the soil fromeroding until the vegetation can germinate and establish root structure.

REINFORCED GEOMATS

(3D Geocomposite mat)

i). General

All the natural slopes and surfaces are subject to continuous erosion forces of water and winds. Protection of slopes by growing locally grown vegetation, in the form of turfing, is the best method to protect the slopes against the erosion because once the roots of this vegetation penetrate into the slope by 75-100 mm, they provide root reinforcement against the slope erosion. The 3D Geocomposite mats are installed after hydroseeding process is completed over slope.

ii). Geomats

In many areas, growing of vegetation/turfing on the slope is difficult or not possible due to infertile nature of the soil on the slopes and/or due to scanty or very heavy rainfall in that area. In such cases, the three-dimensional erosion control mats, called as Geomats, are useful as they increase the soil's resistance to erosion and some fertile soil layer can alsobe placed in these mats to promote growth of vegetation.By reinforcing soil during vegetation growth, they significantly improve development of a strong and deeper root system.

Geomat is a light flexible material, an alternative to massive and ecologically-unfriendly concrete, stone or asphalt constructions. Due to open surface and strip hardness geomat can be easily filled with soil all over its area and depth and it encourages root germination, quick vegetation of slopes and thus guarantees erosion control. With right choice of the material and observation of assembling technique erosion damages can be eliminated evenon difficult areas and steep slopes.

ii). <u>Installation Methodology</u>

iii). 3D Geocomposite mat must be installed starting from the highest point.

- In order to attach the mesh, a 20cm wide and 20cm deep trench must be dug at least 1maway from the slope's edge.
- Insert the 3D Geocomposite mat inside the trench with ground pegs. Next, the trench shouldbe covered and compacted to increase its resistance.
- Please ensure to leave no more than 1m either side of each ground peg when attaching the3D mesh.
- Once installed and secured to the trench, the 3D Geocomposite mat can be unrolled on topof the slope following its downward direction.
- Please ensure to leave between 10 and 20cm overlap between rolls. Likewise, we must alsoplace ground pegs along the joints leaving no more than 1m on either side. When joining theends of two separate rolls, please ensure to leave at least a 10cm overlap as well as to provide further strengthening by installing additional

ground pegs no further apart than 50cmon either side.

- Once finished installing the 3D Geocomposite mat, we must proceed to assess the groundpegs installed in between the ends of two separate rolls.

High Tensile Steel Wire Mesh

Wire meshes have a composition of different percentages of high carbon steel, which is comprised of different diameters of wire and different geometries. Nowadays, high tensile steel wire meshes are used worldwide in different applications like security fences, architecture, natural hazard protection, blast protection during tunneling and road widening activities in hilly terrain, slope protection works.

In most conditions, high tensile wire meshes are used to protect the surface of the soil/ rock slope stabilization. Where the slope of soil/rock profile required cutting to meet the degree ofroad expansion, their surface is required to protect using nail/ SDA/ rock

bolt system with high tensile wire mesh system to secure the region between the soil nail/SDA/ rock bolt reinforced system.
Slope surface protection using the high tensile wire mesh system is very economical compared to traditional protection systems. This wire mesh system has freedom of arrangement for installation due to its flexible nature.

The high tensile wire mesh has considerable tensile strength of approximately 100kN/m, mesh punching strength 160kN. The high tensile wire mesh with their special properties provided for the slope surface stabilization is substantially more economical than wire ropes net systems.

The high tensile wire mesh system is commonly used in geotechnical engineering solutions. These are typically used in the rockfall protection kits, rock/soil slope surface protections, attenuator, secure drapery systems, debris flows, and prevention of avalanche, mudflow, and landslide protection applications.

After 3D Geocomposite mat are installed then high tensile wire mesh system are laid over theslope. This is fixed with bearing plates. Nut & plates are applied over the anchor to tightenthe mesh & 3D Geocomposite mat.

Drain pipes or weep hole pipes (50mm dia) PVC perforated pipes wrapped with non-woven geotextile are also installed parallely with SDA bars along the slope as per GFC drawings.

For all the above mentioned items refer: MORT&H (Section 3200) – Soil Nailing MORT&H (Section 700) – Geosynthetics

Chapter-8: SUMMARY OF IMPROVEMENT PROPOSALS

8.1 Introduction

As evident from the above, the first step towards formulating Improvements Options is to collect information on the project road primarily from engineering surveys and secondarily from various agencies concerned. Towards this end detailed information on the past and present traffic, availability of land, condition of CD structures, potential sources of construction material, environmentally sensitive areas and social hot spots has been collected. Also collected is information pertaining to existing settlements.

8.2 Improvement Proposals

Improvement proposals apropos functional components manifested in appropriate horizontal and vertical alignments, sight distance availability, lateral and vertical, clearances, intersection treatment etc. Aim at improved design speed, road safety and also cover facilities such as proper intersection treatments, bus shelters etc. Improvement proposals apropos structural components on the other hand calls for detailed evaluation of widening options, concentric or eccentric widening of the existing road as dictated by the sight situations like available ROW, existing utilities, terrain, etc., and also existing structural conditions, both for pavement and CD structures.

As evident from the above, the first step towards formulating Improvements Options is to collect information on the project road primarily from engineering surveys and secondarily from various agencies concerned. Towards this end detailed information on the past and present traffic, availability of land, condition of CD structures, potential sources of construction material, environmentally sensitive areas and social hot spots has been collected. Also collected are information pertaining to existing settlements, present configuration of intersections, importance of discrete cross roads, utility lines, locations of bus stops, truck parking etc.

Subsequent to a close observation of all these parameters, frequent site-visits have been undertaken to formulate improvement options that suit requirements of the project.

Development to 2 Lane with Paved shoulder option is planned for the development of project road.

Typical Cross Sections

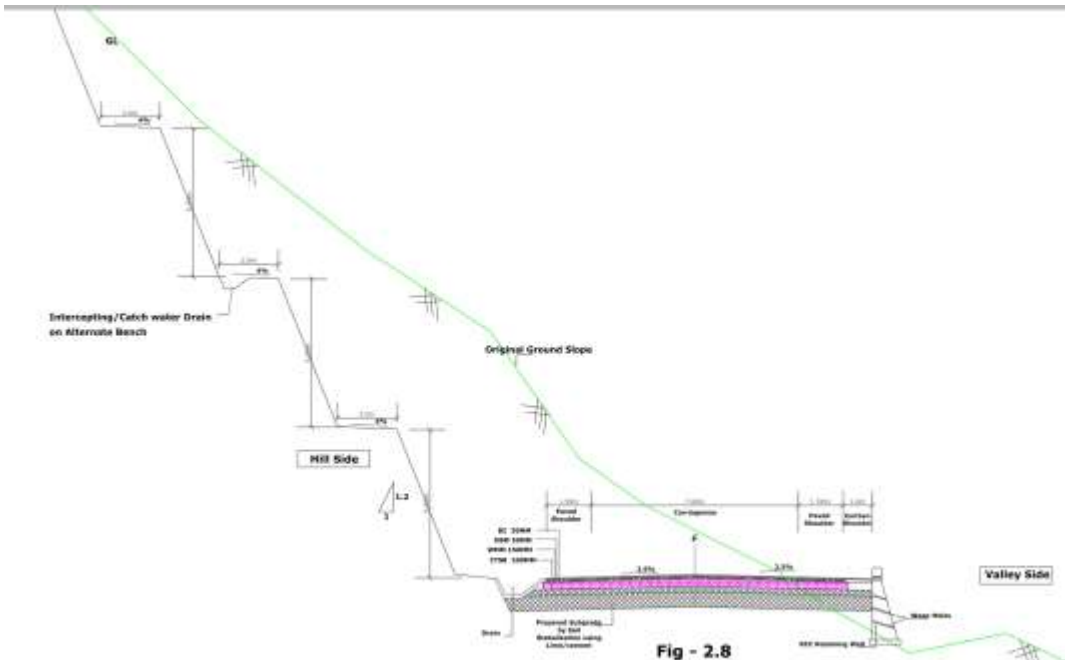

Fig - 2.8
Typical Cross Section
2- lane Carriageway WithOne Side Retaining Wall
(Open Country - Mountainous Terrain)

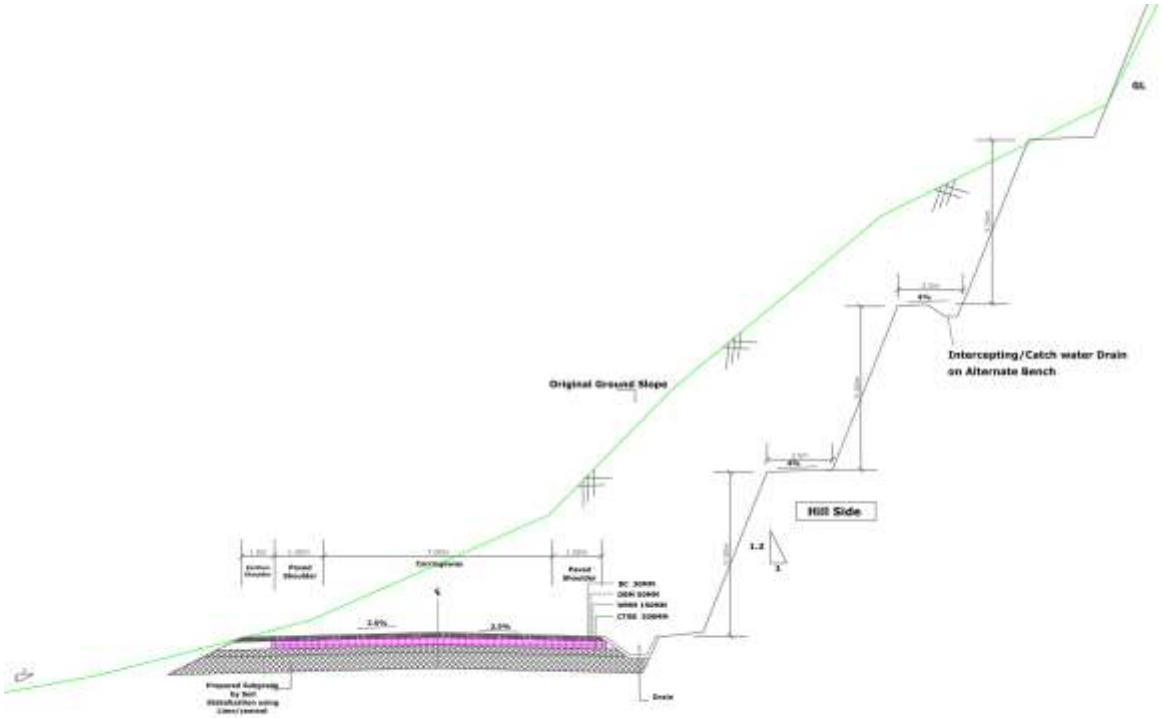

Fig - 2.9
Typical Cross Section
2- lane Carriageway Without Retaining Wall
(Open Country - Mountainous Terrain)

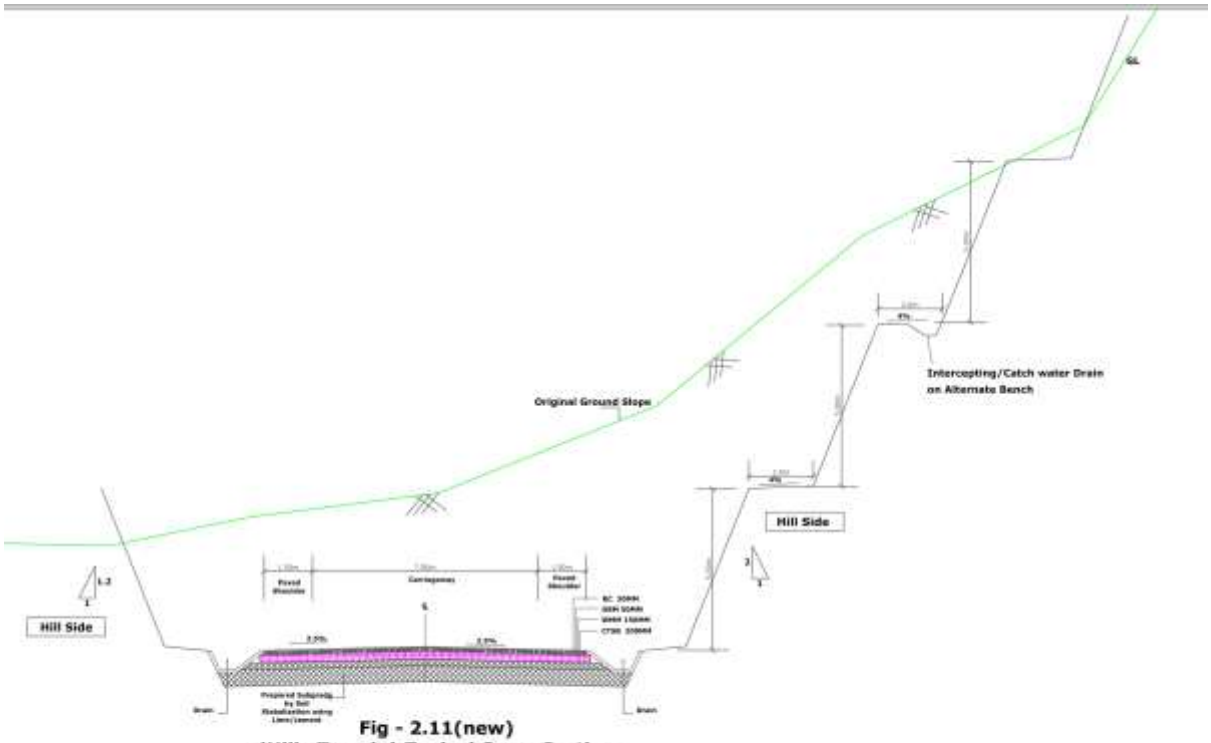

Fig - 2.11(new)
(Hilly Terrain) Typical Cross Section
2- lane Carriageway With Paved Shoulders
(Through Cut) Hill Section

Fig - 2.12 (new)
Typical Cross Section (Hilly Terrain)
2- lane carriageway (With Paved Shoulder)
(With Retaining Wall on both Side)

8.3 Details of Retaining wall-: 7.131 km

Special requirement for hill roads in accordance with the provisions of section 14 of the manual shall be provided in the following locations:-

Table 8.1 Retaining wall Details

S.No.	Design Chainage (In km.)		Side	Length (m)	Remarks
	From	To			
1.	162300	162400	One side	**100**	Hilly portion. Retaining wall shall be designed and provided as per the technical requirement in consultation with the Authority Engineer subject to minimum length of 7131 meter.
2.	162500	162800	One side	**300**	
3.	163100	163300	One side	**200**	
4.	163850	163950	One side	**100**	
5.	164150	164250	One side	**100**	
6.	164300	164450	One side	**150**	
7.	166200	166300	One side	**100**	
8.	167000	167200	One side	**200**	
9.	168100	169600	One side	**1500**	
10.	169600	170600	Both side	**2000**	
11.	170600	171500	One side	**900**	
12.	172000	172200	One side	**200**	
13.	172500	172800	One side	**300**	
14.	173400	173700	One side	**300**	
15.	174400	174500	One side	**100**	
16.	175100	175200	One side	**100**	
17.	175900	176100	One side	**200**	
18.	176300	176581	One side	**281**	
	Total			**7131m**	

8.4 Details of PCC Breast wall:- 19911m

Special requirement for hill roads in accordance with the provisions of section 14 of the manual shall be provided in the following locations:-

Table 8.1A Breast wall Details

S.No.	Des. Chainage		Side	Length in (m)
	From	To		
1	156489	167100	One side	10611
2	167100	168100	Both side	2000
3	168100	169600	One side	1500
4	170600	176400	One side	5800
		Total		**19911 m**

8.5 Details of Hydoseeding & Mulching :- 19011 m

Special requirement for hill roads in accordance with the provisions of section 14 of the manual shall be provided in the following locations:-

Table 8.1C Seeding & Mulching Details

S.No.	Des. Chainage		Side	Length in (m)
	From	To		
1	156489	167100	One side	10611
2	167100	168100	Both side	2000
3	168100	169600	One side	1500
4	171500	176400	One side	4900
		Total		**19011m**

8.6 Special Protection for Sinking Zone

S. No.	Location stretch		Length	Area in Sq.m.	Detail of Special Protection
	From (m)	To (m)	(in m)		
1	156600	156700	100	1000	At Sinking locations the hill surface/ slope to be protected / treated with Soil/ Rock nailing & High Strength Wire Mesh having of minimum diameter 3 mm twisted or Straight of high tensile steel wire as per IRC & BS specifications. The System should be tailor made according to the site conditions and requirements with accessories like Connection Clips / Press Claws / Shackles/ Boundary Ropes / Wire Rope Anchors etc. Equivalent / Higher Protection system will be Technically Evaluated by Approving Authority. The Final Type of product to be used shall be decided upon approval of final design / drawing as per IRC & BS specification.
2	159100	159600	500	20000	
3	160100	160300	200	4000	
4	162750	162800	50	1000	
5	163950	164300	350	10500	
6	165300	165700	400	10000	
7	166200	166400	200	3000	
8	166900	167100	200	2000	
9	167100	167300	200	4000	
10	167300	167800	500	25000	
11	168000	168500	500	5000	
12	173300	173550	250	2500	
13	174600	175100	500	7500	
Total				**95500**	

8.7 Hill Side Drain -: 25292 m

Drains on Hill side shall be provided in open country area at below locations:-

Table 8.2 Hill Side Drain Details

S.No.	TCS Type	Chainage prop.		Side	Length in (m)
		From	To		
1	Fig 2.9	156489	156900	One Side	**411**
2	Fig 2.11(new)	156900	157100	Both Side	**400**
3	Fig 2.9	157100	158500	One Side	**1400**
4	Fig 2.11(new)	158500	159900	Both Side	**2800**
5	Fig 2.9	159900	160600	One Side	**700**
6	Fig 2.11(new)	160600	161400	Both Side	**1600**
7	Fig 2.9	161400	162300	One Side	**900**
8	Fig 2.8	162300	162400	One Side	**100**
9	Fig 2.9	162400	162500	One Side	**100**
10	Fig 2.8	162500	162800	One Side	**300**

	TCS Type	Chainage prop.		Side	Length in (m)
11	Fig 2.9	162800	163100	One Side	**300**
12	Fig 2.8	163100	163300	One Side	**200**
13	Fig 2.9	163300	163850	One Side	**550**
14	Fig 2.8	163850	163950	One Side	**100**
15	Fig 2.9	163950	164150	One Side	**200**
16	Fig 2.8	164150	164250	One Side	**100**
17	Fig 2.11(new)	164250	164300	Both Side	**100**
18	Fig 2.8	164300	164450	One Side	**150**
19	Fig 2.11(new)	164450	164700	Both Side	**500**
20	Fig 2.9	164700	165100	One Side	**400**
21	Fig 2.11(new)	165100	165400	Both Side	**600**
22	Fig 2.9	165400	165600	One Side	**200**
23	Fig 2.11(new)	165600	166200	Both Side	**1200**
24	Fig 2.8	166200	166300	One Side	**100**
25	Fig 2.11(new)	166300	166600	Both Side	**600**
26	Fig 2.9	166600	166700	One Side	**100**
27	Fig 2.11(new)	166700	167000	Both Side	**600**
28	Fig 2.8	167000	167200	One Side	**200**
29	Fig 2.11(new)	167200	168100	Both Side	**1800**
30	Fig 2.8	168100	169600	One Side	**1500**
31	Fig 2.8	170600	171500	One Side	**900**
32	Fig 2.9	171500	172000	One Side	**500**
33	Fig 2.8	172000	172200	One Side	**200**
34	Fig 2.9	172200	172500	One Side	**300**
35	Fig 2.8	172500	172800	One Side	**300**
36	Fig 2.9	172800	172900	One Side	**100**
37	Fig 2.11(new)	172900	173200	Both Side	**600**
38	Fig 2.9	173200	173400	One Side	**200**
39	Fig 2.8	173400	173700	One Side	**300**
40	Fig 2.9	173700	174400	One Side	**700**
41	Fig 2.8	174400	174500	One Side	**100**
42	Fig 2.11(new)	174500	175100	Both Side	**1200**
43	Fig 2.8	175100	175200	One Side	**100**
44	Fig 2.11(new)	175200	175400	Both Side	**400**
45	Fig 2.9	175400	175900	One Side	**500**
46	Fig 2.8	175900	176100	One Side	**200**
47	Fig 2.9	176100	176300	One Side	**200**
48	Fig 2.8	176300	176581	One Side	**281**
			Total		**25292m**

8.8 Catch Water Drain:- 39442 m

Drains on Hill side shall be provided in open country area at below locations:-

S. No.	Chainage		Length (in m)	Avg No. of Bench (LHS)	Avg No. of Bench (RHS)	Catch Water Drain at no.of bench (LHS)	Catch Water Drain at no.of bench (RHS)	Total Length (in m)
	From	To						
1	156489	156700	211	2.000	0.000	1.000	0.000	**211**
2	156700	156900	200	1.000	0.000	1.000	0.000	**200**
3	156900	157100	200	1.000	1.000	1.000	1.000	**400**
4	157100	157400	300	1.000	0.000	1.000	0.000	**300**
5	157400	157500	100	5.000	0.000	3.000	0.000	**300**
6	157500	157700	200	7.000	0.000	4.000	0.000	**800**
7	157700	158100	400	1.000	0.000	1.000	0.000	**400**
8	158100	158200	100	4.000	0.000	2.000	0.000	**200**
9	158200	158500	300	1.000	0.000	1.000	0.000	**300**
10	158500	158700	200	7.000	1.000	4.000	1.000	**1000**
11	158700	158900	200	1.000	1.000	1.000	1.000	**400**
12	158900	159200	300	4.000	1.000	2.000	1.000	**900**
13	159200	159700	500	7.000	1.000	4.000	1.000	**2500**
14	159700	159800	100	1.000	1.000	1.000	1.000	**200**
15	159800	159900	100	5.000	1.000	3.000	1.000	**400**
16	159900	160100	200	2.000	0.000	1.000	0.000	**200**
17	160100	160300	200	5.000	0.000	3.000	0.000	**600**
18	160300	160500	200	1.000	0.000	1.000	0.000	**200**
19	160500	160600	100	4.000	0.000	2.000	0.000	**200**
20	160600	161400	800	6.000	1.000	3.000	1.000	**3200**
21	161400	162100	700	1.000	0.000	1.000	0.000	**700**
22	162100	162300	200	2.000	0.000	1.000	0.000	**200**
23	162300	162500	200	1.000	0.000	1.000	0.000	**200**
24	162500	162600	100	3.000	0.000	2.000	0.000	**200**
25	162600	162700	100	1.000	0.000	1.000	0.000	**100**
26	162700	162800	100	4.000	0.000	2.000	0.000	**200**
27	162800	163400	600	4.000	0.000	2.000	0.000	**1200**
28	163400	163900	500	4.000	0.000	2.000	0.000	**1000**
29	163900	164250	350	6.000	0.000	3.000	0.000	**1050**
30	164250	164300	50	6.000	1.000	3.000	1.000	**200**
31	164300	164450	150	4.000	0.000	2.000	0.000	**300**
32	164450	164700	250	6.000	1.000	3.000	1.000	**1000**
33	164700	164900	200	4.000	0.000	2.000	0.000	**400**
34	164900	165100	200	7.000	0.000	4.000	0.000	**800**
35	165100	165400	300	6.000	1.000	3.000	1.000	**1200**
36	165400	165600	200	6.000	0.000	3.000	0.000	**600**
37	165600	165800	200	4.000	1.000	2.000	1.000	**600**
38	165800	166000	200	1.000	1.000	1.000	1.000	**400**
39	166000	166200	200	2.000	1.000	1.000	1.000	**400**
40	166200	166300	100	3.000	0.000	2.000	0.000	**200**
41	166300	166400	100	3.000	1.000	2.000	1.000	**300**
42	166400	166500	100	2.000	1.000	1.000	1.000	**200**
43	166500	166600	100	1.000	1.000	1.000	1.000	**200**
44	166600	166700	100	4.000	0.000	2.000	0.000	**200**
45	166700	167000	300	2.000	1.000	1.000	1.000	**600**

S. No.	Chainage		Length	Avg No. of Bench	Avg No. of Bench	Catch Water Drain at	Catch Water Drain at no.of	Total Length
46	167000	167100	100	1.000	1.000	1.000	1.000	**200**
47	167100	167200	100	5.000	1.000	3.000	1.000	**400**
48	167200	167500	300	7.000	5.000	4.000	3.000	**2100**
49	167500	167700	200	9.000	4.000	5.000	2.000	**1400**
50	167700	167900	200	5.000	3.000	3.000	2.000	**1000**
51	167900	168100	200	2.000	2.000	1.000	1.000	**400**
52	168100	169600	1500	1.000	0.000	1.000	0.000	**1500**
53	170600	171500	900	1.000	0.000	1.000	0.000	**900**
54	171500	172900	1400	2.000	0.000	1.000	0.000	**1400**
55	172900	173200	300	2.000	1.000	1.000	1.000	**600**
56	173200	174500	1300	2.000	0.000	1.000	0.000	**1300**
57	174500	175100	600	2.000	1.000	1.000	1.000	**1200**
58	175100	175200	100	1.000	0.000	1.000	0.000	**100**
59	175200	175400	200	2.000	1.000	1.000	1.000	**400**
60	175400	176581	1181	1.000	0.000	1.000	0.000	**1181**
Total Length (in m)								**39442**

8.8 Metal Beam Crash Barriers: 14.892 Km.

Table 8.4 Crash Barriers Details

S.No.	TCS Type	Chainage prop.		Side	Length in (m)
		From	To		
1	Fig 2.9	156489	156900	One Side	**411**
2	Fig 2.9	157100	158500	One Side	**1400**
3	Fig 2.9	159900	160600	One Side	**700**
4	Fig 2.9	161400	162300	One Side	**900**
5	Fig 2.8	162300	162400	One Side	**100**
6	Fig 2.9	162400	162500	One Side	**100**
7	Fig 2.8	162500	162800	One Side	**300**
8	Fig 2.9	162800	163100	One Side	**300**
9	Fig 2.8	163100	163300	One Side	**200**
10	Fig 2.9	163300	163850	One Side	**550**
11	Fig 2.8	163850	163950	One Side	**100**
12	Fig 2.9	163950	164150	One Side	**200**
13	Fig 2.8	164150	164250	One Side	**100**
14	Fig 2.8	164300	164450	One Side	**150**
15	Fig 2.9	164700	165100	One Side	**400**
16	Fig 2.9	165400	165600	One Side	**200**
17	Fig 2.8	166200	166300	One Side	**100**
18	Fig 2.9	166600	166700	One Side	**100**
19	Fig 2.8	167000	167200	One Side	**200**
20	Fig 2.8	168100	169600	One Side	**1500**
21	Fig 2.12(new)	169600	170600	Both Side	**2000**
22	Fig 2.8	170600	171500	One Side	**900**
23	Fig 2.9	171500	172000	One Side	**500**
24	Fig 2.8	172000	172200	One Side	**200**

	TCS Type	Chainage prop.		Side	Length in (m)
25	Fig 2.9	172200	172500	One Side	**300**
26	Fig 2.8	172500	172800	One Side	**300**
27	Fig 2.9	172800	172900	One Side	**100**
28	Fig 2.9	173200	173400	One Side	**200**
29	Fig 2.8	173400	173700	One Side	**300**
30	Fig 2.9	173700	174400	One Side	**700**
31	Fig 2.8	174400	174500	One Side	**100**
32	Fig 2.8	175100	175200	One Side	**100**
33	Fig 2.9	175400	175900	One Side	**500**
34	Fig 2.8	175900	176100	One Side	**200**
35	Fig 2.9	176100	176300	One Side	**200**
36	Fig 2.8	176300	176581	One Side	**281**
			Total		**14892 m**

8.9 Widening Scheme as per Standard:

Table 8.5

Two lane undivided carriageway in plain/rolling Terrain with paved shoulders

Carriageway	=	3.50 m	Either side
Paves Shoulder	=	1.50 m	Either side
Earthen Shoulder	=	2.00 m	Either side
Total Roadway	=	14.00 m	-
Proposed ROW	=	24.00 m	-

Table 8.6

Two lane undivided carriageway in Hilly Terrain with paved shoulders

Carriageway	=	3.50 m	Either side
Paved Shoulder	=	1.50 m	Either side
Earthen Shoulder		1.0 m	Valley side
Total Roadway	=	11.00 m	-
Proposed ROW	=	30 m-45m	-

8.10 Horizontal Alignment Design

Design of the horizontal alignment has been carried out using highway design software as per widening scheme finalized. Extensive field checks to verify the feasibility of the proposed alignment have been carried out and suitable modifications to the alignment have been done wherever considered essential to safeguard sensitive elements.

8.11 Homogeneous Section

Based on TOR and existing road condition observed at site, the project road has been classified in 1 homogeneous section as shown below:

Table 8.7 Homogeneous Section Details

S.No.	Chainage prop.	Length	Remark

	From	To	(m)	
1.	156489	176581	20092	
Total			**20092m**	

8.12 Cross Section Details

The overall Cross section details for the project is as given below in table.

Table 8.8 TCS Summary

Sr. No.	Proposed TCS Type	Design Length (m)
1	Fig 2.8	5131
2	Fig 2.9	7761
3	Fig 2.11(new)	6200
4	Fig 2.12(new)	1000
	Total	**20092 m**

8.12.1 Two Lane Road with Paved shoulders in Hilly Terrain with Drains on Hill side and Retaining wall on Valley Side in open country area:- The Carriageway shall be 7.0 m wide with 1.5 m paved shoulder both side and 1.0m earthen shoulder valley side shall be provided. Also, Drain on Hill Side and Retaining wall on Valley Side shall be provided. The Stretch specified following table:-

Table 8.9Type TCS – 2.8

S.No.	Chainage prop.		Length (m)	TCS Type
	From	To		
1.	162300	162400	100	Fig 2.8
2.	162500	162800	300	Fig 2.8
3.	163100	163300	200	Fig 2.8
4.	163850	163950	100	Fig 2.8
5.	164150	164250	100	Fig 2.8
6.	164300	164450	150	Fig 2.8
7.	166200	166300	100	Fig 2.8
8.	167000	167200	200	Fig 2.8
9.	168100	169600	1500	Fig 2.8
10.	170600	171500	900	Fig 2.8
11.	172000	172200	200	Fig 2.8
12.	172500	172800	300	Fig 2.8
13.	173400	173700	300	Fig 2.8
14.	174400	174500	100	Fig 2.8
15.	175100	175200	100	Fig 2.8
16.	175900	176100	200	Fig 2.8
17.	176300	176581	281	Fig 2.8

Total	**5131 m**	

8.12.2 Two Lane Road with Paved shoulders in Hilly Terrain with Hill Side Drain without Retaining Wall in open country area:- The Carriageway shall be 7.0 m wide with 1.5 m paved shoulder both side & 1.0m Earthen Shoulder on valley side and Drain on Hill Side shall be provided. The Stretch specified following table.

Table 8.10 Type TCS – 2.9

S.No.	Chainage prop.		Length (m)	TCS Type
	From	To		
1	156489	156900	411	Fig 2.9
2	157100	158500	1400	Fig 2.9
3	159900	160600	700	Fig 2.9
4	161400	162300	900	Fig 2.9
5	162400	162500	100	Fig 2.9
6	162800	163100	300	Fig 2.9
7	163300	163850	550	Fig 2.9
8	163950	164150	200	Fig 2.9
9	164700	165100	400	Fig 2.9
10	165400	165600	200	Fig 2.9
11	166600	166700	100	Fig 2.9
12	171500	172000	500	Fig 2.9
13	172200	172500	300	Fig 2.9
14	172800	172900	100	Fig 2.9
15	173200	173400	200	Fig 2.9
16	173700	174400	700	Fig 2.9
17	175400	175900	500	Fig 2.9
18	176100	176300	200	Fig 2.9
Total			**7761 m**	

8.12.3 Two Lane Road with Paved shoulders in Hilly Terrain with Hill Side Drain both sides in open country area:- The Carriageway shall be 7.0 m wide with 1.5 m paved shoulder both side and Drain on both Hill Side shall be provided. The Stretch specified following table.

Table 8.11 Type TCS – 2.11(new)

S.No.	Chainage prop.		Length (m)	TCS Type
	From	To		
1.	156900	157100	200	Fig 2.11(new)
2.	158500	159900	1400	Fig 2.11(new)
3.	160600	161400	800	Fig 2.11(new)
4.	164250	164300	50	Fig 2.11(new)
5.	164450	164700	250	Fig 2.11(new)
6.	165100	165400	300	Fig 2.11(new)
7.	165600	166200	600	Fig 2.11(new)
8.	166300	166600	300	Fig 2.11(new)

9.	166700	167000	300	Fig 2.11(new)
10.	167200	168100	900	Fig 2.11(new)
11.	172900	173200	300	Fig 2.11(new)
12.	174500	175100	600	Fig 2.11(new)
13.	175200	175400	200	Fig 2.11(new)
Total			**6200 m**	

8.12.4 Two Lane Road in Hilly Terrain with both side Retaining Wall- The Carriageway shall be 10m wide and 1.0 m Earthen shoulder on both side shall be provided. The width of carriageway specified following table

S.No.	Chainage prop.		Length (m)	TCS Type
	From	To		
1.	169600	170600	1000	Fig 2.12(new)
Total			**1000m**	

8.13 Geometric Improvement/ Realignment

Existing Road is having Poor Horizontal & Vertical Geometries. Hence, Major length is in geometric improvements. The realignment details are given below:-

S.No.	Chainage prop.		Length (m)	Remark
	From	To		
1.	169600	170800	1200	Realignment
Total			**1200m**	

8.14 Classification of Project Stretches:

The project is classified into following stretches as per terrain classification

Table 8.12

Sr. No.	From	To	Terrain Classification
1	156489	176581	Mountaneous/Steep

8.15 Horizontal Curve details

Table 8.13 Horizontal Curve Details

Sr. No.	Intersection Point Chainage (m)	Circular Curve Start Chainage (m)	Circular Curve End Chainage (m)	Radius of circular Curve (m)	Transition Curve Length (m)	Speed (Km/h)
1	156588.070	156551.771	156624.335	70	30	40
2	156713.001	156664.686	156761.166	50	40	40
3	156827.694	156807.506	156847.876	125	15	40
4	156906.777	156866.064	156947.489	50	40	40
5	157001.579	156958.107	157043.431	30	30	30
6	157110.230	157076.341	157144.112	70	30	40
7	157229.177	157184.973	157273.001	70	30	40
8	157373.455	157346.232	157400.653	100	20	40

Sr. No.	Intersection Point Chainage (m)	Circular Curve Start Chainage	Circular Curve End Chainage	Radius of circular Curve	Transition Curve Length (m)	Speed (Km/h)
9	157538.219	157470.261	157600.420	90	25	40
10	157714.129	157667.852	157760.146	60	35	40
11	157975.625	157948.406	158002.843	80	25	40
12	158103.173	158052.497	158152.706	70	30	40
13	158272.217	158230.827	158313.557	60	35	40
14	158394.889	158372.910	158414.325	50	0	40
15	158480.123	158425.292	158534.127	50	40	40
16	158603.075	158574.575	158631.572	90	25	40
17	158702.120	158656.727	158747.307	60	35	40
18	158798.641	158763.258	158834.024	60	35	40
19	158927.800	158894.566	158961.031	75	30	40
20	159135.186	159080.223	159188.766	60	35	40
21	159265.349	159244.962	159280.775	30	0	30
22	159344.102	159290.927	159339.369	20	0	20
23	159377.626	159335.833	159408.964	20	20	20
24	159443.642	159410.971	159468.848	50	0	40
25	159525.469	159501.900	159545.949	50	0	40
26	159586.786	159554.743	159616.424	20	20	20
27	159774.280	159738.639	159809.920	60	35	40
28	159871.872	159835.676	159908.067	60	35	40
29	160085.966	160044.723	160127.208	50	40	40
30	160225.727	160166.410	160283.277	50	40	40
31	160402.486	160300.204	160475.729	67	35	40
32	160513.148	160476.221	160550.031	70	30	40
33	160589.213	160571.797	160606.627	125	15	40
34	160702.264	160668.027	160736.491	70	30	40
35	160784.616	160762.211	160807.020	100	20	40
36	160955.951	160934.975	160976.927	100	20	40
37	161029.313	160993.606	161065.021	60	35	40
38	161114.738	161098.704	161128.154	30	0	30
39	161232.653	161160.463	161296.667	100	20	40
40	161544.001	161397.074	161615.360	90	25	40
41	161782.081	161742.480	161821.429	90	25	40
42	162005.072	161953.310	162055.336	90	25	40
43	162126.121	162080.810	162170.957	70	30	40
44	162255.420	162214.521	162295.995	90	25	40
45	162363.469	162317.963	162405.860	40	25	30
46	162453.793	162423.217	162484.354	90	25	40
47	162568.062	162535.146	162576.138	20	0	20
48	162791.576	162580.802	162666.567	30	0	30
49	162747.641	162706.364	162779.017	20	20	20
50	162836.959	162793.270	162878.955	30	30	30

Sr. No.	Intersection Point Chainage (m)	Circular Curve Start Chainage	Circular Curve End Chainage	Radius of circular Curve	Transition Curve Length (m)	Speed (Km/h)
51	162960.282	162920.520	162998.804	40	25	30
52	163052.603	163005.839	163096.413	30	30	30
53	163193.222	163140.507	163245.410	50	40	40
54	163403.175	163377.658	163428.425	20	20	20
55	163523.493	163461.959	163581.054	125	15	40
56	163736.144	163705.898	163766.239	125	15	40
57	163876.656	163824.472	163927.611	75	30	40
58	164007.316	163955.490	164058.298	60	35	40
59	164188.958	164145.689	164232.122	60	35	40
60	164303.230	164265.079	164340.997	30	30	30
61	164385.128	164342.288	164419.302	25	20	30
62	164492.318	164449.162	164535.374	60	35	40
63	164627.729	164590.743	164664.674	75	30	40
64	164811.835	164747.396	164872.860	50	40	40
65	164995.975	164959.075	165032.641	30	30	30
66	165092.279	165042.235	165137.576	30	30	30
67	165175.603	165149.225	165201.572	20	20	20
68	165249.455	165223.947	165274.963	40	25	30
69	165341.647	165310.031	165373.030	300	0	40
70	165491.770	165445.212	165537.421	150	15	40
71	165695.587	165634.093	165755.457	200	15	40
72	165888.797	165816.595	165953.813	50	40	40
73	166260.114	166211.437	166308.620	50	40	40
74	166420.933	166385.791	166456.056	70	30	40
75	166505.470	166480.285	166530.433	20	20	20
76	166563.039	166537.713	166588.125	20	20	20
77	166685.916	166645.724	166713.432	50	0	40
78	166756.838	166713.629	166779.545	40	0	30
79	166811.244	166788.963	166833.524	100	20	40
80	167009.820	166980.256	167033.654	50	0	40
81	167161.349	167128.835	167193.609	300	0	40
82	167297.028	167223.968	167309.558	40	0	30
83	167344.602	167311.874	167377.195	100	20	40
84	167395.383	167349.320	167440.968	75	30	40
85	167560.752	167538.960	167580.063	50	0	40
86	167650.946	167583.008	167715.806	150	20	40
87	167792.965	167752.551	167833.248	75	30	40
88	167885.709	167861.478	167909.835	300	0	40
89	168002.310	167961.009	168042.982	100	20	40
90	168262.665	168197.936	168325.440	300	0	40
91	168502.903	168444.209	168559.946	150	20	40
92	168840.502	168681.831	168990.173	530	0	40

Sr. No.	Intersection Point Chainage (m)	Circular Curve Start Chainage	Circular Curve End Chainage	Radius of circular Curve	Transition Curve Length (m)	Speed (Km/h)
93	169078.601	169040.591	169116.576	1000	0	40
94	169230.541	169194.420	169266.316	300	0	40
95	169356.847	169323.879	169389.672	100	20	40
96	169563.277	169529.062	169591.252	60	0	40
97	169650.659	169602.869	169697.082	100	20	40
98	169873.360	169827.436	169918.798	200	15	40
99	170031.838	169998.331	170065.241	200	15	40
100	170274.896	170221.892	170325.648	100	20	40
101	170489.673	170469.420	170509.912	600	0	40
102	170733.718	170677.886	170786.701	100	20	40
103	170845.485	170789.375	170898.809	125	15	40
104	171011.293	170983.492	171039.033	150	15	40
105	171269.222	171213.352	171323.522	60	35	40
106	171509.670	171443.237	171512.035	30	0	30
107	171582.466	171532.227	171632.425	50	40	40
108	171713.721	171660.598	171766.265	50	40	40
109	171855.865	171776.384	171903.245	35	30	30
110	171945.685	171903.655	171987.714	50	40	40
111	172099.501	172054.601	172144.370	50	40	40
112	172298.692	172229.138	172362.522	50	40	40
113	172513.945	172435.605	172581.022	50	40	40
114	172718.937	172675.135	172762.723	50	40	40
115	172863.794	172821.317	172906.266	50	40	40
116	172946.172	172921.211	172971.125	100	20	40
117	173184.133	173030.828	173226.349	50	40	40
118	173284.458	173243.984	173324.932	50	40	40
119	173390.965	173352.691	173429.233	60	35	40
120	173563.813	173489.982	173542.232	20	0	20
121	173589.944	173545.177	173633.733	100	20	40
122	173811.759	173718.482	173881.522	80	25	40
123	174143.096	174102.836	174182.815	100	20	40
124	174369.617	174325.098	174414.111	50	40	40
125	174505.125	174427.166	174572.100	50	40	40
126	174700.611	174635.831	174760.965	75	30	40
127	174865.559	174798.972	174927.844	50	40	40
128	174981.020	174928.379	175033.141	50	40	40
129	175179.532	175153.934	175205.080	125	15	40
130	175298.930	175255.482	175342.095	75	30	40
131	175422.514	175354.880	175484.515	125	15	40
132	175563.873	175541.686	175586.046	125	15	40
133	175751.162	175694.665	175805.260	90	25	40
134	175869.417	175808.274	175896.807	50	0	40

Sr. No.	Intersection Point Chainage (m)	Circular Curve Start Chainage	Circular Curve End Chainage	Radius of circular Curve	Transition Curve Length (m)	Speed (Km/h)
135	176004.776	175958.828	176033.147	50	0	40
136	176081.039	176053.117	176104.047	50	0	40
137	176185.381	176144.126	176226.636	50	40	40
138	176347.439	176306.575	176388.152	75	30	40
139	176521.197	176460.055	176579.089	75	30	40

B. Vertical Alignment details

Table 8.13B Vertical Alignment Details

S.No.	IP		Type of Curve	Curve Length	K Value	Gradient	
	Chainage	Level				In	OUT
1	156529.261	1006.168	HOG	90	14.601	0.915	-5.249
2	156710.307	996.666	SAG	100	8.890	-5.249	6.000
3	156901.575	1008.142	HOG	110	9.167	6.000	-6.000
4	157459.855	974.645	SAG	150	17.028	-6.000	2.809
5	157730.007	982.234	HOG	100	14.314	2.809	-4.177
6	158116.172	966.104	HOG	100	64.226	-4.177	-5.734
7	158486.537	944.867	SAG	90	11.785	-5.734	1.903
8	158669.261	948.344	HOG	90	22.371	1.903	-2.120
9	158886.496	943.738	HOG	90	41.783	-2.120	-4.274
10	159485.023	918.157	SAG	90	15.904	-4.274	1.385
11	159762.169	921.997	HOG	90	14.514	1.385	-4.816
12	160049.261	908.170	SAG	90	481.283	-4.816	-4.629
13	160338.301	894.792	HOG	90	72.993	-4.629	-5.862
14	160487.888	886.022	SAG	90	82.267	-5.862	-4.768
15	160691.093	876.335	SAG	90	92.213	-4.768	-3.792
16	160983.304	865.255	SAG	90	29.373	-3.792	-0.728
17	161364.742	862.476	HOG	90	17.071	-0.728	-6.000
18	161549.212	851.408	SAG	90	14.259	-6.000	0.312
19	162109.261	853.157	HOG	90	34.884	0.312	-2.268
20	162361.976	847.425	SAG	90	27.599	-2.268	0.993
21	162911.330	852.881	HOG	90	21.077	0.993	-3.277
22	163238.684	842.154	HOG	90	68.966	-3.277	-4.582
23	163877.077	812.902	SAG	90	9.369	-4.582	5.024
24	164279.046	833.097	HOG	90	27.498	5.024	1.751
25	164445.376	836.009	HOG	90	19.223	1.751	-2.931
26	164618.065	830.947	SAG	90	22.877	-2.931	1.003
27	164909.261	833.868	HOG	90	52.053	1.003	-0.726
28	165160.358	832.045	HOG	90	29.566	-0.726	-3.770
29	165389.337	823.413	HOG	90	89.286	-3.770	-4.778
30	165799.152	803.832	SAG	90	8.812	-4.778	5.435
31	166096.040	819.969	HOG	150	14.918	5.435	-4.620
32	166471.388	802.629	SAG	90	30.242	-4.620	-1.644

S.No.	IP		Type of Curve	Curve Length	K Value	Gradient	
	Chainage	Level				In	OUT
33	166840.000	796.570	HOG	160	30.441	-1.644	-6.900
34	167540.000	748.270	SAG	60	60.000	-6.900	-5.900
35	167690.000	739.420	HOG	60	60.000	-5.900	-6.900
36	168390.000	691.120	SAG	60	60.000	-6.900	-5.900
37	168540.000	682.270	HOG	60	60.000	-5.900	-6.900
38	169240.000	633.970	SAG	60	60.000	-6.900	-5.900
39	169849.092	598.034	SAG	60	400.000	-5.900	-5.750
40	170500.439	560.581	SAG	90	17.928	-5.750	-0.730
41	170835.209	558.137	SAG	90	60.120	-0.730	0.767
42	171071.446	559.949	SAG	90	17.199	0.767	6.000
43	171458.246	583.157	HOG	90	16.630	6.000	0.588
44	171613.675	584.071	SAG	90	20.316	0.588	5.018
45	171793.652	593.102	HOG	90	17.182	5.018	-0.220
46	172251.446	592.096	HOG	90	83.488	-0.220	-1.298
47	172456.619	589.434	HOG	90	77.121	-1.298	-2.465
48	172667.481	584.235	SAG	90	25.077	-2.465	1.124
49	173137.252	589.515	HOG	90	15.795	1.124	-4.574
50	173440.625	575.638	SAG	90	46.201	-4.574	-2.626
51	173857.903	564.680	HOG	90	26.675	-2.626	-6.000
52	175134.718	488.072	SAG	90	23.190	-6.000	-2.119
53	175760.625	474.808	SAG	90	20.067	-2.119	2.366
54	176026.996	481.110	HOG	90	10.764	2.366	-5.995
55	176582.002	447.839	SAG	0	0.000	-5.995	0.000

8.16 Restrictions in Horizontal Alignment:

The Project road section is an existing bitumen road and has a well-defined formation. The improvements include flattening the sharp horizontal curves conforming to the minimum design of 80 kmph for plain/rolling terrain and 40 to 60 kmph for hilly terrain except locations listed below:-

Table 8.14 Restricted Horizontal Curve Details

Sr. No.	Intersection Point Chainage (m)	Circular Curve Start Chainage (m)	Circular Curve End Chainage (m)	Radius of circular Curve (m)	Transition Curve Length (m)	Speed (Km/h)
1	157001.579	156958.107	157043.431	30	30	30
2	159265.349	159244.962	159280.775	30	0	30
3	159344.102	159290.927	159339.369	20	0	20
4	159377.626	159335.833	159408.964	20	20	20
5	159586.786	159554.743	159616.424	20	20	20
6	161114.738	161098.704	161128.154	30	0	30
7	162363.469	162317.963	162405.860	40	25	30
8	162568.062	162535.146	162576.138	20	0	20

Sr. No.	Intersection Point Chainage (m)	Circular Curve Start Chainage	Circular Curve End Chainage	Radius of circular Curve	Transition Curve Length (m)	Speed (Km/h)
9	162791.576	162580.802	162666.567	30	0	30
10	162747.641	162706.364	162779.017	20	20	20
11	162836.959	162793.270	162878.955	30	30	30
12	162960.282	162920.520	162998.804	40	25	30
13	163052.603	163005.839	163096.413	30	30	30
14	163403.175	163377.658	163428.425	20	20	20
15	164303.230	164265.079	164340.997	30	30	30
16	164385.128	164342.288	164419.302	25	20	30
17	164995.975	164959.075	165032.641	30	30	30
18	165092.279	165042.235	165137.576	30	30	30
19	165175.603	165149.225	165201.572	20	20	20
20	165249.455	165223.947	165274.963	40	25	30
21	166505.470	166480.285	166530.433	20	20	20
22	166563.039	166537.713	166588.125	20	20	20
23	166756.838	166713.629	166779.545	40	0	30
24	167297.028	167223.968	167309.558	40	0	30
25	171509.670	171443.237	171512.035	30	0	30
26	171855.865	171776.384	171903.245	35	30	30
27	173563.813	173489.982	173542.232	20	0	20

At above locations Safety features like Traffic Sign boards, Crash Barrier, Road Delineators, etc. is proposed & Considered in Cost Estimates.

The improvement proposal of the project road has been designed in such a manner so as to utilize the existing road and cross drainage structures to its maximum and have minimum acquisition of structures & land to avoid resettlement impacts and shifting of utilities.

8.17 Junction Design

At-grade intersections, unless properly designed, can be accident-prone and can reduce the overall capacity of the road. The basic requirements for the design of intersections are not only to cater to safe movements for drivers, but also to provide them complete traffic-related information by way of signs, pavement markings and traffic signals. Simplicity and uniformity should be the guiding principles for intersection design. Based upon these principles the at-grade intersections have been categorized as:

1) Minor:

2) Channelized with or without acceleration and deceleration lanes;

3) Staggered;

4) Signalized intersections; and

There are a number of intersections along the project corridor with various categories of roads.

8.18 Major Junctions:

List of Major Junctions along the project corridor is presented in the table below:

Table 8.15: List of Major Junctions

S.no	Existing Chainage	Design Chainage	Category of Road	Type of Junction	Remarks
1	182+169	176+581	NH-54(L/s Jatinga R/s Maibong)	Y	

8.19 Minor Junctions:

There are a number of intersections along the project corridor with various categories of roads. There is approx. 1 Nos. of minor junction in our project road. Details are given below.

Table 8.16: List of Minor Junctions

S.NO.	Existing Chainage	Design Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Type of Road (BT/ER)	Detail of Destination of Junction
1	161+150	156+770	T	Village Road	RHS	ER	To P. Leikul Village
2	161+250	165+870	X	Village Road	BS	ER	To P. Leikul Village
3	161+325	156+950	X	Village Road	BS	ER	To P. Leikul Village
4	161+400	157+010	Y	Village Road	RHS	ER	To P. Leikul Village
5	161+500	157+100	Y	Village Road	LHS	ER	To P. Leikul Village
6	161+740	157+330	Y	Village Road	RHS	ER	To P. Leikul Village
7	163+305	158+815	Y	Village Road	LHS	BT	To Gamvom Village
8	164+880	160+330	Y	Village Road	LHS	ER	To Impoi(H) Village
9	164+900	160+350	Y	Village Road	RHS	ER	To Impoi(CH) Village
10	165+010	160+450	Y	Village Road	RHS	ER	To Impoi(CH) Village
11	166+080	161+500	X	Village Road	BS	ER	To Asalu Village
12	166+230	161+640	Y	Village Road	RHS	ER	To Asalu Village
13	166+460	161+870	Y	Village Road	LHS	ER	To Asalu Village
14	166+640	162+050	Y	Village Road	RHS	ER	To Asalu Village
15	167+100	162+510	Y	Village Road	LHS	ER	To Asalu Village
16	167+200	162+615	Y	Village Road	RHS	ER	To Hekaukang Village
17	167+230	162+650	Y	Village Road	LHS	ER	To Hekaukang Village
18	167+540	162+950	Y	Village Road	LHS	ER	To Hekaukang

S.NO.	Existing Chainage	Design Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Type of Road (BT/ER)	Detail of Destination of Junction
							Village
19	168+340	163+710	Y	Village Road	LHS	ER	To Nakhojau Village
20	168+480	163+840	Y	Village Road	LHS	ER	To Nakhojau Village
21	169+750	165+070	Y	Village Road	RHS	ER	To Pangmol Village
22	171+175	166+455	X	Village Road	BS	ER	To N. Lonkai Village
23	171+215	166+500	Y	Village Road	LHS	ER	To N. Lonkai Village
24	171+345	166+620	Y	Village Road	RHS	ER	To N. Lonkai Village
25	171+500	166+770	Y	Village Road	LHS	ER	To N. Lonkai Village
26	171+775	167+000	Y	Village Road	LHS	ER	To P. Lonkai Village
27	171+880	167+085	Y	Village Road	LHS	BT	To P. Lonkai Village
28	172+080	167+285	Y	Village Road	RHS	BT	To P. Lonkai Village
29	172+295	167+500	Y	Village Road	RHS	ER	To Nirianam Village
30	172+740	167+925	Y	Village Road	RHS	ER	To Nirianam Village
31	172+825	168+020	Y	Village Road	RHS	ER	To Chudining Village
32	173+135	168+300	Y	Village Road	RHS	ER	To Chudining Village
33	173+200	168+370	Y	Village Road	RHS	ER	To Chudining Village
34	173+540	168+690	X	Town Road	BS	ER	To NchureloaVillage
35	175+010	170+000	Y	Town Road	RHS	ER	To Assam Rifles Camp
36	175+875	170+800	Y	Town Road	RHS	ER	To Mahur Town
37	175+910	170+890	Y	Town Road	LHS	ER	To Mahur Town
38	176+010	170+975	Y	Town Road	RHS	ER	To Mahur Town
39	176+245	171+200	Y	Town Road	LHS	ER	To Mahur Town
40	176+515	171+470	Y	Village Road	LHS	ER	To Daodung Village
41	176+675	171+530	Y	Village Road	RHS	ER	To Daodung Village
42	176+800	171+750	Y	Village Road	LHS	ER	To Daodung Village
43	176+845	171+800	Y	Village Road	RHS	ER	To Daodung Village
44	177+595	172+515	Y	Village Road	LHS	ER	To Daodung Village
45	177+800	172+690	Y	Village Road	RHS	ER	To Daodung Village
46	178+325	173+200	Y	Village Road	RHS	ER	To Daodung Village

S.NO.	Existing Chainage	Design Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Type of Road (BT/ER)	Detail of Destination of Junction
47	178+735	173+500	Y	Village Road	LHS	ER	To Daodung Village
48	182+169	176+581	Y	NH-54	BS	BT	L/s Jatinga R/s Maibong

8.20 Project Facilities:

As per provisions below Project facilities should be provided along the Project Corridor.

Table 9.17: List of Project facilities

Sr. No.	Type of Facilities	Design Chainage	Side	Location
1	Bus Bay & Shelter	157+600-157+700	BS	P.Leikul
2	Bus Bay & Shelter	159+950-160+050	BS	Impoi(H&CH)
3	Bus Bay & Shelter	161+600-161+700	BS	Asalu
4	Bus Bay & Shelter	163+250-163+350	BS	Hekaukang
5	Bus Bay & Shelter	166+100-166+200	BS	N.Lonkai
6	Bus Bay & Shelter	166+850-166+950	BS	P.Lonkai
7	Bus Bay & Shelter	169+400-169+500	BS	Chudining
8	Bus Bay & Shelter	172+200-172+300	BS	Daodung
9	Truck lay bye & Shelter	157+800-157+900	One Side	-
10.	Rest Area with toilet Block	157+800-157+900	One Side	-

8.21 Improvement proposal for Bridges

Existing bridges to be re-constructed/newly constructed

1. The existing bridges at the following location shall be re-constructed as new Structures:-

(a) Major Bridges – NIL

Table 8.18: Major Bridges Details

S.No.	Design Chainage	Existing Chainage	Existing			Proposed			
			Structure Type	Span (m)	Width of bridge (m)	Recommendation	Span	Structure Type	Width of Bridge (m)
NIL									

(b) Minor Bridges – 5no.

Table 8.19: Minor Bridges Details

S. No.	Desing Chanage(Km)	Existing Chainage (Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	Span Arrangement (No. X Length) (m)	Width of Culvert (m)	Proposal			Proposed Width
					Total (m)	Recommendation	Type	Span	
1	161940	157490	BOX	1X3X3	3.5	Reconstruction	T- Beam Girder	3x16	18.00
2	169935	165255	BOX	2X3X4	7.2	Reconstruction	BOX	2X4X4	18.00
3	–	170210	–		–	New Construction	T -Beam Girder	3X16	18.00
4	–	170435	–		–	New Construction	T -Beam Girder	1X25	18.00
5	–	174710	–	–	–	New Construction	T -Beam Girder	1X25	18.00

8.22 Improvement Proposal of Culverts

General Condition of Culverts

As per the observations made at site for the project stretch, there are two types of culverts found. (i) Slab Culverts (RCC slabs and Stone slabs), (ii) Pipe Culverts. The structural condition of most of the RCC slab culverts, Pipe culverts is generally poor such as in spalled concrete, damaged / missing parapet wall, exposed reinforcement in slab, debris, & vegetation in waterway etc. A summary of all the types of culverts found at site.

8.22.1 Reconstruction of existing culverts:

The existing culverts at the following locations shall be re-constructed as new culverts:

(B) Culverts – 89no.

Table 8.20: Reconstruction Culverts Details

S.No	Existing Chainage	Design Chainage	Existing	Proposed		
			Structure Type	Structure	Span/Dia. Of Pipe (m)	Proposed width
1.	160895	156510	HPC	BOX	1X3X3	12.00
2.	161100	156705	HPC	BOX	1X3X3	12.00
3.	161510	157100	HPC	BOX	1X3X3	12.00
4.	162435	157960	BURRIED	BOX	1X2X2	12.00
5.	162560	158075	BURRIED	BOX	1X3X3	12.00
6.	162975	158490	HPC	BOX	1X3X3	12.00
7.	163310	158810	FCW	BOX	1X3X3	12.00
8.	163625	159115	HPC	BOX	1X3X3	12.00
9.	163770	159260	HPC	BOX	1X3X3	12.00
10.	163900	159385	HPC	BOX	1X3X3	12.00
11.	164130	159590	HPC	BOX	1X3X3	12.00

S.No	Existing Chainage	Design Chainage	Existing	Proposed		
			Structure Type	Structure	Span/Dia. Of Pipe (m)	Proposed width
12.	164245	159695	HPC	BOX	1X2X2	12.00
13.	164455	159890	HPC	BOX	1X3X3	12.00
14.	164720	160145	HPC	BOX	1X3X3	12.00
15.	164845	160285	HPC	BOX	1X3X3	12.00
16.	165100	160525	HPC	BOX	1X3X3	12.00
17.	165275	160700	HPC	BOX	1X3X3	12.00
18.	165475	160890	HPC	BOX	1X3X3	12.00
19.	165630	161025	HPC	BOX	1X3X3	12.00
20.	165740	161135	HPC	BOX	1X3X3	12.00
21.	165795	161190	HPC	BOX	1X3X3	12.00
22.	165920	161320	HPC	BOX	1X3X3	12.00
23.	166250	161655	HPC	BOX	1X3X3	12.00
24.	166360	161760	HPC	BOX	1X3X3	12.00
25.	166500	161905	RCC SLAB	BOX	1X3X3	12.00
26.	166715	162115	HPC	BOX	1X3X3	12.00
27.	166855	162265	BURRIED	BOX	1X2X2	12.00
28.	166925	162335	HPC	BOX	1X2X2	12.00
29.	167150	162550	BOX	BOX	1X3X3	12.00
30.	167330	162730	HPC	BOX	1X3X3	12.00
31.	167825	163200	HPC	BOX	1X3X3	12.00
32.	168035	163405	HPC	BOX	1X3X3	12.00
33.	168265	163630	HPC	BOX	1X2X2	12.00
34.	168390	163740	HPC	BOX	1X2X2	12.00
35.	168550	163900	HPC	BOX	1X3X3	12.00
36.	168625	163975	HPC	BOX	1X2X2	12.00
37.	168860	164115	BOX	BOX	1X3X3	12.00
38.	168840	164195	RCC SLAB	BOX	1X3X3	12.00
39.	168925	164270	HPC	BOX	1X3X3	12.00
40.	168950	164290	HPC	BOX	1X3X3	12.00
41.	169150	164490	HPC	BOX	1X3X3	12.00
42.	169290	164620	HPC	BOX	1X3X3	12.00
43.	164425	164750	HPC	BOX	1X2X2	12.00
44.	169710	165025	HPC	BOX	1X3X3	12.00
45.	170090	165410	HPC	BOX	1X3X3	12.00
46.	170190	165505	HPC	BOX	1X3X3	12.00

S.No	Existing Chainage	Design Chainage	Existing	Proposed		
			Structure Type	Structure	Span/Dia. Of Pipe (m)	Proposed width
47.	170420	165725	HPC	BOX	1X3X3	12.00
48.	170520	165805	BURRIED	BOX	1X2X2	12.00
49.	171000	166285	HPC	BOX	1X3X3	12.00
50.	171180	166450	HPC	BOX	1X3X3	12.00
51.	171220	166490	BURRIED	BOX	1X3X3	12.00
52.	171425	166690	HPC	BOX	1X2X2	12.00
53.	171580	166835	BOX	BOX	1X3X3	12.00
54.	171690	166910	BURRIED	BOX	1X3X3	12.00
55.	171790	166995	BURRIED	BOX	1X3X3	12.00
56.	171885	167085	BURRIED	BOX	1X3X3	12.00
57.	172355	167550	HPC	BOX	1X3X3	12.00
58.	172810	167990	BOX	BOX	1X3X3	12.00
59.	173855	168990	HPC	BOX	1X2X2	12.00
60.	174110	169235	HPC	BOX	1X2X2	12.00
61.	174175	169290	HPC	BOX	1X2X2	12.00
62.	174245	169360	HPC	BOX	1X3X3	12.00
63.	174370	169470	HPC	BOX	1X3X3	12.00
64.	174490	169560	HPC	BOX	1X3X3	12.00
65.	174930	169985	HPC	BOX	1X3X3	12.00
66.	175980	170945	RCC SLAB	BOX	1X3X3	12.00
67.	176220	171180	RCC SLAB	BOX	1X3X3	12.00
68.	176505	171460	RCC SLAB	BOX	1X3X3	12.00
69.	176550	171510	RCC SLAB	BOX	1X3X3	12.00
70.	176615	171610	HPC	BOX	1X2X2	12.00
71.	177045	171980	HPC	BOX	1X3X3	12.00
72.	177130	172080	RCC SLAB	BOX	1X3X3	12.00
73.	177265	172210	RCC SLAB	BOX	1X3X3	12.00
74.	177415	172370	RCC SLAB	BOX	1X3X3	12.00
75.	177510	172460	HPC	BOX	1X2X2	12.00
76.	177725	172620	RCC SLAB	BOX	1X3X3	12.00
77.	177975	172860	RCC SLAB	BOX	1X3X3	12.00
78.	178155	173040	BURRIED	BOX	1X2X2	12.00
79.	178890	173640	RCC SLAB	BOX	1X3X3	12.00
80.	179995	173730	BURRIED	BOX	1X3X3	12.00
81.	179250	173960	RCC SLAB	BOX	1X3X3	12.00

S.No	Existing Chainage	Design Chainage	Existing	Proposed		
			Structure Type	Structure	Span/Dia. Of Pipe (m)	Proposed width
82.	179695	174380	RCC SLAB	BOX	1X3X3	12.00
83.	180190	174800	FCW	BOX	1X3X3	12.00
84.	180695	175115	RCC SLAB	BOX	1X3X3	12.00
85.	180820	175265	HPC	BOX	1X3X3	12.00
86.	181070	175475	HPC	BOX	1X2X2	12.00
87.	181185	175585	HPC	BOX	1X2X2	12.00
88.	181340	175750	HPC	BOX	1X2X2	12.00
89.	182170	176570	HPC	BOX	1X2X2	12.00

8.22.2 Widening of existing culverts:

The existing culverts at the following locations shall be widened:

(A) Culverts – 0 nos.

Table 8.21: Widening Culverts Details

S.No	Existing Chainage	Design Chainage	Existing			Proposed		
			Existing Span Arrangement (m)	Width (m)	Structure Type	Structure	Width (m)	Span/Dia. Of Pipe (m)
NIL								

8.22.3 Retain & Repair of existing culverts:

The existing culverts at the following locations shall be retained with minor repair:

(A) Culverts – 0 nos.

Table 8.22: Repair Culverts Details

S.No	Existing Chainage	Design Chainage	Existing	
			Existing Span Arrangement (m)	Width (m)
NIL				

8.22.4 Additional new culverts:-

Additional new culverts shall be constructed as per particulars given in the table below:

a. **Hume Pipe Culvert** – 0 Nos.

b. **Box Culvert** –16 Nos.

Table 8.23: Box Culverts Details (New Construction)

S.No.	Location (Design Chainage)	Dia. Of Pipe/Span Length (m)	Width of Culvert (m)

S.No.	Location (Design Chainage)	Dia. Of Pipe/Span Length (m)	Width of Culvert (m)
1.	165990	1X2X2	12.00
2.	168190	1X2X2	12.00
3.	168390	1X2X2	12.00
4.	168590	1X2X2	12.00
5.	168785	1X2X2	12.00
6.	169830	1X3X3	12.00
7.	170210	1X3X3	12.00
8.	170600	1X3X3	12.00
9.	173300	1X2X2	12.00
10.	173410	1X2X2	12.00
11.	174150	1X2X2	12.00
12.	174580	1X3X3	12.00
13.	175025	1X2X2	12.00
14.	175850	1X2X2	12.00
15.	176190	1X2X2	12.00
16.	176360	1X2X2	12.00

Table 8.24: Summary of Culvert Proposal

Reconstruction (Box Culverts)	**89**
New construction (Box Culverts)	**16**

Chapter-9

ENVIRONMENTAL SCREENING AND PRELIMINARY ENVIRONMENTAL ASSESSMENT

9.1 INITIAL ENVIRONENTAL EXAMINATION

9.1.1 GENERAL

The Initial Environmental Examination (IEE) is carried out to assess the potential environmental impacts likely to be triggered by the project road. The project road will be upgrading, without any land acquisition and displacement of people. The project road belongs to **Category A** projects as per ADB's Environmental Assessment Guidelines (2003) and requires an IEE to be carried out. IEE report will be prepared based on the IEE format of ADB with due consideration to environmental legislation e.g. Environment (Protection) Rules, 1986 of Government of India (GoI).

The project, up-gradation of Tamenglong-Tousem-Laisong-Haflong Road is located in Tamenglong & Dima Hasao District of Manipur & Assam.

The objective of IEE is as following:

- to provide information about the general environmental settings around the sub project area as baseline data;
- to provide information on potential impacts of the project and characteristic of impacts, magnitude, distribution, and their duration;
- to provide information on potential mitigation measures to minimize the impact;
- to provide information on Environmental Management Plan (EMP)
- The field visits were made to collect the requisite information from various government departments and from other secondary sources (including limited public consultation in the form of focused group discussions).

In the IEE, activities proposed to be undertaken as part of this project will be considered and the potential impacts will be analyzed.

9.1.2 DESCRIPTION OF THE PROJECT

The road generally traverses through hilly terrain except at some portion of the road passing through Plain/Rolling terrain. The Project Road starts from Tamenglong town, Manipur and terminated at Mahur Town, Assam.

The proposed project road at present has two/intermediate/single lane carriageway. The road will be widened for two lane with paved shoulder. It is planned to upgrade the existing road with provisions for side drains, bridges, culverts, retaining walls etc. The project road will be implemented within the existing ROW (If possible).

The terrain is flat with very minor changes in elevation, and the landscape is open and forest cover as per REA Checklist below. The only noticeable changes from the flat terrain occur in the few places where the road briefly descends through ravines carved out by streams, and then climbs back to the level plain. Agriculture is the predominant land use and wheat crop is mainly cultivated on roadside. Settlements are sparse; the road runs largely through open fields. Numerous hand pumps are placed alongside the roadway for obtaining drinking.

9.1.3 ASIAN DEVELOPMENT BANK REQUIREMENTS

The ADB classifies projects such as SRED into one of three categories based on a screening of their expected environmental impacts:

- **Category A.** Category A projects are defined by the ADB as "Projects expected to have significant adverse environmental impacts. An environmental impact statement (EIA) (as defined by the ADB regulations) is required to address significant impacts."
- **Category B.** Category B projects are defined as "Projects judged to have some adverse environmental impacts, but of a lesser degree and/or significance than those for Category A projects. An initial environmental examination (IEE) is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report."
- **Category C**. Category C projects are defined as "Projects unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are still reviewed."

9.1.4 GOVERNMENT OF INDIA REQUIREMENTS

The following is provided for informational purposes. The IEE in hand has not been prepared to meet, and **does not purpose to meet**, GOI requirements that may ultimately be determined to be applicable to certain SRED activities. As of this writing, it is not anticipated that any GOI EIAs will be required. Careful planning of those activities that

of necessity occur outside the existing ROW (for example: placement of labor camps, extraction of fill from borrows areas, placement of temporary approaches to river crossings during bridge replacement), combined with proper contracting and procurement measures, should keep all SRED activities below the threshold that would trigger the need for an EIA.

- **Central Government Requirements.**

  - Primary responsibility for administration and implementation of the GOI policy with respect to conservation, ecologically sustainable development and pollution control rests with the Ministry of Environment and Forest (MOEF) and the regulations established pursuant to the National Conservation Strategy; National Forest Policy; the Policy for Abatement of Pollution (1992); and the Indian Environmental Protection Act 1986 (29 of 1986), revised in 1997.

  - Guidance for the preparation of environmental impact assessments (EIAs) within this overall framework for environmental clearance of new development proposals is provided by the GOI's *Handbook of Environmental Procedures and Guidelines* (1994).

  - Additional guidelines for road projects are provided by the Ministry of Road Transport and Highways (MORTH) in its publication entitled *Environmental Guidelines for Rail/Road and Highway Projects.* The Guidelines include the summary questionnaire to be submitted to MOEF for the preparation of EIAs for domestic road projects requiring an EIA as noted above.

  - MOEF Circular No. 21012/26-99-1a-111 dated 15 October 1997 exempts linear projects with ROWs of less than 20 metres (including the existing ROW and land acquisition as may be required by the project) from most review processes. Projects entirely contained within the existing ROW are considered as maintenance, which is generally not subject to MOEF review.

  - Thus, road projects limited to actions such as those proposed by SRED are generally exempted from GOI/EIA requirements. The Project will not include construction of any new high level bridges and thus will not require significant changes to the existing road alignment or grade level.

- **State Forest Department Requirements**

  - <u>Removal of trees along the ROW:</u> Trees will have to be removed within the existing ROW in some places to allow for widening of the carriageway, construction of shoulders, or to meet current road safety standards. It should be noted that trees within the ROW are considered to be within the purview of the State Forest Department. Therefore, an application will be required pursuant to MOEF letter Ref no. 4-1/97-FC, dated 18 February

1998, which provides revised guidelines for applicability of the Forest Conservation Act (1980) to linear infrastructure projects such as rail and road projects. Clearance by the State Forest Department is assumed to have been granted unless there is an indication to the contrary within 30 days.

- Impacts to Reserved Forests: In the event of potential impacts to Reserved Forests, a Notice of Compliance (NOC) is required from the State Forest Department. In the event that a submission to MOEF is required, the NOC must be obtained prior to action by MOEF.

- **State level Environment Impact assessment Authority.**

  - A State level Environment Impact assessment Authority hereinafter referred to as the SEIAA shall be constituted by the Central Government under sub-section (3) of section 3 of the Environment (Protection) Act, 1986 comprising of three members including a Chairman and a Member – Secretary to be nominated by the State Government or the Union territory administration concerned.

    All projects and activities are broadly categorized in to two categories – Category A and Category B, based on the spatial extent of potential impacts and potential impacts on human health and man made resources:

(i) All projects or activities included as Category 'A' in the Schedule, including expansion and modernization of existing projects or activities and change in product mix, shall require prior environmental clearance from the Central Government in the Ministry of Environment and Forests (MoEF) on the recommendations of an Expert Appraisal Committee (EAC to be constituted by the Central Government for the purposes of this notification.

(ii) All projects or activities included as Category 'A' in the Schedule, including expansion and modernization of existing projects or activities as specified will require prior environmental clearance from the Sate/Union territory Environment Impact assessment Authority (SEIAA).

- **State Pollution Control Board Requirements (SPCB).**

  - Certain actions to be included in SRED (e.g. the locations and operations of asphalt plants) will require submission of an application to the SPCB pursuant to the Water (Prevention and Control of Pollution) Act of 1974, Cess Act of 1977, and Air (Prevention and Control of Pollution) Act of 1981.

  - The SPCB generally establishes a review panel and circulates the application for public review and comment in each affected district. At least one public hearing is held in

each affected district following not less than 30 days notice in local and regional newspapers.

- A state-level hearing is also required, taking all comments received from the districts into account. Assuming acceptability, the SPCB issues a NOC.
- The SPCB's NOC, as well as the Forest Department's NOC, is required before MOEF action on any required EIA can be considered complete.

9.1.5 DESCRIPTION OF THE ENVIRONMENT

Data and information required for preparation of the IEE report have been collected from various government departments, secondary sources and through actual field visits. Environmental conditions of the area are discussed below:

(i) Physical Resources

- **Climate of Assam**

With the "Tropical Monsoon Rainforest Climate", Assam is temperate (summer max. at 95–100 °F or 35–38 °C and winter min. at 43–46 °F or 6–8 °C) and experiences heavy rainfall and high humidity. The climate is characterised by heavy monsoon downpours reducing summer temperatures and affecting foggy nights and mornings in winters, frequent during the afternoons. Spring (Mar–Apr) and autumn (Sept–Oct) are usually pleasant with moderate rainfall and temperature. Assam's agriculture usually depends on the south-west monsoon rains

- **Ambient Air Quality**

The air quality along the road is good as there is less flow of traffic. No major source of emission of exhaust gases exist along the road except some commercial and residential establishments, which burn wood as a fuel for commercial and domestic purposes.

As existing road is in narrow condition, dust due to wind blown and movement of vehicles on earthen shoulder portion is observed along the road. However, such dust particles are settled within short distances from the road.

- **Noise Levels**

In the area along the project road, noise levels are moderate as there is less traffic flow. Therefore, the contribution of traffic, in increase of ambient noise levels can be considered insignificant.

- **Topography and Soil**

The topography along the project road is generally hilly. Soil is usually Red Soil, yellow soil and black soil at some streches.

- **Seismology**

As per seismic zonal map of India, the sub project area is located in seismic zone II. The bridges, culverts and other structures, therefore, need to be designed accordingly.

(ii) Ecological Resources

- **Terrestrial Ecology**

Impacts to flora will be minimal throughout most of the Project areas. Most of the length of the ROW lies in rural (primarily agricultural) areas where the floral habitat has been seriously disturbed and altered from its native state. Certain portion, however, passes through or near some of the forested areas and no threatened or endangered plant species are located within or adjacent to the affected ROWs, and no adverse impacts to special status species are likely to occur due to these activities. Virtually all rehabilitation activities will be confined to the existing ROWs, and both direct and indirect impacts to threatened or endangered plant species are unlikely.

Plant species present within the ROW are either introduced species or ubiquitous native species, which are highly tolerant of grazing, compaction, and other physical disturbances. Construction activities will have direct impact only in a narrow band of vegetation adjacent to the existing roadways. Potential impacts to flora, in both the forest and non-forest areas will be avoided by ensuring that roadside activities such as asphalt plants, construction camps and other ancillary features are properly sited.

ROW, both inside and outside of forested areas, is lined by mature trees overarching the roadways. In some portion trees will have to be cut to permit rehabilitation of the roads to current safety standards.

- **Wildlife**

No impact is anticipated in terms of the wildlife habitat alteration or its destruction. In short is no wildlife area within the project area along the road.

- **Fisheries**

No fishing activity is observed in the drains of subproject area.

- **Rare or Endangered Species**

No rare or endangered species is reported in the area.

(iii) Economic Development

- **Industries**

No major/minor industrial activity is observed along the project road.

- **Commercial Activities**

Commercial activities observed mostly near the inhabitation portion, along the project road. These commercial activities are in the form of shops.

- **Infrastructure Facilities**

Infrastructure facilities are adequate in the area along the project road.

- **Agricultural Development**

The climate of the area is more suitable for growing agricultural i.e. wheat, Potato as well as vegetables. There exist huge potential as far as the agriculture development is concerned. Soils are Medium to Deep Black with relatively high clay content. The principal crops are paddy, wheat, jute, sugar cane, potato, turmeric, coconut and oil seeds. Irrigation is common.

- **Tourism in Assam**

The Assam Tourism Development Corporation Ltd. was incorporated on the 9th June, 1988 and registered under the Companies Act, 1956 Vide No:- 02-03006 of 1988-89. The State Govt. of Assam has promoted and set up the Corporation for growth and development of tourism in Assam.
6th international Tourism Mart 2017 began in Guwahati on 5 December 2017.

- **Tourist Hotspots**
- Kaziranga National Park
- Manas National Park
- Pobitora Wildlife Sanctuary
- Nameri National Park
- Dibru- Saikhowa National Park
- Orange National Park

Roughly shaped like a bird with wings stretching along the length of the Brahmaputra river, Assam is the central state in the North-East region of India and serves at the gateway to the rest of the Seven Sister States. The land of red river and blue hills, Assam comprises three main geographical areas: Brahmaputra Valley which constitutes the expansive wingspan, the Barak Valley extending like a tail, and the intervening karbi Plateau and North Cachar Hills. Assam Shares its border with Meghalaya, Arunachal Pradesh, Nagaland, Manipur, Tripura, Mizoram and West Bengal; and there are National Highway leading to their capital cities. It also shares international borders with Bhutan and Bangladesh. In ancient times Assam was known as Pragjyotisha or Pragjyotishpura, and kamarupa.

Rapid Environmental Assessment (REA) Checklist – Road

Road Section: **P. Leikul- Mahur(Borowapu) Section (Pkg-10) of Tamenglong-Mahur Road (NH-137) the state of Assam**

Screening questions	Yes	No	Remarks
A. Project sitting Is the project area adjacent to or within any of the following environmentally sensitive areas?			The project road does not pass through any National park/wildlife century and forest area. The project is not closed to any cultural heritage site.
▪ Cultural heritage site		X	The project does not pass through any heritage cultural site.
▪ Protected area	X		The project does pass through any Protected area
▪ Wetland		X	
▪ Mangrove		X	
▪ Estuarine		X	
▪ Buffer zone of protected area		X	The project does not pass through any Protected area
▪ Special area for protecting biodiversity		X	
B. Potential environmental impacts Will the project cause…			
Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		X	The topography of project road is mainly plain terrain with small section of hilly and rolling terrain. Minor impacts of landscape by road embankments, cuts and fills are anticipated. No encroachment of historical places. However, some temples exist along the project road which may get impacted. Proper management plan will be required during construction to sustain the quarries.
Encroachment on precious ecology (e.g. Sensitive or protected areas)?		X	

Screening questions	Yes	No	Remarks
Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		X	Project road crossed water streams. Controlled construction activities will ensure sediment discharge into streams to the extent.
Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?		X	Adequate sanitary facilities and drainage in the workers camps will help to avoid this possibility. As the construction activity in this project will not contain any harmful ingredients, no impact on surface water quality is anticipated.
Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	X		With appropriate mitigation measures and use of most modern environment friendly equipments/machineries air pollution shall be reduced to permissible levels
Noise and vibration due to blasting and other civil works?	X		Short term minor impact may occur during construction period, Suitable mitigation measures will be required to minimize the adverse effects
Dislocation or involuntary resettlement of people		X	No resettlement
Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		X	Imposing of appropriate mitigation measures in contract agreement to keep the air pollution within permissible levels will keep a check on this problem.
Hazardous driving conditions where construction interferes with pre-existing roads?		X	To minimized the impact suitable traffic management plan will be required

Screening questions	Yes	No	Remarks
Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?	X		Proper provisions for sanitation, health care and solid waste disposal facilities will be available in the contract documents to avoid such possibility. Workers will be made aware about communicable diseases
Creation of temporary breeding habitats for mosquito vectors of disease?		X	
Dislocation and compulsory resettlement of people living in right-of-way?		X	No displacement
Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life?		X	Adoption of suitable traffic signage system at sensitive places will reduce such possibility.
Increased noise and air pollution resulting from traffic volume?	X		Due to improvement in Riding Quality & Comfort in driving due to unidirectional traffic such pollution will be reduced. Mitigation measures along with monitoring plan will be required
Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	X		Controlled construction activities and proper drainage system will reduce this possibility. Due to improvement in Riding Quality & Comfort in driving due to unidirectional traffic such pollution will be reduced.

After reviewing the answers above the Mission Leader and Environment Specialist agree that the project.

		should be categorized as an A project.
X		should be categorized as a B project.
		should be categorized as a B project in an environmentally sensitive area.
		should be categorized as a C project.
		should be categorized as an A/B project because (give reason).
		requires additional information for classification. Therefore,
o		an Environment Specialist should be involved in the PPTA Fact-finding Mission.
o		Mission Leader should gather additional information during the PPTA Fact-finding Mission.

On the basis of above finding, project road may be categorized as Project 'B'

Chapter-10

INITIAL SOCIAL ASSESSMENT AND PRELIMANARY LAND ACQUISITION/RESETTLEMENT PLAN

INITIAL SOCIAL ASSESMENT

10.2.1 INTRODUCTION

An initial social assessment (ISA) is required for every development project in order to identify the people who may be beneficially or adversely affected by the project. It should access the stage of development of various subgroups and their needs, demands and absorptive capacity. It should also identify the institutions to be involved in the project and assess their capacities. The ISA should identify the key social dimensions aspects such as in voluntary resettlement, indigenous peoples, poverty reduction, and women in development. The ISA is generally taken as early as possible in the project cycle and preferably by the time of fact finding for a project preparation technical assistance.

As per the guidelines of ADB and Government of India policy the initial social and poverty analysis is being carried out. The social analysis study will among other things provide a socio economic profile of the project area. Particular attention is given to areas like indigenous people, communicable deceases like HIV AIDS, human trafficking, poverty alleviation, gender, local population, industry and agriculture. Aspects like health, education child labour land acquisition and resettlement need to be analyzed.

10.2.2 BACKGROUND

As part of the Project, to ascertain the Resettlement and Social Development Component of the Project, the scope of the present study as defined by the Terms of References (TORs) involved several elements as discussed below:

(a) To examine and assess the overall social and poverty profile of the Project area on the basis of the primary and secondary data sources such as statistical handbooks, poverty data, land use patterns etc, field visits, key stakeholder interviews and preparation of a socio-economic profile of the state of Tripura and the project districts.

(b) Preparation of social and poverty analysis, taking into account socio-economic and poverty status of the project area of influence, including the nature, extent and determinants of poverty in the project area including assessment of the risk of human trafficking and HIV/AIDS due to the project. In addition, estimation of the likely socioeconomic and poverty reduction impacts of the project also constituted an important aspect of the study.

(c) Consultations with concerned officials in the Government and other relevant offices, this includes consultation with APs and affected communities to assess responses to the Project and ascertain the nature and scope of local participation in project planning and implementation.

(d) To identify, analyze and, wherever appropriate, quantify the potential resettlement impacts of the proposed Project on the area population.

(e) To suggest measures to enhance benefits and mitigate adverse impact.

The report is based on the findings of the socioeconomic surveys, field visits and small group meetings with the Project populations in the Project area.

10.2.3 METHODOLOGY

The study will be conducted with a participatory approach that aimed at putting the community at the center with a collective process of reflection, discussion and consultation with all major stakeholders in the Project. The primary stakeholders, such as farmers, shopkeepers, daily wage laborers, panchayat members, women, and other socio-economically deprived groups like Scheduled Caste (SC), scheduled tribes (ST), health workers, school teachers, and non-government organizations (NGOs) will be consulted individually, in homogenous sub-groups and mixed groups to understand the local needs thereby to assess the responses to the proposed subprojects and also a certain the impact of the proposed project on the communities area and the overall region.

The team will make Field Visits to the respective projects and also interact with the villages (to be affected by the proposed project intervention) in order to ascertain the socio-economic profile of the area,

PRA techniques like social mapping, resource mapping, transect walk, mobility maps etc. will be used during the course of the field investigation.

Community meetings shall be initiated to obtain the views, responses & possible solutions from the local people.

Focus group discussions (FGD's) will be organized at the village level with different potential affected groups of people, more importantly, women, indigenous and other socio-economically deprived people to ascertain the impact of the project on them.

Meetings with village panchayats, non-government organizations, health workers, and school teachers will also be held during the course of field visits with special emphasis on project impact, poverty, road safety and related issues.

A Census Survey covering all affected structures along the alignments of each of the subprojects shall be conducted by means of a detailed questionnaire.

A detailed analysis of secondary data sources shall be carried out to understand the social, economic & demographic situation in the project area & will be submitted along with Detailed Project Report.

10.2.4 INVOLUNTARY SETTLEMENT ISSUES

The road area is not free of encroachments and illegal settlements within ROW. There shall not be any need for involuntary resettlement of people

10.2.5 INDEGENIOUS PEOPLE'S DEVELOPMENT

The study findings reveal that there would no significant impact on the indigenous people due to road widening and development. During the discussions held with the ST communities in the Project locations, the group expressed that the improved road network will augment access to services and economic opportunities not just for them but also for all segments of the state population. They did not envisage any negative impacts of the proposed project. However, a checklist has been prepared for Initial Screening for Project with Impact on Indigenous Peoples.

10.2.6 INITIAL POVERTY AND SOCIAL ASSESSMENT

On the basis of socio-economic data collected from the District Handbooks and other departmental publications and brochures relevant to the Project roads, as stated earlier, a Project Road Influence Area Profile (PRIA) has been prepared. The profile consists of demographic features, land utilization, occupation structure, agriculture production, acreage intensity, irrigation facilities, and concentration of infrastructure facilities, such as, availability of banks, hospital beds, primary schools, electrified villages, drinking water facilities, status of accessibility (paved/unpaved road), number of hat/bazaar, primary health centers, government public distribution shops, post offices and family planning center. The compiled data have been used in the present project for several analyses during the study. A summary with salient features is presented **below.**

Assam State Information

Geography:

A significant geographical aspect of Assam is that it contains three of six physiographic divisions of India – The Northern Himalayas (Eastern Hills), The Northern Plains (Brahmaputra plain) and Deccan Plateau (Karbi Anglong). 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). The hills of Karbi Anglong, North Cachar and those in and close to Guwahati (also Khasi-Garo Hills) now eroded and dissected are originally parts of the South Indian Plateau system. In the south, the Barak originating in the Barail Range (Assam-Nagaland border) flows through the Cachar district with a 25–30 miles (40–50 km) wide valley and enters Bangladesh with the name Surma River.

Urban Centres include Guwahati, one of the 100 fastest growing cities in the world. Guwahati is the gateway to the North-East India. Silchar, (in the Barak valley) the 2nd most populous city in Assam and an important centre of business, education and tourism. Other large cities include Dibrugarh, a oil, natural gas, tea and tourism industry; and Jorhat.

Economy

Assam's economy is based on agriculture and oil. Assam produces more than half of India's tea.[The Assam-Arakan basin holds about a quarter of the country's oil reserves, and produces about 12% of its total petroleum. According to the recent estimates Assam's per capita GDP is 6,157 at constant prices (1993–94) and 10,198 at current prices; almost 40% lower than that in India.According to the recent estimates,]per capita income in Assam has reached 6756 (1993–94 constant prices) in 2004–05, which is still much lower than India's.

The economy of Assam today represents a unique juxtaposition of backwardness amidst plenty Despite its rich natural resources, and supplying of up to 25% of India's petroleum needs, Assam's growth rate has not kept pace with that of India; the difference has increased rapidly since the 1970s. The Indian economy grew at 6% per annum over the period of 1981 to 2000; the growth rate of Assam was only 3.3%.In the Sixth Plan period, Assam experienced a negative growth rate of 3.78% when India's was positive at 6%. In the post-liberalised era (after 1991), the difference widened further.

According to recent analysis, Assam's economy is showing signs of improvement. In 2001–02, the economy grew (at 1993–94 constant prices) at 4.5%, falling to 3.4% in the next financial year. During 2003–04 and 2004–05, the economy grew (at 1993–94 constant prices) at 5.5% and 5.3% respectively. The advanced estimates placed the growth rate for 2005–06 at above 6%.Assam's GDP in 2004 is estimated at $13 billion in current prices. Sectoral analysis again exhibits a dismal picture. The average annual growth rate of agriculture, which was 2.6% per annum over the 1980s, has fallen to 1.6% in the 1990s The manufacturing sector showed some improvement in

the 1990s with a growth rate of 3.4% per annum than 2.4% in the 1980s. For the past five decades, the tertiary sector has registered the highest growth rates of the other sectors, which even has slowed down in the 1990s than in the 1980s.

Demography

Total population of Assam was 26.66 million with 4.91 million households in 2001. Higher population concentration was recorded in the districts of Kamrup, Nagaon, Sonitpur, Barpeta, Dhubri, Darrang, and Cachar. Assam's population was estimated at 28.67 million in 2006 and at 30.57 million in 2011 and is expected to reach 34.18 million by 2021 and 35.60 million by 2026.

As per 2011 census, total population of Assam was 31,169,272. The total population of the state has increased from 26,638,407 to 31,169,272 in the last ten years with a growth rate of 16.93%.

Of the 32 districts, eight districts registered rise in the decadal population growth rate. Religious minority-dominated districts like Dhubri, Goalpara, Barpeta, Morigaon, Nagaon, and Hailakandi, recorded growth rates ranging from 20 per cent to 24 per cent during the last decade. Eastern Assam districts including Sivasagar, and Jorhat registered around 9 per cent population growth. These districts do not share any international border.

In 2011, literacy rate in the state was 73.18%. Male literacy rate was 78.81% and female literacy rate was 67.27%.In 2001, the census had recorded literacy in Assam at 63.3% with male literacy at 71.3% and female at 54.6%. Urbanisation rate was recorded at 12.9%.

Growth of population in Assam has risen since the mid-decades of the 20th century. Population grew from 3.29 million in 1901 to 6.70 million in 1941. It increased to 14.63 million in 1971 and 22.41 million in 1991. The growth in the western and southern districts was high primarily due to the influx of people from East Pakistan, now Bangladesh.

The mistrust and clashes between native Bodos and Bengali Muslims started as early as 1952. but is rooted in anti Bengali sentiments of the 1940s At least 77 people died and 400,000 people was displaced in the 2012 Assam violence between indigenous Bodos and Bengali Muslims.

The People of India project has studied 115 of the ethnic groups in Assam. 79 (69%) identify themselves regionally,(19%) locally, and 3 trans-nationally. The earliest settlers were Austroasiatic and Dravidians speakers, followed by Tibeto-Burman, Indo-Aryan speakers, and Tai–Kadai speakers. Forty-five languages are spoken by different

communities, including three major language families: Austroasiatic Sino-Tibetan and Indo-European. Three of the spoken languages do not fall in these families. There is a high degree of bilingualism.[citation needed.

10.2.7 INITIAL SOCIAL IMPACTS AS A RESULT OF ROAD DEVELPOMENT

As per local inquiry and analysis of data collected, general picture suggests that the impact of road development project on social scenario of area shall be fairly positive. Since there are no critical issues which could adversely affect local people in terms of employment, culture, livelihood, health education etc. the project seems to create a positive impact on people in the project road influence area.

10.2.8 IMPACT ON POVERTY

The project road shall develop the transportation infrastructure in the adjoining area which in turn, wills c

erate avenues for development in employment, commerce, tourism, agriculture, health and education. All these aspects shall enhance social development of the area which shall ultimately result in reduction of poverty level.

10.2.9 IMPACT ON INDIGENEOUS PEOPLE

The indigenous people who are presently confined to local area only shall after development of road and thus transportation infrastructure will get more exposure to education, health, markets etc. The area is not vulnerable to migration settlements from external people. Since the major occupation of people in local area is agricultural based and there are no proper warehousing facilities for storage of agricultural product in the area the indigenous people will be benefited by road development project.

Initial Screening Checklist for Project with Impact on Indigenous Peoples

Sub Project: **Improvement/up-gradation of P. Leikul mahur(Borowapu) Section (Pkg-10) of Tamenglong-Mahur Road(NH-137) the state of Assam**

Screening question	Not known	Yes	No	Any other comments
Aside from the mainstream population, are there population groups who have been living in the project location before modern states or territories were created and before modern borders were defined?			✓	The Initial Social assessment of project study area identifies no ST household in the project area will be affected.

Are there population groups who maintain culture and social identities separate from mainstream or dominant societies and cultures?			✓	
Are there populations of tribal groups or culture minorities who have migrated into the project areas to which they are not indigenous, but have established a presence and separate social cultural identity?			✓	
Are there population groups that self- identifies themselves, or are identified by other and the mainstream population or by the Law, as being part of a distinct indigenous cultural group of ethnic minority?			✓	
Are there populations groups with a linguistic identify different from that of the mainstream society?			✓	
Are there population groups with social, culture, economic and political traditions and institutions distinct from the mainstream culture?			✓	
Are there population groups with economic systems oriented more toward traditional systems of production than the mainstream systems?			✓	
Are there population groups who maintain attachments to traditional habitats and ancestral territories and the natural resources in these habitats and territories?			✓	

Chapter-11: DETAILS OF FOREST & ENVIRONMENTAL CLEARANCE

11.1ENVIRONMENTAL CLEARANCE

As per MOEF guideline presently, Project Road does not require environmental clearance.

11.2 FORESTCLEARANCE

As per information by North Cachar Hills Autonomous Council, DimaHasao District no forest land exists on proposed alignment required **from Km 156.489 to 176.581 P. Leikul mahur(Borowapu) Section (Pkg-10) of Tamenglong-Mahur Road(NH-137)** the state of **Assam**.

11.3 WILD LIFE CLEARANCE

As per information by North Cachar Hills Autonomous Council, DimaHasao District no Wildlife Sanctuary/National Park/Protected forest exists on proposed alignment **from Km 156.489 to 176.581 P. Leikul mahur(Borowapu) Section (Pkg-10) of Tamenglong-Mahur Road(NH-137)** the state of **Assam**.

11.4 ECO-SENSITIVE ZONE CLEARANCE

As per information by North Cachar Hills Autonomous Council, DimaHasao District no Eco-Sensitive Zone exists on proposed alignment **from Km 156.489 to 176.581 P. Leikul mahur(Borowapu) Section (Pkg-10) of Tamenglong-Mahur Road(NH-137)** the state of **Assam**.

Chapter-12: COST ESTIMATE

12.1 General

This chapter provides a cost estimate **from Km 156.489 to 176.531 P. Leikul mahur(Borowapu) Section (Pkg-10) of Tamenglong-Mahur Road(NH-137)** in the state of **Assam**. The cost estimate is prepared based on the detailed assessment of project road section.

12.2 Methodology

The rate for various items has been adopted from (PWD) Schedules of Rates, Assam (Revision-2020-21).

12.3 Construction Quantities

The quantities of earthwork and pavement for road and bridge have been worked out manually.

The details of quantities work out for road work on the basis of following proposed typical cross sections:

Proposed typical cross section for project highway is given in table 13.1 below:

Table No. 12.1 Type of Typical Cross Section

Sr. No.	Description	Design Length (Km.) HS-I (Km)	Proposed TCS Type
1	Reconstruction in Two-Lane Carriageway with Paved Shoulder in Hilly Terrain with both side drain on hill side	6.200	TCS-2.11(new)
2	Two Lane Road in Hilly Terrain with both side Retaining Wall	1.000	TCS-2.12(new)
3	Two Lane Road with Paved shoulders in Hilly Terrain with Trapezoidal Drains on Hill side and Retaining wall on Valley Side in open country area	5.131	TCS-2.8
4	Reconstruction in Two-Lane Carriageway with Paved Shoulder in Hilly Terrain without retaining wall	7.761	TCS-2.9
	Total	**20.092 Km**	

12.4 Cross Section Details

The Project Road Section majorly Passes through Hilly terrain, so as per IRC SP: 73-2018, fig 2.8, fig 2.9, fig 2.10, fig2.10A (new) & fig 2.11(new) will be the adopted cross section including paved shoulder.

TCS-2.11(new)- Reconstruction in Two-Lane Carriageway with Paved Shoulder in Hilly Terrain with both side drain on hill side(Box cut)

TCS-2.8- Reconstruction in Two-Lane Carriageway with Paved Shoulder in Hilly Terrain with drain on hill side & Retaining wall on Valley side.

Fig-2.9- Reconstruction in Two-Lane Carriageway with Paved Shoulder in Hilly Terrain with drain on hill side & without Retaining wall.

Fig-2.12 (new) **-** Reconstruction in Two-Lane Carriageway in Hilly Terrain with both side raised footpath over covered drain (Built-up area)

12.5 Project Cost

The summary of cost estimate is presented as below:

S. No.	Item	Total Cost in Crores
A	***ROAD WORKS***	
1	*EARTHWORK UPTO SUBGRADE*	125.03
2	*GRANULAR SUB-BASE*	17.88
3	*NON BITUMINOUS BASE-COURSE*	11.75
4	*BITUMINOUS BASE-COURSE*	13.67
5	*WEARING COAT*	6.09
	SUB TOTAL (A)	**174.43**
B	***CROSS DRAINAGE STRUCTURES***	
6	*Reconstruction/ New Construction of Culverts*	47.31
7	*Reconstruction/ New Construction of Minor bridges*	19.14
8	*Reconstruction/ New Construction of Major bridges*	-
	SUB TOTAL OF CROSS DRAINAGE STRUCTURES (B)	**66.45**
C	***OTHER ITEMS***	
9	*Traffic Signs, marking and Appurtenances*	12.30
10	*Project Facilities*	3.03
11	*Drainage Works*	7.31
12	*Protection Works including Special Protection for Sinking Zone*	259.29
13	*Junction Improvement*	10.03
14	*Trees Plantation*	0.89
	SUB TOTAL OF OTHER ITEMS (C)	**292.85**
D	***Total Civil Costruction Cost (D= A+B+C)***	**533.73**
E	***Cost of Utility Shifting***	
15	*Water Supply Utilities as per PHED Estimates*	**1.02**
16	*Electrical Utilities as per APDCL Estimates*	**6.37**
	Total (E)	**7.39**
H	***Total Tender Cost (F=D+E)***	**541.12**
	Cost Per Km	**26.93**
I	***Pre Construction Activities***	
17	*Tentative Cost of Land Acquisition (for 74.0509 Ha)*	242.96
18	*Tentative Cost of Tree Felling*	5.61
	Total of Pre Construction Activities (I)	**248.57**
J	***GST/Contigencies and Centages***	

S. No.	Item	Total Cost in Crores
19	*Add Other Charges of Utility Shifting (Supervision, GST)*	1.36
20	*Add GST@ 18% on D above*	96.07
21	*Contigencies @ 1% of D above*	5.34
22	*Agency Charges @ 3% of D above +GST@18%*	18.89
23	*Supervision charges @ 3% of D above*	16.01
24	*Price Escalation @ 5% of 'D' above as per phasing of the project execution only for the period beyond 1 year of the Bid submission date*	26.69
25	*Maintenance during construction/Defect Liability Period @ 2.5% of 'D' (Calculate as per the rate prescribed in the latest Document on EPC Contract+GST@18%*	15.74
	Total of GST/Contigencies and Centages (J)	**180.10**
Total Project Cost (F+I+J)		**969.78**
Cost per Km.		**48.27**

CHAPTER – 13 CONCLUSION & RECOMMENDATION

13.1 General

National Highways and Infrastructure Development Corporation Limited, has decided to take up up-gradation & rehabilitation of Tamenglong-Mahur Road in the State of Assam where the intensity of traffic has increased and there is requirement of augmentation of capacity for safe and efficient movement of traffic.

Given the needs of the project to adequately address the concerns of the local population, the project has been conceived with suitable improvements.

13.2 Audit of Proposed Design

The Audit Team reviewed the proposed design from a road safety perspective and recommended in the following provisions.

Table 15.1: Road Safety Audit Report

Contents	Items	Provisions
Aspects to be checked	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.	In general main carriageway has been designed for minimum design speed of 80 kmph in plain & Rolling terrain for providing reasonable speed to heavy commercial vehicle. Turning radius at junctions and sharp curves will be improved to facilitate high-speed turns. All major junctions will have acceleration and deceleration lanes.
	Width options considered for various sections.	Two lane + Paved Shoulder
	Safety implications of the scheme beyond its physical limits; i.e. how the scheme fits into its environs and road hierarchy	Initial environment impact assessment has been carried out and report shall be prepared and submitted separately.
General	Departures from standards	Project road is designed at minimum speed of 40 kmph.
	Cross-sectional variation	Variation In Cross section will be as per site requirements.
	Drainage	Adequate provisions in terms of unlined drain on both side of main carriageway in plain / rolling terrain, open lined drain with kerbs in Hilly section and covered lined drain in built-up areas under separator are

Contents	Items	Provisions
		proposed. Besides above, drain network connectivity is also considered by keeping the provision of pipe culverts on cross roads merging/diverging from the project road.
	Climatic conditions	Hot in Summer and Cold in Winter
	Pedestrian Crossings	Provision for at grade crossing is made at locations based on pedestrian crossing survey.
	Landscaping	Vegetation/ Agriculture/ Forest
	Public Transport	State government (Manipur & Assam) and private operators regularly ply buses. Besides for local transport, people travel by privately run buses/jeeps.
	Visibility	All horizontal and vertical curves have been designed for appropriate stopping sight distance.
	Staging of contracts	The entire length of the project road is proposed to be develop. This Report deals P. Leikul Mahur(Borowapu) Section (Pkg-10) of Tamenglong-Mahur Road.
Local Alignment	New / Existing road interface	Concentric widening is followed to restrict land acquisition issues to bare minimum. As far as possible, existing geometry has been followed in urban area. Aspects of ease in construction and traffic movement during the construction phase have been considered while preparing the widening scheme. Realignment is proposed in some areas to maintain the design speed.
	Safety Aids on steep slopes	In high embankment section, metal beam crash barrier provision has been made. Vertical grades have been kept within 3.33% to 6% depending up on terrain.
Junctions	Minimize potential conflicts	As cross traffic movement on most of the junctions are found to be varying from low to high, there is need to minimize conflict points. Conflict points will be addressed by providing

Contents	Items	Provisions
		adequate wearing lengths.
	Layout	As far as possible, Y-junction will be eliminated and layout will be so designed so as to have minimum acquisition of land.
	Visibility	All junctions will be designed to have adequate least stopping sight distance.
Signs and Lighting	Signs / Markings	Standard road signage having retro-reflective sheeting of Super High Intensity grade type IX and pavement marking of highest grade have been considered for the project road. Road studs and Arrow Sign Boards are considered at Junction and curve portions.
Construction and Operation	Build ability	All aspects of available latest construction technology have been considered while proposing the highway and bridge design.
	Operational	Pavement design has been proposed in such a manner as would require minimum maintenance.
	Network management	New junctions have been introduced where the road is proposed to be re-alignment is proposed.

13.3 Recommendations

The following general recommendations are made:

- Based on the lane capacity analysis, the consultant suggests going for two lane with Paved shoulder for the project Road section.
- The scheme of construction / improvement proposals for Project Road, cross drainage structures and other facilities discussed in various chapters will be adopted for development of highway project.
- Highway expansions can be developed without causing significant adverse environmental impacts to the natural, social, economic or cultural environments of the study area, assuming the mitigation measures identified in this report are incorporated into detailed design.
- The project road has been designed for minimum 80 km/h speed in plain terrain & minimum 30km/h in hilly terrain with some exceptions.

- The vertical profile of the project road has been designed as at-grade sections with gentle gradient to achieve cost savings and minimize construction of elevated structures.
- Flexible pavement is recommended for entire stretch.
- The project section can be constructed within 24 months period with strategic planning and through one construction package. The construction work may begin from April, 2023.
- The baseline data was collected as per guidelines for Environmental Impact Assessment of highway project and as per provision in EIA notification of 27th January 1994 and amended on 14th September 2006.
- **The estimated TPC of** is Rs **969.78** Crores.
- The Project is to be developed on EPC Mode. Schedules of Concession Agreement (EPC) are presented in Vol-IX.

ANNEXURES TO

MAIN REPORT

INDEX

1. Road Inventory & Condition Survey

DETAIL ROAD INVENTORY & CONDITION SURVEY

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

S.No.	Design Chainage		Formation Width (m)	Existing ROW (m)	CARRIAGEWAY			SHOULDER			Embankment Height (m)	Submergencer (cm)	Drains Type		Service Road if any	Road Side Drain (F/NF)	Details of Junctions			
	From (Km)	To (Km)			#1.Type (BT/ CC/ WBM/ ER)	Width (m)	#2. Condition (G /F/ P/ VP)	#3. Type (Erarthen /Hard/Paved)	Width (m)	Condition (G/ F/ P/ VP)			Left	Right			Location (km)	TypeT/Y/+	Destination	SH / NH / MDR /LC & Carriageway Width (m)
1	160875	175600	6-7	7m	BT	3.00	P	ER	1-1.5	P	H	-	-	-	-	-	-	-	-	-
2	175600	182169	6-7	10m	BT	3.75	P	ER	1-1.5	P	H	-	-	-	-	-	-	-	-	-

2. Terrain Details

Terrain Details

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

S. No.	Existing Chainage		Length (in m)	Terrain
	From	To		
1	160875	182169	21294	Hilly
Total Length (in m)			21294	

3. Land Use pattern

Land Use Pattern

Project road: P. Leikul- Mahur (Borowapu) Section
Section:- From Km 160+875 to 182+169
District: Dima Hasao
State: Assam

S. No.	Ex Chainage		Length (in m)	Des Chainage		Length (in m)	Land Use
	From	To		From	To		
1	160875	161100	225	156500	156720	220	Agricultrure
2	161100	161800	700	156720	157390	670	Builtup
3	161800	164550	2750	157390	160000	2610	Agricultrure
4	164550	165200	650	160000	160640	640	Builtup
5	165200	165800	600	160640	161200	560	Agricultrure
6	165800	166700	900	161200	162115	915	Builtup
7	166700	166850	150	162115	162270	155	Agricultrure
8	166850	167850	1000	162270	163235	965	Builtup
9	167850	171000	3150	163235	166300	3065	Agricultrure
10	171000	172050	1050	166300	167230	930	Builtup
11	172050	172700	650	167230	167900	670	Agricultrure
12	172700	173350	650	167900	168515	615	Builtup
13	173350	174550	1200	168515	169615	1100	Agricultrure
14	174550	177700	3150	169615	172000	2385	Builtup
15	177700	182169	4469	172000	176635	4635	Agricultrure

Village Detail

Project road: P. Leikul- Mahur (Borowapu) Section
Section:- From Km 160+875 to 182+169
District: Dima Hasao
State: Assam

S. No.	Ex Chainage		Length (in m)	Land Use
	From	To		
1	160875	161940	1065	P.Leikul Village
2	161940	164560	2620	Impoi(H) Village
3	164560	164720	160	LHS-Impoi(H) Village RHS-Impoi(CH) Village
4	164720	165275	555	LHS-Asalu Village RHS-Impoi(CH) Village
5	165275	165800	525	Impoi(CH) Village
6	165800	167050	1250	Asalu Village
7	167050	168040	990	Hekaukang Village
8	168040	168850	810	Nakhojau Village
9	168850	171000	2150	Pangmol Village
10	171000	171580	580	N. Lonkai Village
11	171580	172350	770	P. Lonkai Village
12	172350	173350	1000	Nrianam Village
13	173350	174020	670	Chudining Village
14	174020	174540	520	Nchureloa Village
15	174540	174850	310	Nkeadamglao Village
16	174850	175700	850	Mahur
17	175700	176500	800	Mahur Garden
18	176500	180100	3600	Daodung & Gudairaji Village
19	180100	182169	2069	Borowapu Village

5. Junction Detail

Junction Detail

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

S.NO.	Existing Chainage	Design Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/ VR)	SIDE (LHS/RHS)	Type of Road (BT/ER)	Detail of Destination of Junction
1	161+150	156+770	T	Village Road	RHS	ER	To P. Leikul Village
2	161+250	165+870	X	Village Road	BS	ER	To P. Leikul Village
3	161+325	156+950	X	Village Road	BS	ER	To P. Leikul Village
4	161+400	157+010	Y	Village Road	RHS	ER	To P. Leikul Village
5	161+500	157+100	Y	Village Road	LHS	ER	To P. Leikul Village
6	161+740	157+330	Y	Village Road	RHS	ER	To P. Leikul Village
7	163+305	158+815	Y	Village Road	LHS	BT	To Gamvom Village
8	164+880	160+330	Y	Village Road	LHS	ER	To Impoi(H) Village
9	164+900	160+350	Y	Village Road	RHS	ER	To Impoi(CH) Village
10	165+010	160+450	Y	Village Road	RHS	ER	To Impoi(CH) Village
11	166+080	161+500	X	Village Road	BS	ER	To Asalu Village
12	166+230	161+640	Y	Village Road	RHS	ER	To Asalu Village
13	166+460	161+870	Y	Village Road	LHS	ER	To Asalu Village
14	166+640	162+050	Y	Village Road	RHS	ER	To Asalu Village
15	167+100	162+510	Y	Village Road	LHS	ER	To Asalu Village
16	167+200	162+615	Y	Village Road	RHS	ER	To Hekaukang Village
17	167+230	162+650	Y	Village Road	LHS	ER	To Hekaukang Village
18	167+540	162+950	Y	Village Road	LHS	ER	To Hekaukang Village
19	168+340	163+710	Y	Village Road	LHS	ER	To Nakhojau Village
20	168+480	163+840	Y	Village Road	LHS	ER	To Nakhojau Village
21	169+750	165+070	Y	Village Road	RHS	ER	To Pangmol Village
22	171+175	166+455	X	Village Road	BS	ER	To N. Lonkai Village
23	171+215	166+500	Y	Village Road	LHS	ER	To N. Lonkai Village
24	171+345	166+620	Y	Village Road	RHS	ER	To N. Lonkai Village
25	171+500	166+770	Y	Village Road	LHS	ER	To N. Lonkai Village
26	171+775	167+000	Y	Village Road	LHS	ER	To P. Lonkai Village
27	171+880	167+085	Y	Village Road	LHS	BT	To P. Lonkai Village
28	172+080	167+285	Y	Village Road	RHS	BT	To P. Lonkai Village
29	172+295	167+500	Y	Village Road	RHS	ER	To Nirianam Village
30	172+740	167+925	Y	Village Road	RHS	ER	To Nirianam Village
31	172+825	168+020	Y	Village Road	RHS	ER	To Chudining Village
32	173+135	168+300	Y	Village Road	RHS	ER	To Chudining Village
33	173+200	168+370	Y	Village Road	RHS	ER	To Chudining Village
34	173+540	168+690	X	Town Road	BS	ER	To NchureloaVillage
35	175+010	170+000	Y	Town Road	RHS	ER	To Assam Rifles Camp
36	175+875	170+800	Y	Town Road	RHS	ER	To Mahur Town
37	175+910	170+890	Y	Town Road	LHS	ER	To Mahur Town
38	176+010	170+975	Y	Town Road	RHS	ER	To Mahur Town
39	176+245	171+200	Y	Town Road	LHS	ER	To Mahur Town
40	176+515	171+470	Y	Village Road	LHS	ER	To Daodung Village
41	176+675	171+530	Y	Village Road	RHS	ER	To Daodung Village
42	176+800	171+750	Y	Village Road	LHS	ER	To Daodung Village
43	176+845	171+800	Y	Village Road	RHS	ER	To Daodung Village
44	177+595	172+515	Y	Village Road	LHS	ER	To Daodung Village

Junction Detail

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

S.NO.	Existing Chainage	Design Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/ VR)	SIDE (LHS/RHS)	Type of Road (BT/ER)	Detail of Destination of Junction
45	177+800	172+690	Y	Village Road	RHS	ER	To Daodung Village
46	178+325	173+200	Y	Village Road	RHS	ER	To Daodung Village
47	178+735	173+500	Y	Village Road	LHS	ER	To Daodung Village
48	182+169	176+581	Y	NH-54	BS	BT	L/s Jatinga R/s Maibong

6. Culvert & Bridge Inventory

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

Sl. No.	Existing Chainage as per Survey drawng (Km)	Desing Chanage(Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	Thickness of Slab (m)	Span Arrangement and Total Ventway (No. X Length) (m)	Width (m)		Length (m)	Width of parapet (m)	Details of Protection Works		Condition of various features of Culvert					Condition of various features of Bridges				Height above Bed Level	PROPOSAL				Remarks
						Total (m)	Carriageway (m)			Type	Condition	Slab/Pipe/ Box/Arch	Head Wall	Wing Wall	Return Wall	Parapet/Handrail	Foudation	Substructure	Superstructure	Railing/Parapet		Recommendation on widening / Reconstruction etc.	Type of Structure	Span No.X Length	Width(in m)	
1	160895	156510	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
2	161100	156705	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
3	161510	157100	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
4	161940	157490	BOX	_	1X3X3	3.5	_	3.5	_	_	_	F	_	F	F	_	_	_	_	_	_	Reconstruction	T- Beam Girder	3x16	18.00	MNB
5	162015	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
6	162435	157960	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
7	162495	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
8	162560	158075	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
9	162650	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
10	162975	158490	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
11	163310	158810	FCW	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
12	163625	159115	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
13	163770	159260	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
14	163900	159385	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
15	164010	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
16	164130	159590	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
17	164245	159695	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
18	164455	159890	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

Sl. No.	Existing Chainage as per Survey drawng (Km)	Desing Chanage(Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	Thickness of Slab (m)	Span Arrangement and Total Ventway (No. X Length) (m)	Width (m)		Length (m)	Width of parapet (m)	Details of Protection Works		Condition of various features of Culvert					Condition of various features of Bridges				Height above Bed Level	PROPOSAL				Remarks
						Total (m)	Carriageway (m)			Type	Condition	Slab/Pipe/ Box/Arch	Head Wall	Wing Wall	Return Wall	Parapet/Handrail	Foudation	Substructure	Superstructure	Railing/Parapet		Recommendation on widening / Reconstruction etc.	Type of Structure	Span No.X Length	Width(in m)	
19	164500	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
20	164720	160145	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
21	164845	160285	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
22	164900	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
23	165040	_	FCW	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Deleted				
24	165100	160525	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
25	165275	160700	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
26	165475	160890	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
27	165550	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
28	165630	161025	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
29	165740	161135	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
30	165795	161190	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
31	165920	161320	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
32	166170	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
33	166250	161655	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
34	166360	161760	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
35	166395	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
36	166445	_	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Deleted				

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

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						Total (m)	Carriageway (m)			Type	Condition	Slab/Pipe/ Box/Arch	Head Wall	Wing Wall	Return Wall	Parapet/Handrail	Foudation	Substructure	Superstructure	Railing/Parapet		Recommendation on widening / Reconstruction etc.	Type of Structure	Span No.X Length	Width(in m)	
37	166500	161905	RCC SLAB	0.2	1X1	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
38	166715	162115	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
39	166810	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
40	166855	162265	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
41	166925	162335	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
42	167150	162550	BOX	_	1X2X2	2.6	_	2.6	_	_	_	F	_	F	F	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
43	167330	162730	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
44	167375	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
45	167825	163200	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
46	167895	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
47	167990	_	RCC SLAB	0.2	1X2	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Deleted				
48	168035	163405	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
49	168265	163630	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
50	168390	163740	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
51	168550	163900	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
52	168625	163975	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
53	168690	-	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
54	168860	164115	BOX	_	1X1X1	1.8	_	1.8	_	_	_	F	_	F	F	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

Sl. No.	Existing Chainage as per Survey drawng (Km)	Desing Chanage(Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	Thickness of Slab (m)	Span Arrangement and Total Ventway (No. X Length) (m)	Width (m)		Length (m)	Width of parapet (m)	Details of Protection Works		Condition of various features of Culvert					Condition of various features of Bridges				Height above Bed Level	PROPOSAL				Remarks
						Total (m)	Carriageway (m)			Type	Condition	Slab/Pipe/ Box/Arch	Head Wall	Wing Wall	Return Wall	Parapet/Handrail	Foudation	Substructure	Superstructure	Railing/Parapet		Recommendation on widening / Reconstruction etc.	Type of Structure	Span No.X Length	Width(in m)	
55	168840	164195	RCC SLAB	0.2	1X2	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
56	168925	164270	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
57	168950	164290	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
58	169150	164490	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
59	169290	164620	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
60	164425	164750	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
61	169710	165025	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
62	169935	165255	BOX	_	2X3X4	7.2	_	11.5	_	_	_	F	_	F	S	_	_	_	_	_	_	Reconstruction	BOX	2X4X4	18.00	MNB
63	170040	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
64	170090	165410	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
65	170110	_	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Deleted				
66	170190	165505	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
67	170420	165725	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
68	170520	165805	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
69	_	165990	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
70	171000	166285	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
71	171070	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
72	171180	166450	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

Sl. No.	Existing Chainage as per Survey drawng (Km)	Desing Chanage(Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	Thickness of Slab (m)	Span Arrangement and Total Ventway (No. X Length) (m)	Width (m)		Length (m)	Width of parapet (m)	Details of Protection Works		Condition of various features of Culvert					Condition of various features of Bridges				Height above Bed Level	PROPOSAL				Remarks
						Total (m)	Carriageway (m)			Type	Condition	Slab/Pipe/ Box/Arch	Head Wall	Wing Wall	Return Wall	Parapet/Handrail	Foudation	Substructure	Superstructure	Railing/Parapet		Recommendation on widening / Reconstruction etc.	Type of Structure	Span No.X Length	Width(in m)	
73	171220	166490	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
74	171425	166690	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
75	171580	166835	BOX	_	1X3X3	7.4	_	3.2	_	_	_	F	_	F	F	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
76	171690	166910	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
77	171790	166995	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
78	171885	167085	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
79	171890	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
80	172025	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
81	172355	167550	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
82	172810	167990	BOX	_	1X3X3	7.5	_	3.2	_	_	_	F	_	F	F	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
83	_	168190	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
84	_	168390	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
85	_	168590	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
86	_	168785	_	_		_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
87	173855	168990	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
88	174110	169235	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
89	174175	169290	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
90	174245	169360	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

Sl. No.	Existing Chainage as per Survey drawng (Km)	Desing Chanage(Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	Thickness of Slab (m)	Span Arrangement and Total Ventway (No. X Length) (m)	Width (m)		Length (m)	Width of parapet (m)	Details of Protection Works		Condition of various features of Culvert					Condition of various features of Bridges				Height above Bed Level	PROPOSAL				Remarks
						Total (m)	Carriageway (m)			Type	Condition	Slab/Pipe/ Box/Arch	Head Wall	Wing Wall	Return Wall	Parapet/Handrail	Foudation	Substructure	Superstructure	Railing/Parapet		Recommendation on widening / Reconstruction etc.	Type of Structure	Span No.X Length	Width(in m)	
91	174370	169470	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
92	174475	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
93	174490	169560	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
94	174785	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
95	_	169830	_	_		_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X3X3	12.00	
96	174930	169985	HPC		1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
97	174950	_	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Deleted				
98	_	170210	_	_		_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X3X3	12.00	
99	175260	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
100	175465	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
101	175700	_	BAILEY BRIDGE		1X20	5.4	4.2	20	_	_	_	_	_	_	_	_	_	_	_	_	7.5	Deleted				
102	_	170210	_	_		_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	T -Beam Girder	3X16	18.00	MNB
103	_	170435	_	_		_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	T -Beam Girder	1X25	18.00	MNB
104	_	170600	_	_		_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X3X3	12.00	
105	175980	170945	RCC SLAB	0.2	1X3	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
106	176220	171180	RCC SLAB	0.2	1X1	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
107	176505	171460	RCC SLAB	0.2	1X3	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
108	176550	171510	RCC SLAB	0.3	1X3	7.6	_	4.2	_	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

Sl. No.	Existing Chainage as per Survey drawng (Km)	Desing Chanage(Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	Thickness of Slab (m)	Span Arrangement and Total Ventway (No. X Length) (m)	Width (m)		Length (m)	Width of parapet (m)	Details of Protection Works		Condition of various features of Culvert					Condition of various features of Bridges				Height above Bed Level	PROPOSAL				Remarks
						Total (m)	Carriageway (m)			Type	Condition	Slab/Pipe/ Box/Arch	Head Wall	Wing Wall	Return Wall	Parapet/Handrail	Foudation	Substructure	Superstructure	Railing/Parapet		Recommendation on widening / Reconstruction etc.	Type of Structure	Span No.X Length	Width(in m)	
109	176615	171610	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
110	176990	_	RCC SLAB	0.2	1X1	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Deleted				
111	177045	171980	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
112	177090	_	RCC SLAB	0.2	1X1	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Deleted				
113	177130	172080	RCC SLAB	0.2	1X1	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
114	177265	172210	RCC SLAB	0.2	1X1	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
115	177415	172370	RCC SLAB	0.2	1X1	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
116	177510	172460	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
117	177725	172620	RCC SLAB	0.2	1X1.5	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
118	177975	172860	RCC SLAB	0.2	1X1	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
119	178155	173040	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
120	178220	_	FCW	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Deleted				
121	_	173300	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
122	_	173410	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
123	178890	173640	RCC SLAB	0.2	1X1.5	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
124	179995	173730	BURRIED	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
125	179050	_	FCW	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Deleted				
126	179250	173960	RCC SLAB	0.2	1X1.5	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

Project road: P. Leikul- Mahur (Borowapu) Section

Section:- From Km 160+875 to 182+169

District: Dima Hasao

State: Assam

Sl. No.	Existing Chainage as per Survey drawng (Km)	Desing Chanage(Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	Thickness of Slab (m)	Span Arrangement and Total Ventway (No. X Length) (m)	Width (m)		Length (m)	Width of parapet (m)	Details of Protection Works		Condition of various features of Culvert					Condition of various features of Bridges				Height above Bed Level	PROPOSAL				Remarks
						Total (m)	Carriageway (m)			Type	Condition	Slab/Pipe/ Box/Arch	Head Wall	Wing Wall	Return Wall	Parapet/Handrail	Foudation	Substructure	Superstructure	Railing/Parapet		Recommendation on widening / Reconstruction etc.	Type of Structure	Span No.X Length	Width(in m)	
127	179350	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
128	_	174150	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
129	179635	_	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Deleted				
130	179695	174380	RCC SLAB	0.2	1X1.5	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
131	_	174580	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X3X3	12.00	
132	_	174710	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	T -Beam Girder	1X25	18.00	MNB
133	180190	174800	FCW	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
134	_	175025	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
135	180475	_	BURRIED	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Deleted				
136	180695	175115	RCC SLAB	0.2	1X1.5	6	_	3.2	_	_	_	F	_	P	P	_	_	_	_	_	1.0	Reconstruction	BOX	1X3X3	12.00	
137	180820	175265	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X3X3	12.00	
138	181070	175475	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
139	181185	175585	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
140	181340	175750	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	
141	_	175850	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
142	_	176190	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
143	_	176360	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	BOX	1X2X2	12.00	
144	182170	176570	HPC	_	1ROW900	7.5	6.1	4.7	0.7	_	_	F	F	_	_	F	_	_	_	_	_	Reconstruction	BOX	1X2X2	12.00	

8. Proposed ROW Details

Traffic Volume Count Survey

Tamenglong-Tousem-Liasang-Haflong Road

Location - 0+300 (Tamenglong) | Date-14/9/17-21/9/17

Average Daily Traffic

	Pessenger Vehicles				Commercial Vehicles				Slow Moving						EME/ HCV	Total
	Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tractor		
PCU Factor	1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5	
DAY 1	97	114	7	4	41	35	0	0	82	0	0	26	0	0	3	409
DAY 2	85	105	7	4	34	39	0	0	81	0	0	31	0	0	2	388
DAY 3	97	109	7	4	31	35	0	0	77	0	0	36	0	0	2	398
DAY 4	103	106	7	4	35	33	0	0	92	0	0	40	0	0	3	423
DAY 5	89	111	5	4	36	43	0	0	93	0	0	50	0	0	2	433
DAY 6	86	96	5	3	28	29	0	0	101	0	0	46	0	0	1	395
DAY 7	80	98	7	5	45	29	0	0	112	0	0	39	0	0	2	417
Total weekly traffic	637	739	45	28	250	243	0	0	638	0	0	268	0	0	15	2863
ADT	***91***	***106***	***6***	***4***	***36***	***35***	***0***	***0***	***91***	***0***	***0***	***38***	***0***	***0***	***2***	***409***
PCU	***91***	***106***	***9***	***12***	***54***	***105***	***0***	***0***	***46***	***0***	***0***	***19***	***0***	***0***	***9***	***451***

Traffic Volume Count Survey

Tamenglong-Tousem-Liasang-Haflong Road

Location - 0+300 (Tamenglong) | Date-14/9/17-21/9/17

Average Daily Traffic

	Pessenger Vehicles				Commercial Vehicles				Slow Moving						EME/HCV	Total
	Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	AnimalCart	Hand Cart	Cycle	Tractor with Trolly	Tractor		
PCU Factor	1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5	
DAY 1 UP	52	74	4	1	24	24	0	0	43	0	0	7	0	0	2	231
DAY 1 DN	45	40	3	3	17	11	0	0	39	0	0	19	0	0	1	178
DAY 2 UP	38	57	4	1	23	24	0	0	36	0	0	9	0	0	1	193
DAY 2 DN	47	48	3	3	11	15	0	0	45	0	0	22	0	0	1	195
DAY 3 UP	48	55	4	1	20	21	0	0	34	0	0	12	0	0	0	195
DAY 3 DN	49	54	3	3	11	14	0	0	43	0	0	24	0	0	2	203
DAY 4 UP	56	54	4	1	19	23	0	0	41	0	0	19	0	0	1	218
DAY 4 DN	47	52	3	3	16	10	0	0	51	0	0	21	0	0	2	205
DAY 5 UP	44	56	2	1	19	29	0	0	46	0	0	26	0	0	1	224
DAY 5 DN	45	55	3	3	17	14	0	0	47	0	0	24	0	0	1	209
DAY 6 UP	48	57	2	1	11	18	0	0	48	0	0	13	0	0	1	199
DAY 6 DN	38	39	3	2	17	11	0	0	53	0	0	33	0	0	0	196
DAY 7 UP	35	43	4	2	26	16	0	0	56	0	0	14	0	0	1	197
DAY 7 DN	45	55	3	3	19	13	0	0	56	0	0	25	0	0	1	220
Total of 7 Days	637	739	45	28	250	243	0	0	638	0	0	268	0	0	15	2863
ADT	***91***	***106***	***6***	***4***	***36***	***35***	***0***	***0***	***91***	***0***	***0***	***38***	***0***	***0***	***2***	409
PCU	***91***	***106***	***9***	***12***	***54***	***105***	***0***	***0***	***46***	***0***	***0***	***19***	***0***	***0***	***9***	451

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong) Date-14-9-17 to 15-9-17

Direction-up Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	4	2	2	1	6	2			1			1				
9.00am	10.00am	5	4			3	4			3			1				
10.00am	11.00am	6	6			4	1			7			3				
11.00am	12.00pm	3	3			8	1			5			2				
12.00pm	1.00pm	3	5				3			2							
1.00pm	2.00pm	5	8			1	5			2						1	
2.00pm	3.00pm	4	6				4			4							
3.00pm	4.00pm	5	9			1	2			3						1	
4.00pm	5.00pm	7	4	2			1			1							
5.00pm	6.00pm	2	4			1	1			1							
6.00pm	7.00pm	1	2							2							
7.00pm	8.00pm	2	2														
8.00pm	9.00pm		3														
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	1	3							2							
6.00am	7.00am	1	6							6							
7.00am	8.00am	3	7							4							
Total		52	74	4	1	24	24	0	0	43	0	0	7	0	0	2	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong) | Date-14-9-17 to 15-9-17

Direction-Down | Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	2	5	1		2	2			5			1				
9.00am	10.00am	3	3		1	5	2			6			2				
10.00am	11.00am	6	1			4	1			4			2			1	
11.00am	12.00pm	4	2			3	3			2			1				
12.00pm	1.00pm	1	4			1	1			2			3				
1.00pm	2.00pm	2	4			1	1			1			4				
2.00pm	3.00pm	4	2							5			4				
3.00pm	4.00pm	1	6		1					3			1				
4.00pm	5.00pm	7	3							6			1				
5.00pm	6.00pm	3	1	1						2							
6.00pm	7.00pm	3	2							1							
7.00pm	8.00pm	1	1														
8.00pm	9.00pm	1	1														
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	3	2				1										
6.00am	7.00am	2	1			1				1							
7.00am	8.00am	2	2	1	1					1							
Total		45	40	3	3	17	11			39			19			1	

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong) | Date-15-9-17 to 16-9-17

Direction- UP | Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	3	4	2	1	3	3			1			2				
9.00am	10.00am	2	3			2	1			3			2			1	
10.00am	11.00am	4	5			4	2			7			1				
11.00am	12.00pm	6	7			4	6			5			1				
12.00pm	1.00pm	1	3			3	4			2							
1.00pm	2.00pm	2	4			2	2			2			3				
2.00pm	3.00pm	4	5			1	2			4							
3.00pm	4.00pm	3	2			1	1			3							
4.00pm	5.00pm	2	7	2		2	2			1							
5.00pm	6.00pm	4	4			1	1			1							
6.00pm	7.00pm	2	1							2							
7.00pm	8.00pm	1	3														
8.00pm	9.00pm																
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	1	1							1							
6.00am	7.00am	2	3							2							
7.00am	8.00am	1	5							2							
Total		38	57	4	1	23	24	0	0	36	0	0	9	0	0	1	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong) Date-15-9-17 to 16-9-17

Direction-Down Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	3	7	1		1	3			2			2				
9.00am	10.00am	2	5		1	3	2			4			4				
10.00am	11.00am	4	2			2	2			6			5				
11.00am	12.00pm	7	3			1	1			4			1				
12.00pm	1.00pm	5	4			2	4			3			2				
1.00pm	2.00pm	3	6				2			9			2			1	
2.00pm	3.00pm	4	3			1				4			1				
3.00pm	4.00pm	2	2		1					2			3				
4.00pm	5.00pm	5	1							5			1				
5.00pm	6.00pm	2	3	1						1							
6.00pm	7.00pm	3	2							2			1				
7.00pm	8.00pm	2	2														
8.00pm	9.00pm	1	1														
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	1	3				1										
6.00am	7.00am	2	2			1				1							
7.00am	8.00am	1	2	1	1					2							
Total		47	48	3	3	11	15	0	0	45	0	0	22	0	0	1	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong)

Date-16-9-17 to 17-9-17

Direction- UP

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	4	2	2	1	2	4			4			1				
9.00am	10.00am	3	4			3	2			6			2				
10.00am	11.00am	5	3			4	1			3			2				
11.00am	12.00pm	7	5			1	5			4			1				
12.00pm	1.00pm	4	2			1	3			3			2				
1.00pm	2.00pm	3	5			3	2			1			3				
2.00pm	3.00pm	2	7			1	1			3			1				
3.00pm	4.00pm	1	3			2	2			2							
4.00pm	5.00pm	1	4	2		1	1			1							
5.00pm	6.00pm	6	6			2				2							
6.00pm	7.00pm	3	2							2							
7.00pm	8.00pm	2	1														
8.00pm	9.00pm																
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	2	2														
6.00am	7.00am	2	5							1							
7.00am	8.00am	3	4							2							
Total		48	55	4	1	20	21	0	0	34	0	0	12	0	0	0	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong) | Date-16-9-17 to 17-9-17

Direction-Down | Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	2	5	1		2	2			3			3				
9.00am	10.00am	3	9			1	1			4			2			1	
10.00am	11.00am	5	4			1	2			5			5				
11.00am	12.00pm	7	3		1	2	2			2			3				
12.00pm	1.00pm	9	5				3			7			1				
1.00pm	2.00pm	4	7			1	1			6			2				
2.00pm	3.00pm	2	6							2			2			1	
3.00pm	4.00pm	1	1		1	2				2			5				
4.00pm	5.00pm	4	2							4			1				
5.00pm	6.00pm	3	2	1						3							
6.00pm	7.00pm	2	1							1							
7.00pm	8.00pm	4	3														
8.00pm	9.00pm	2	2														
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am		1			1											
6.00am	7.00am		2			1	2			2							
7.00am	8.00am	1	1	1	1		1			2							
Total		49	54	3	3	11	14	0	0	43	0	0	24	0	0	2	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong)

Date-17-9-17 to 18-9-17

Direction- UP

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	6	3	2		1	5			7			5				
9.00am	10.00am	4	5		1	2	1			9			4				
10.00am	11.00am	3	5			5	3			4			3				
11.00am	12.00pm	8	6			2	4			2			2				
12.00pm	1.00pm	5	4			2	2			5			1				
1.00pm	2.00pm	7	2			1	3			3			1				
2.00pm	3.00pm	6	8			3	2			4			2				
3.00pm	4.00pm	2	2			1	1			1			1				
4.00pm	5.00pm	3	6	2		2	1			2						1	
5.00pm	6.00pm	5	2				1			1							
6.00pm	7.00pm	2	3							1							
7.00pm	8.00pm	1	1														
8.00pm	9.00pm		1														
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	1	1														
6.00am	7.00am	2	3							1							
7.00am	8.00am	1	2							1							
Total		56	54	4	1	19	23	0	0	41	0	0	19	0	0	1	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong) | Date-17-9-17 to 18-9-17

Direction-Down | Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	3	2	1		3	1			5			4				
9.00am	10.00am	2	7			2	2			7			1				
10.00am	11.00am	4	5		1	5	1			9			6				
11.00am	12.00pm	6	2				1			4			2				
12.00pm	1.00pm	8	4			1	2			8			1			1	
1.00pm	2.00pm	7	9				1			5			1				
2.00pm	3.00pm	4	7			1	1			3			3				
3.00pm	4.00pm	3	5		1	1				1			2				
4.00pm	5.00pm	2	3							2							
5.00pm	6.00pm	1	1	1						1			1			1	
6.00pm	7.00pm	3	2							2							
7.00pm	8.00pm	1	1														
8.00pm	9.00pm	1															
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am									1							
6.00am	7.00am	1	1			1				2							
7.00am	8.00am	1	3	1	1	2	1			1							
Total		47	52	3	3	16	10	0	0	51	0	0	21	0	0	2	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong)

Date-18-9-17 to 19-9-17

Direction- UP

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	4	4	2		2	3			8			4				
9.00am	10.00am	2	6			3	2			6			6				
10.00am	11.00am	1	8			5	4			5			5				
11.00am	12.00pm	3	5			1	2			1			1				
12.00pm	1.00pm	5	9		1	3	5			6			2			1	
1.00pm	2.00pm	6	1			2	4			2			3				
2.00pm	3.00pm	8	5			1	3			5			2				
3.00pm	4.00pm	4	4			1	2			3			1				
4.00pm	5.00pm	2	6			1	1			1			1				
5.00pm	6.00pm	1	1				1			2							
6.00pm	7.00pm	2	2				2			1							
7.00pm	8.00pm	3	1							1							
8.00pm	9.00pm	1															
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am																
6.00am	7.00am	1	1							3							
7.00am	8.00am	1	3							2			1				
Total		44	56	2	1	19	29	0	0	46	0	0	26	0	0	1	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong) Date-18-9-17 to 19-9-17

Direction-Down Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	4	2	1		2	3			7			3				
9.00am	10.00am	3	7			4	1			5			4				
10.00am	11.00am	1	5		1	3	2			4			6				
11.00am	12.00pm	2	2			1	1			3			1				
12.00pm	1.00pm	6	4			1	3			9			2				
1.00pm	2.00pm	8	9			2	1			4			3			1	
2.00pm	3.00pm	5	7							2			1				
3.00pm	4.00pm	2	5		1	1				2							
4.00pm	5.00pm	1	3				1			1			1				
5.00pm	6.00pm	3	1	1			1			1			1				
6.00pm	7.00pm	2	2							3			2				
7.00pm	8.00pm	2	1														
8.00pm	9.00pm	1															
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	2	2							1							
6.00am	7.00am	1	2			1	1			3							
7.00am	8.00am	2	3	1	1	2				2							
Total		45	55	3	3	17	14	0	0	47	0	0	24	0	0	1	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong) | Date-19-9-17 to 20-9-17

Direction- UP | Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	3	3		1	2	3			5			2				
9.00am	10.00am	4	5			1	1			7			1				
10.00am	11.00am	8	6			3	2			5			4			1	
11.00am	12.00pm	5	1			1	2			1			2				
12.00pm	1.00pm	1	6				1			4			1				
1.00pm	2.00pm	3	7				1			3			1				
2.00pm	3.00pm	4	9			1	4			7			2				
3.00pm	4.00pm	7	4			2	1			4							
4.00pm	5.00pm	5	2	2			1			2							
5.00pm	6.00pm	2	1			1	2			1							
6.00pm	7.00pm	1								1							
7.00pm	8.00pm	2	1														
8.00pm	9.00pm		3														
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am		2							1							
6.00am	7.00am	1	4							5							
7.00am	8.00am	2	3							2							
Total		48	57	2	1	11	18	0	0	48	0	0	13	0	0	1	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong) | Date-19-9-17 to 20-9-17

Direction-Down | Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	3	4	1		3	1			6			2				
9.00am	10.00am	2	2		1	4	1			8			1				
10.00am	11.00am	1	1			2	2			1			6				
11.00am	12.00pm	5	3			3	2			5			8				
12.00pm	1.00pm	1	6			2	1			3			4				
1.00pm	2.00pm	6	4				2			4			6				
2.00pm	3.00pm	2	5	1			1			6			2				
3.00pm	4.00pm	3	1			1				7			1				
4.00pm	5.00pm	5	3			1				6			2				
5.00pm	6.00pm	1	1							1			1				
6.00pm	7.00pm	2	1							2							
7.00pm	8.00pm	2	2							1							
8.00pm	9.00pm	1	1														
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	1	1														
6.00am	7.00am	2	2			1	1			2							
7.00am	8.00am	1	2	1	1					1							
Total		38	39	3	2	17	11	0	0	53	0	0	33	0	0	0	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong)

Date-20-9-17 to 21-9-17

Direction- UP

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	5	6			2	3			5			3				
9.00am	10.00am	3	4	2		3	2			4			1				
10.00am	11.00am	1	3			5	1			6			2				
11.00am	12.00pm	2	1		1	1				2			1				
12.00pm	1.00pm	7	2			2	5			7			1				
1.00pm	2.00pm	3	5			3	2			5			3				
2.00pm	3.00pm	1	4		1	5	1			8			2				
3.00pm	4.00pm	2	3			1	1			4						1	
4.00pm	5.00pm	1	1	2		2	1			5							
5.00pm	6.00pm	3	2							2							
6.00pm	7.00pm	1	4			2				1							
7.00pm	8.00pm	2	3							1							
8.00pm	9.00pm		1														
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am		1							2							
6.00am	7.00am	3	1							3							
7.00am	8.00am	1	2							1			1				
Total		35	43	4	2	26	16	0	0	56	0	0	14	0	0	1	0

Daily Traffic Volume Count Survey

Location - 0+300 (Tamenglong)

Date-20-9-17 to 21-9-17

Direction-Down

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving						HCV	Other
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tractor		
8.00am-	9.00am	5	4	1		3	1			9			2				
9.00am	10.00am	2	5			2	2			8			4				
10.00am	11.00am	4	2			1	1			4			2				
11.00am	12.00pm	6	1		1	3	1			7			4				
12.00pm	1.00pm	8	3			1	3			6			3			1	
1.00pm	2.00pm	4	5			2	2			4			5				
2.00pm	3.00pm	3	4		1	1	1			2			1				
3.00pm	4.00pm	2	6			2	1			5			2				
4.00pm	5.00pm	1	2							3			1				
5.00pm	6.00pm	2	8	1						1			1				
6.00pm	7.00pm	3	3							1							
7.00pm	8.00pm	1	1							1							
8.00pm	9.00pm	1	3														
9.00pm	10.00pm																
10.00pm	11.00pm																
11.00pm	12.00am																
12.00am	1.00am																
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	1	2			1				1							
6.00am	7.00am	1	4			2				3							
7.00am	8.00am	1	2	1	1	1	1			1							
Total		45	55	3	3	19	13	0	0	56	0	0	25	0	0	1	0

Traffic Volume Count Survey																
Tamenglong-Tousem-Liasang-Haflong Road																
Location - Near Mahur Town													Date-16/3/17-23/3/17			
Average Daily Traffic																
	Pessenger Vehicles				Commercial Vehicles				Slow Moving						EME/ HCV	Total
	Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tractor		
PCU Factor	1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5	
DAY 1	400	640	11	4	131	65	3	0	655	0	0	41	0	0	5	1955
DAY 2	582	494	9	5	75	12	1	0	449	0	0	101	0	0	8	1736
DAY 3	569	559	9	4	98	18	18	0	564	0	0	104	0	0	5	1948
DAY 4	553	878	12	5	134	21	20	0	526	0	0	154	0	0	6	2309
DAY 5	409	583	7	3	127	21	13	0	673	0	0	123	0	0	6	1965
DAY 6	585	450	14	50	42	14	0	0	540	0	0	176	0	0	0	1871
DAY 7	599	538	15	5	115	49	6	0	568	0	0	107	0	0	5	2007
Total weekly traffic	3697	4142	77	76	722	200	61	0	3975	0	0	806	0	0	35	13791
ADT	***528***	***592***	***11***	***11***	***103***	***29***	***9***	***0***	***568***	***0***	***0***	***115***	***0***	***0***	***5***	***1971***
PCU	***528***	***592***	***17***	***33***	***155***	***87***	***27***	***0***	***284***	***0***	***0***	***58***	***0***	***0***	***23***	***1804***

Traffic Volume Count Survey
Tamenglong-Tousem-Liasang-Haflong Road

Location - Near Mahur Town

Date-16/3/17-23/3/17

Average Daily Traffic

	Pessenger Vehicles				Commercial Vehicles				Slow Moving						EME/HCV	Total
	Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	AnimalCart	Hand Cart	Cycle	Tractor with Trolly	Tractor		
PCU Factor	1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5	
DAY 1 UP	199	286	4	2	57	36	3	0	326	0	0	16	0	0	0	929
DAY 1 DN	201	354	7	2	74	29	0	0	329	0	0	25	0	0	5	1026
DAY 2 UP	292	245	5	4	31	7	0	0	224	0	0	69	0	0	3	880
DAY 2 DN	290	249	4	1	44	5	1	0	225	0	0	32	0	0	5	856
DAY 3 UP	289	293	6	2	52	13	10	0	314	0	0	32	0	0	0	1011
DAY 3 DN	280	266	3	2	46	5	8	0	250	0	0	72	0	0	5	937
DAY 4 UP	309	328	6	3	56	12	9	0	247	0	0	93	0	0	0	1063
DAY 4 DN	244	550	6	2	78	9	11	0	279	0	0	61	0	0	6	1246
DAY 5 UP	234	299	5	2	53	10	13	0	322	0	0	25	0	0	0	963
DAY 5 DN	175	284	2	1	74	11	0	0	351	0	0	98	0	0	6	1002
DAY 6 UP	288	237	6	48	31	7	0	0	222	0	0	96	0	0	0	935
DAY 6 DN	297	213	8	2	11	7	0	0	318	0	0	80	0	0	0	936
DAY 7 UP	311	273	11	2	29	34	0	0	332	0	0	17	0	0	3	1012
DAY 7 DN	288	265	4	3	86	15	6	0	236	0	0	90	0	0	2	995
Total of 7 Days	3697	4142	77	76	722	200	61	0	3975	0	0	806	0	0	35	13791
ADT	***528***	***592***	***11***	***11***	***103***	***29***	***9***	***0***	***568***	***0***	***0***	***115***	***0***	***0***	***5***	1971
PCU	***528***	***592***	***17***	***33***	***155***	***87***	***27***	***0***	***284***	***0***	***0***	***58***	***0***	***0***	***23***	1804

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-16-3-17 to 17-3-17

Direction-up

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	19	14	2			1			19							
9.00am	10.00am	20	21	2		6				35							
10.00am	11.00am	15	36			3				26							
11.00am	12.00pm	12	41			2	1			33							
12.00pm	1.00pm	13	17			6	1			12							
1.00pm	2.00pm	13	29			6	1			26							
2.00pm	3.00pm	11	17			4	1			16							
3.00pm	4.00pm	14	13		2	2	1			31							
4.00pm	5.00pm	13	25			1				31							
5.00pm	6.00pm	10	30			6				31			1				
6.00pm	7.00pm	18	17			2	1			16			1				
7.00pm	8.00pm	6	8			2	4			11			3				
8.00pm	9.00pm	3	1			1	3	1		3			2				
9.00pm	10.00pm	3	1			1	2	1		4			1				
10.00pm	11.00pm	1				1	3	1		3							
11.00pm	12.00am	2				3	1			3							
12.00am	1.00am	1				2	3										
1.00am	2.00am	1				1	2										
2.00am	3.00am	2				2	2										
3.00am	4.00am	1					2										
4.00am	5.00am	1					3										
5.00am	6.00am	4	1			2	3			3							
6.00am	7.00am	7	5			1				8			3				
7.00am	8.00am	9	10			3	1			15			5				
Total		199	286	4	2	57	36	3		326			16				

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-16-3-17 to 17-3-17

Direction-Down

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	8	20			6	1			10							
9.00am	10.00am	16	19			5	3			38							
10.00am	11.00am	13	37			6	1			31			4				
11.00am	12.00pm	14	50			8				21							
12.00pm	1.00pm	16	23	1		2	2			12			6				
1.00pm	2.00pm	13	36	1		4				27							
2.00pm	3.00pm	20	25	2	1	7	1			19			1				
3.00pm	4.00pm	22	13			2				23			2				
4.00pm	5.00pm	20	34			3				28			2				
5.00pm	6.00pm	10	38			3	1			29			1				
6.00pm	7.00pm	6	10				2			9							
7.00pm	8.00pm	4	2				2			3			1				
8.00pm	9.00pm	1	4			1	1			5			1				
9.00pm	10.00pm	1	3			1				4							
10.00pm	11.00pm	1	2			1				2						1	
11.00pm	12.00am	1	2				1			2							
12.00am	1.00am	1				1	2			1							
1.00am	2.00am	0				1	1			3						1	
2.00am	3.00am	2				1	1			1							
3.00am	4.00am	3	1			1				1							
4.00am	5.00am	3	5			3	1			2							
5.00am	6.00am	5	8		1	6	7			17			2				
6.00am	7.00am	6	8	1		1	2			16							
7.00am	8.00am	15	14	2		11				25			20			3	
Total		201	354	7	2	74	29			329			25			5	

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-17-3-17 to 18-3-17

Direction- UP

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving						HCV	Other
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or		
8.00am-	9.00am	18	22	1		2				17			4			1	
9.00am	10.00am	21	24			5				16			8				
10.00am	11.00am	24	19		1	4	1			11			10				
11.00am	12.00pm	19	21			2				13			6				
12.00pm	1.00pm	22	16	2						19			5				
1.00pm	2.00pm	13	14		1	2				21			9			1	
2.00pm	3.00pm	21	14			2	2			24			5				
3.00pm	4.00pm	25	18		1					26			4				
4.00pm	5.00pm	23	15	1		1	1			18			4				
5.00pm	6.00pm	28	20	1		3				13			3			1	
6.00pm	7.00pm	16	14				1			13			1				
7.00pm	8.00pm	18	12			2	1			9			3				
8.00pm	9.00pm	14	10							10			2				
9.00pm	10.00pm	13	7		1	3				5							
10.00pm	11.00pm	7	5			1				3							
11.00pm	12.00am	5	5							2							
12.00am	1.00am	2	2														
1.00am	2.00am		1														
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am																
6.00am	7.00am	1	4			2	1			1			2				
7.00am	8.00am	2	2			2				3			3				
Total		292	245	5	4	31	7			224			69			3	

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-17-3-17 to 18-3-17

Direction-Down

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	14	11			4				17			2				
9.00am	10.00am	18	14	1		8	1			19			4			1	
10.00am	11.00am	21	17			7		1		21							
11.00am	12.00pm	23	21			3				24			8				
12.00pm	1.00pm	22	20			3				28							
1.00pm	2.00pm	26	24				1			12			4			2	
2.00pm	3.00pm	13	28		1	1	1			18			4				
3.00pm	4.00pm	19	22	1		2	1			17			3				
4.00pm	5.00pm	21	18			5				13							
5.00pm	6.00pm	24	16			2				11			1			1	
6.00pm	7.00pm	28	14	1		1				4						1	
7.00pm	8.00pm	19	18	1			1			12			4				
8.00pm	9.00pm	17	9			2				17							
9.00pm	10.00pm	11	7			1				1							
10.00pm	11.00pm	4	3							4							
11.00pm	12.00am	4	1							1							
12.00am	1.00am	2															
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am					1											
6.00am	7.00am	1	2			3				4			1				
7.00am	8.00am	3	4			1				2			1				
Total		290	249	4	1	44	5	1		225			32			5	

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-18-3-17 to 19-3-17

Direction- UP

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	23	16			4		1		18							
9.00am	10.00am	24	18	1		6	1			21			4				
10.00am	11.00am	27	21		1	9		2		29			6				
11.00am	12.00pm	18	32	2		3		1		34			3				
12.00pm	1.00pm	31	24			2	2			27			2				
1.00pm	2.00pm	36	30	1		2		1		19			2				
2.00pm	3.00pm	17	19		1	5	2			22			4				
3.00pm	4.00pm	21	22			3	2			20							
4.00pm	5.00pm	23	17			1		1		27			2				
5.00pm	6.00pm	16	20	1		2				18			1				
6.00pm	7.00pm	13	18			1	1			21			2				
7.00pm	8.00pm	9	11			1	1			16							
8.00pm	9.00pm	7	9	1		1				9							
9.00pm	10.00pm	5	8			2		1		7							
10.00pm	11.00pm	5	6							6							
11.00pm	12.00am	2	4			1				6							
12.00am	1.00am	1	2							2							
1.00am	2.00am	1	1														
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am		1			1	2										
6.00am	7.00am	4	6			3	1	2		5			2				
7.00am	8.00am	6	8			5	1	1		7			4				
Total		289	293	6	2	52	13	10		314			32				

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-18-3-17 to 19-3-17

Direction-Down

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	11	18			4		2		8			2			1	
9.00am	10.00am	19	15	1		5	1			12							
10.00am	11.00am	16	17		1	2				16			5				
11.00am	12.00pm	20	22			2	1			19			6				
12.00pm	1.00pm	24	27			3				21			8			1	
1.00pm	2.00pm	28	29	1		6		2		23			11			1	
2.00pm	3.00pm	23	25			8	2			20			9				
3.00pm	4.00pm	20	17			2				26			7				
4.00pm	5.00pm	18	20			2		1		18			5				
5.00pm	6.00pm	21	17		1	3	1			21			2				
6.00pm	7.00pm	25	11			1		1		20			2				
7.00pm	8.00pm	17	13	1		2		1		16			4				
8.00pm	9.00pm	11	4			2		1		11			1				
9.00pm	10.00pm	9	8			1				8			2			1	
10.00pm	11.00pm	6	11							4							
11.00pm	12.00am	5	3							2							
12.00am	1.00am	2	1														
1.00am	2.00am	1															
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am																
6.00am	7.00am	2	3			2				2			3			1	
7.00am	8.00am	2	5			1				3			5				
Total		280	266	3	2	46	5	8		250			72			5	

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-19-3-17 to 20-3-17

Direction- UP

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	23	17			4		1		10			8				
9.00am	10.00am	18	26	2		6	2			13			5				
10.00am	11.00am	20	35		1	7		2		18			9				
11.00am	12.00pm	22	28			3	1			11			6				
12.00pm	1.00pm	31	12	1		3		1		29			4				
1.00pm	2.00pm	29	17	1		2	2			17			9				
2.00pm	3.00pm	26	23		1	1	2			21			6				
3.00pm	4.00pm	23	28			4		2		10			9				
4.00pm	5.00pm	19	12			5		2		26			7				
5.00pm	6.00pm	17	19		1	5	3	1		14			5				
6.00pm	7.00pm	13	18	2		4	1			21			4				
7.00pm	8.00pm	11	21			1	1			18			3				
8.00pm	9.00pm	14	20							11			7				
9.00pm	10.00pm	9	16			1				11			1				
10.00pm	11.00pm	11	14			2				17			2				
11.00pm	12.00am	7	9			1											
12.00am	1.00am	6	2														
1.00am	2.00am	2															
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	1															
6.00am	7.00am	2	4			4							3				
7.00am	8.00am	5	7			3							5				
Total		309	328	6	3	56	12	9		247			93				

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-19-3-17 to 20-3-17

Direction-Down

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	11	16			7		1		13			2			1	
9.00am	10.00am	16	219			4	1			28			2				
10.00am	11.00am	12	31		1	6				21			5				
11.00am	12.00pm	20	42	1		3	2			12			8			1	
12.00pm	1.00pm	24	33	1		6		2		17			11				
1.00pm	2.00pm	21	37			6	1	2		29			4				
2.00pm	3.00pm	16	35	2	1	4				32			6				
3.00pm	4.00pm	20	23			5	2			29						1	
4.00pm	5.00pm	13	18	1		9	2			21			2			1	
5.00pm	6.00pm	25	14	1		7		1		16			2			1	
6.00pm	7.00pm	18	21			5				19			4				
7.00pm	8.00pm	13	18			4	1			10			3				
8.00pm	9.00pm	11	11			4				8			1				
9.00pm	10.00pm	9	10							5			2				
10.00pm	11.00pm	4	7			1		1		5			2				
11.00pm	12.00am	3	5							6							
12.00am	1.00am	1	2			2				2							
1.00am	2.00am		1							1							
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am							1									
6.00am	7.00am	2	3			4		1		3			2			1	
7.00am	8.00am	5	4			1		2		2			5				
Total		244	550	6	2	78	9	11		279			61			6	

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-20-3-17 to 21-3-17

Direction- UP

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	21	19			3	1			12							
9.00am	10.00am	23	28	2		8		2		24							
10.00am	11.00am	18	33		1	2				36							
11.00am	12.00pm	15	38			5		2		31			2				
12.00pm	1.00pm	17	22	1		4				28							
1.00pm	2.00pm	22	27		1	4	1			17			2				
2.00pm	3.00pm	26	13			1				24							
3.00pm	4.00pm	14	18				1	1		26			6				
4.00pm	5.00pm	13	21	2		2				22							
5.00pm	6.00pm	19	12			2		2		18			8				
6.00pm	7.00pm	11	18				1			14							
7.00pm	8.00pm	8	7			3				22							
8.00pm	9.00pm	4	9			1		1		17							
9.00pm	10.00pm	6	6					1		8							
10.00pm	11.00pm	3	5			1				5							
11.00pm	12.00am	1	3			1				5							
12.00am	1.00am	1	3			1		1		3							
1.00am	2.00am					4											
2.00am	3.00am	1	2														
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	1	2			1											
6.00am	7.00am	4	5			4	2	2		4			2				
7.00am	8.00am	6	8			6	4	1		6			5				
Total		234	299	5	2	53	10	13		322			25				

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-20-3-17 to 21-3-17

Direction-Down

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	11	17			7				30			6			1	
9.00am	10.00am	14	21	1		9				35			8				
10.00am	11.00am	18	33			3				38			11				
11.00am	12.00pm	16	27	1		7				36			9				
12.00pm	1.00pm	13	22			5	1			26			10				
1.00pm	2.00pm	20	28			4	2			27			7			2	
2.00pm	3.00pm	20	26			2				31			8				
3.00pm	4.00pm	21	29		1	9	1			27			9			1	
4.00pm	5.00pm	13	18			1				25			5			1	
5.00pm	6.00pm	9	21			3	2			18			6				
6.00pm	7.00pm	7	16			8				11			7				
7.00pm	8.00pm	4	10			2	1			15			3			1	
8.00pm	9.00pm	2	8			6				14			2				
9.00pm	10.00pm	1	6			1	4			6			2				
10.00pm	11.00pm	1								4			1				
11.00pm	12.00am	1	1							1							
12.00am	1.00am																
1.00am	2.00am	1															
2.00am	3.00am	1															
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am					1				1							
6.00am	7.00am	1				2				2			1				
7.00am	8.00am	1	1			4				4			3				
Total		175	284	2	1	74	11			351			98			6	

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-21-3-17 to 22-3-17

Direction- UP

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	18	23	1		2				17			6				
9.00am	10.00am	13	21			5	1			16			9				
10.00am	11.00am	21	19			4				11			5				
11.00am	12.00pm	24	20	2	5	2	2			13			7				
12.00pm	1.00pm	19	16		9	2	1			19			9				
1.00pm	2.00pm	22	14	1	4	1	1			21			11				
2.00pm	3.00pm	21	14	1	11	3				24			6				
3.00pm	4.00pm	25	15		13	1	2			26			2				
4.00pm	5.00pm	28	16		6	5				18			4				
5.00pm	6.00pm	18	20			1				13			9				
6.00pm	7.00pm	16	14			1				13			7				
7.00pm	8.00pm	19	13	1		1				9			2				
8.00pm	9.00pm	17	13							1			5				
9.00pm	10.00pm	11	7							8			4				
10.00pm	11.00pm	6	5							5			6				
11.00pm	12.00am	4	2							6							
12.00am	1.00am	2								2							
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am												1				
6.00am	7.00am	2	3			1							1				
7.00am	8.00am	2	2			2							2				
Total		288	237	6	48	31	7	0	0	222	0	0	96	0	0	0	0

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-21-3-17 to 22-3-17

Direction-Down

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	21	11							20			6				
9.00am	10.00am	27	23			1				27			9				
10.00am	11.00am	33	20	3		2				37			10				
11.00am	12.00pm	22	18		1					31			12				
12.00pm	1.00pm	36	11	1						35			8				
1.00pm	2.00pm	18	14			2				26			5				
2.00pm	3.00pm	28	17	2		2				21			3				
3.00pm	4.00pm	23	21		1	1				30			6				
4.00pm	5.00pm	19	24	1			2			34			5				
5.00pm	6.00pm	17	13	1		2	2			26			3				
6.00pm	7.00pm	13	15							13			1				
7.00pm	8.00pm	14	9							7			4				
8.00pm	9.00pm	8	6				1			3			2				
9.00pm	10.00pm	5	2										1				
10.00pm	11.00pm	3	1							1							
11.00pm	12.00am	1	2														
12.00am	1.00am		1														
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am	1															
4.00am	5.00am																
5.00am	6.00am	1															
6.00am	7.00am	2	2				2			2			3				
7.00am	8.00am	5	3			1				5			2				
Total		297	213	8	2	11	7			318			80				

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-22-3-17 to 23-3-17

Direction- UP

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tract or	HCV	Other
8.00am-	9.00am	20	21				2			12							
9.00am	10.00am	28	18	3		1	1			27			2				
10.00am	11.00am	23	17				4			21							
11.00am	12.00pm	18	26	2	1	2	3			29			1				
12.00pm	1.00pm	21	13	2		2	1			16							
1.00pm	2.00pm	17	31			1	2			18			3				
2.00pm	3.00pm	26	28	1			5			21							
3.00pm	4.00pm	27	24	1		2	4			24			1				
4.00pm	5.00pm	29	17			4				31			1			1	
5.00pm	6.00pm	16	20	2		1	3			36							
6.00pm	7.00pm	18	14		1	3	6			27			1				
7.00pm	8.00pm	14	12			2	1			18							
8.00pm	9.00pm	11	7			2				16			2				
9.00pm	10.00pm	12	6			1				11							
10.00pm	11.00pm	9	3							9							
11.00pm	12.00am	7	3													1	
12.00am	1.00am	5	2														
1.00am	2.00am	4	1							3							
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am																
6.00am	7.00am	3	4			3	2			5			1				
7.00am	8.00am	3	6			5				8			5			1	
Total		311	273	11	2	29	34	0	0	332	0	0	17		0	3	0

Daily Traffic Volume Count Survey

Location - Near Mahur Town

Date-22-3-17 to 23-3-17

Direction-Down

Road Name:- Tamenglong-Haflong Road

TIME		Pessenger Vehicles				Commercial Vehicles				Slow Moving							
		Car/Van/ Jeep	Three Wheeler	Mini bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tractor	HCV	Other
8.00am-	9.00am	31	14			12	2			18			3				
9.00am	10.00am	37	23			14	3			16			6			1	
10.00am	11.00am	30	28	1		19		1		13			4				
11.00am	12.00pm	33	31		1	8	1			21			9				
12.00pm	1.00pm	19	24			11	1			24			2				
1.00pm	2.00pm	18	21			4				28			9				
2.00pm	3.00pm	12	16				2			19			8				
3.00pm	4.00pm	27	21	1		3				22			4			1	
4.00pm	5.00pm	21	15			2	3	2		24			8				
5.00pm	6.00pm	20	11		1	5				13			9				
6.00pm	7.00pm	11	13	2				1		15			7				
7.00pm	8.00pm	7	16			1		1		9			5				
8.00pm	9.00pm	5	10							4			1				
9.00pm	10.00pm	4	6		1					3			2				
10.00pm	11.00pm	3	5														
11.00pm	12.00am	1	2														
12.00am	1.00am	1															
1.00am	2.00am																
2.00am	3.00am																
3.00am	4.00am																
4.00am	5.00am																
5.00am	6.00am	1	2			1							1				
6.00am	7.00am	3	5			1	1	1		2			5				
7.00am	8.00am	4	2			5	2			5			7				
Total		288	265	4	3	86	15	6	0	236	0	0	90		0	2	0

Traffic Volume Count Survey

Tamenglong- Tousem-Liasang-Haflong Road

Average Daily Traffic (ADT)

	Pessenger Vehicles				Commercial Vehicles				Slow Moving						EME/ HCV	Total
	Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tractor		
PCU Factor	1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5	
Location-1 (Near Tamenglong)	91	106	6	4	36	35	0	0	91	0	0	38	0	0	2	409
Location-2 (Near Mahur)	528	592	11	11	103	29	9	0	568	0	0	115	0	0	5	1971
Average of Both Location	310	349	9	8	70	32	5	0	330	0	0	77	0	0	4	1194
ADT	***310***	***349***	***9***	***8***	***70***	***32***	***5***	***0***	***330***	***0***	***0***	***77***	***0***	***0***	***4***	***1194***
PCU	***310***	***349***	***14***	***24***	***105***	***96***	***15***	***0***	***165***	***0***	***0***	***39***	***0***	***0***	***18***	***1135***

Traffic Volume Count Survey																
Tamenglong- Tousem-Liasang-Haflong Road																
Annual Average Daily Traffic (AADT)																
	Pessenger Vehicles				Commercial Vehicles				Slow Moving						EME/ HCV	Total
	Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tractor		
PCU Factor	1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5	
Location-1 (Ch-0+000)	83	96	5	4	33	32	0	0	83	0	0	35	0	0	2	373
Location-2 (Ch-26+100)	480	539	10	10	94	26	8	0	517	0	0	105	0	0	5	1794
Average of Both Location	282	318	8	7	64	29	4	0	300	0	0	70	0	0	4	1086
AADT	***282***	***318***	***8***	***7***	***64***	***29***	***4***	***0***	***300***	***0***		***70***	***0***	***0***	***4***	***1086***
PCU	***282***	***318***	***12***	***21***	***96***	***87***	***12***	***0***	***150***	***0***		***35***	***0***	***0***	***18***	***1031***

Traffic Volume Count Survey																			
Tamenglong- Tousem-Liasang-Haflong Road																			
Projections of AADT																			
		Growth Rate	Pessenger Vehicles				Commercial Vehicles				Slow Moving Vehicles						EME/ HCV	ADT	PCU
			Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tractor			
Year			1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5		
Construction Period	2017		282	318	8	7	64	29	4	0	300	0	0	70	0	0	4	1086	1031
	2018	7.5%	303	342	9	8	69	31	4	0	323	0	0	75	0	0	4	1168	1108
	2019	7.5%	326	368	10	9	74	33	4	0	347	0	0	81	0	0	4	1256	1190
	2020	7.5%	350	396	11	10	80	35	4	0	373	0	0	87	0	0	4	1350	1278
	2021	7.5%	376	426	12	11	86	38	4	0	401	0	0	94	0	0	4	1452	1374
1	2022	7.5%	404	458	13	12	92	41	4	0	431	0	0	101	0	0	4	1560	1475
2	2023	7.5%	434	492	14	13	99	44	4	0	463	0	0	109	0	0	4	1676	1583
3	2024	7.5%	467	529	15	14	106	47	4	0	498	0	0	117	0	0	4	1801	1698
4	2025	7.5%	502	569	16	15	114	51	4	0	535	0	0	126	0	0	4	1936	1825
5	2026	7.5%	540	612	17	16	123	55	4	0	575	0	0	135	0	0	4	2081	1960
6	2027	7.5%	581	658	18	17	132	59	4	0	618	0	0	145	0	0	4	2236	2104
7	2028	7.5%	625	707	19	18	142	63	4	0	664	0	0	156	0	0	4	2402	2257
8	2029	7.5%	672	760	20	19	153	68	4	0	714	0	0	168	0	0	4	2582	2424
9	2030	7.5%	722	817	22	20	164	73	4	0	768	0	0	181	0	0	4	2775	2602
10	2031	7.5%	776	878	24	22	176	78	4	0	826	0	0	195	0	0	4	2983	2795
11	2032	7.5%	834	944	26	24	189	84	4	0	888	0	0	210	0	0	4	3207	3004
12	2033	7.5%	897	1015	28	26	203	90	4	0	955	0	0	226	0	0	4	3448	3227
13	2034	7.5%	964	1091	30	28	218	97	4	0	1027	0	0	243	0	0	4	3706	3467
14	2035	7.5%	1036	1173	32	30	234	104	4	0	1104	0	0	261	0	0	4	3982	3723
15	2036	7.5%	1114	1261	34	32	252	112	4	0	1187	0	0	281	0	0	4	4281	4000
16	2037	7.5%	1198	1356	37	34	271	120	4	0	1276	0	0	302	0	0	4	4602	4297
17	2038	7.5%	1288	1458	40	37	291	129	4	0	1372	0	0	325	0	0	4	4948	4619
18	2039	7.5%	1385	1567	43	40	313	139	4	0	1475	0	0	349	0	0	4	5319	4965
19	2040	7.5%	1489	1685	46	43	336	149	4	0	1586	0	0	375	0	0	4	5717	5334
20	2041	7.5%	1601	1811	49	46	361	160	4	0	1705	0	0	403	0	0	4	6144	5729

Traffic Volume Count Survey																			
Tamenglong- Tousem-Liasang-Haflong Road																			
Projections of AADT including Diverted & Induced Traffic																			
		Growth Rate	Pessenger Vehicles				Commercial Vehicles				Slow Moving Vehicles						EME/ HCV	AADT	PCU
			Car/Van/Jeep	Three Wheeler	Mini Bus	Standard Bus	Tempo LCV	2 Axle	3 Axle	M Axle	Two Wheeler	Animal Cart	Hand Cart	Cycle	Tractor with Trolly	Tractor			
Year			1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	0.5	6.0	3.0	0.5	4.5	1.5	4.5		
Construction Period	2017		282	318	8	7	64	29	4	0	300	0	0	70	0	0	4	1086	1031
	2018	7.5%	303	342	9	8	69	31	4	0	323	0	0	75	0	0	4	1168	1108
	2019	7.5%	326	368	10	9	74	33	4	0	347	0	0	81	0	0	4	1256	1190
	2020	7.5%	350	396	11	10	80	35	4	0	373	0	0	87	0	0	4	1350	1278
	2021	7.5%	376	426	12	50	86	38	4	0	401	0	0	94	0	0	4	1491	1491
Adding Diverted Traffic			1340	0	50	50	361	174	63	21	0	0	0	0	0	0	0	2059	2912
1	2022	7.5%	1744	458	63	104	453	215	67	21	431	0	0	101	0	0	4	3661	4513
2	2023	7.5%	1471	492	68	112	487	405	72	23	463	0	0	109	0	0	4	3706	4970
3	2024	7.5%	1581	529	73	120	524	435	77	25	498	0	0	117	0	0	4	3983	5340
4	2025	7.5%	1700	569	78	129	563	468	83	27	535	0	0	126	0	0	4	4282	5741
5	2026	7.5%	1828	612	84	139	605	503	89	29	575	0	0	135	0	0	4	4603	6170
6	2027	7.5%	1965	658	90	149	650	541	96	31	618	0	0	145	0	0	4	4947	6630
7	2028	7.5%	2112	707	97	160	699	582	103	33	664	0	0	156	0	0	4	5317	7125
8	2029	7.5%	2270	760	104	172	751	626	111	35	714	0	0	168	0	0	4	5715	7656
9	2030	7.5%	2440	817	112	185	807	673	119	38	768	0	0	181	0	0	4	6144	8230
10	2031	7.5%	2623	878	120	199	868	723	128	41	826	0	0	195	0	0	4	6605	8846
11	2032	7.5%	2820	944	129	214	933	777	138	44	888	0	0	210	0	0	4	7101	9509
12	2033	7.5%	3032	1015	139	230	1003	835	148	47	955	0	0	226	0	0	4	7634	10219
13	2034	7.5%	3259	1091	149	247	1078	898	159	51	1027	0	0	243	0	0	4	8206	10985
14	2035	7.5%	3503	1173	160	266	1159	965	171	55	1104	0	0	261	0	0	4	8821	11809
15	2036	7.5%	3766	1261	172	286	1246	1037	184	59	1187	0	0	281	0	0	4	9483	12693
16	2037	7.5%	4048	1356	185	307	1339	1115	198	63	1276	0	0	302	0	0	4	10193	13641
17	2038	7.5%	4352	1458	199	330	1439	1199	213	68	1372	0	0	325	0	0	4	10959	14666
18	2039	7.5%	4678	1567	214	355	1547	1289	229	73	1475	0	0	349	0	0	4	11780	15764
19	2040	7.5%	5029	1685	230	382	1663	1386	246	78	1586	0	0	375	0	0	4	12664	16945
20	2041	7.5%	5406	1811	247	411	1788	1490	264	84	1705	0	0	403	0	0	4	13613	18215

Summary of VDF

LOCATION	DIRECTION	LCV	Bus	2 AXLE	3 AXLE
KM - 136+650	**Mahur- Lisang**	0.001	0.157	1.207	3.531
	Lisang- Mahur	0.009	0.337	2.696	8.848
	Adopted VDF	**0.009**	**0.337**	**2.696**	**8.848**

VDF Calculation(UP)

Sl.No.	Vehicle Type						Equivalency Factor				Total EF	VDF
							1st Axle	2nd Axle	3rd Axle	4th Axle		
	LCV	0.45	0.52				0.000368	0.000286			0.000654	**0.001336700**
	LCV	0.52	0.68				0.000656	0.000836			0.001492	
	LCV	0.51	0.62				0.000607	0.000578			0.001185	
	LCV	0.51	0.55				0.000607	0.000358			0.000965	
	LCV	0.49	0.62				0.000517	0.000578			0.001095	
	LCV	0.50	0.50				0.000561	0.000245			0.000806	
	LCV	0.61	0.65				0.001242	0.000698			0.00194	
	LCV	0.52	0.72				0.000656	0.00105			0.001706	
	LCV	0.51	0.53				0.000607	0.000309			0.000916	
	LCV	0.60	0.78				0.001162	0.001446			0.002608	
	Bus	1.24	2.07				0.021192	0.071721			0.092913	**0.15705925**
	Bus	1.24	2.08				0.021192	0.073117			0.094309	
	Bus	2.07	2.44				0.164569	0.138459			0.303028	
	Bus	1.29	2.32				0.024822	0.113165			0.137987	
	2XL	2.95	4.13				0.67882	1.136476			1.815296	**1.2073965**
	2XL	2.10	3.23				0.174319	0.425178			0.599497	
	3XL	1.90	4.95	4.80			0.116811	3.013642			3.130453	**3.5307694**
	3XL	2.75	5.45	5.51			0.512623	4.811887			5.32451	
	3XL	3.30	6.31	6.25			1.062974	8.299114			9.362088	
	3XL	0.83	2.07	1.52			0.004254	0.055393			0.059647	
	3XL	1.91	1.85	1.81			0.119289	0.059841			0.17913	
	3XL	1.94	5.22	5.16			0.126962	3.871351			3.998313	
	3XL	2.01	1.71	1.52			0.146303	0.036299			0.182602	
	3XL	3.18	5.99	5.82			0.91659	6.487431			7.404021	
	3XL	1.98	1.74	1.68			0.137762	0.045623			0.183385	
	3XL	3.10	5.48	5.39			0.827777	4.655768			5.483545	

VDF Calculation(DN)

Sl.No.	Vehicle Type						Equivalency Factor				Total EF	VDF
							1st Axle	2nd Axle	3rd Axle	4th Axle		
	LCV	0.54	1.35				0.000763	0.012975			0.013738	**0.009195500**
	LCV	0.52	0.69				0.000656	0.000886			0.001542	
	LCV	0.44	0.39				0.000336	0.000091			0.000427	
	LCV	0.91	1.87				0.006147	0.047767			0.053914	
	LCV	0.56	0.61				0.000882	0.000541			0.001423	
	LCV	0.49	0.52				0.000517	0.000286			0.000803	
	LCV	0.44	0.46				0.000336	0.000175			0.000511	
	LCV	0.54	0.58				0.000763	0.000443			0.001206	
	Bus	1.07	1.93				0.01175	0.054199			0.065949	**0.33714325**
	Bus	1.24	2.11				0.021192	0.077427			0.098619	
	Bus	1.22	2.14				0.019857	0.081925			0.101782	
	Bus	2.50	3.70				0.350128	0.732095			1.082223	
	2XL	2.65	5.96				0.442029	4.928845			5.370874	**2.6960885**
	2XL	1.22	0.78				0.019857	0.001446			0.021303	
	3XL	2.15	3.24	3.39			0.191523	0.644359			0.835882	**8.84783625**
	3XL	3.23	6.83	6.95			0.975611	12.024583			13.000194	
	3XL	2.29	6.84	6.87			0.246496	11.782107			12.028603	
	3XL	2.68	6.38	6.46			0.462388	9.064278			9.526666	

Summary of CMSA		
Year	**Pkg-1**	**Design year**
2017 to 2021	Project Clearance & Construction Period	
2022	**0.23**	1
2023	**0.49**	2
2024	**0.76**	3
2025	**1.05**	4
2026	**1.36**	5
2027	**1.70**	6
2028	**2.06**	7
2029	**2.45**	8
2030	**2.87**	9
2031	**3.32**	10
2032	**3.80**	**11**
2033	**4.32**	12
2034	**4.88**	13
2035	**5.48**	14
2036	**6.13**	15
2037	**6.82**	16
2038	**7.57**	17
2039	**8.37**	18
2040	**9.23**	19
2041	**10.16**	20

MSA VALUES

Year	LCV	2 Axle	3 Axle	MAV	Bus	Total yearly CVs (nos.)	Cummulative yearly CVs (nos.)	Yearly Design ESA	Cummulative Design ESA	MSA	Design year
VDF	0.009	2.696	8.848	2.5	0.337						
2018						Project Clearance & Construction period					
2019											
2020											
2021											
2022	453	215	67	21	167	336895	336895	234569.44	234569.44	0.23	1
2023	487	231	72	23	180	362445	**699340**	252283	486853	**0.49**	2
2024	524	248	77	25	194	389820	**1089160**	270556	757409	**0.76**	3
2025	563	267	83	27	209	419385	**1508545**	291492	1048901	**1.05**	4
2026	605	287	89	29	225	450775	**1959320**	312986	1361887	**1.36**	5
2027	650	309	96	31	242	484720	**2444040**	337146	1699033	**1.70**	6
2028	699	332	103	33	260	520855	**2964895**	361866	2060899	**2.06**	7
2029	751	357	111	35	280	559910	**3524805**	389312	2450212	**2.45**	8
2030	807	384	119	38	301	601885	**4126690**	418267	2868479	**2.87**	9
2031	868	413	128	41	324	647510	**4774200**	449952	3318431	**3.32**	10
2032	933	444	138	44	348	696055	**5470255**	484304	3802735	**3.80**	11
2033	1003	477	148	47	374	747885	**6218140**	519771	4322506	**4.32**	12
2034	1078	513	159	51	402	804095	**7022235**	558916	4881423	**4.88**	13
2035	1159	551	171	55	432	864320	**7886555**	600793	5482216	**5.48**	14
2036	1246	592	184	59	464	928925	**8815480**	645894	6128111	6.13	15
2037	1339	636	198	63	499	998275	**9813755**	694280	6822391	**6.82**	16
2038	1439	684	213	68	536	1073100	**10886855**	746839	7569230	**7.57**	17
2039	1547	735	229	73	576	1153400	**12040255**	802687	8371917	**8.37**	18
2040	1663	790	246	78	619	1239540	**13279795**	862316	9234233	**9.23**	19
2041	1788	849	264	84	665	1332250	**14612045**	926183	10160416	**10.16**	20

PROPOSED ROW DETAIL

Sl.no	Chainage		Total length	Proposed ROW		Total ROW
	From	To		LHS	RHS	
1	156.489	156.689	0.200	25.000	15.000	40.000
2	156.689	157.389	0.700	15.000	15.000	30.000
3	157.389	157.689	0.300	45.000	15.000	60.000
4	157.689	157.989	0.300	15.000	15.000	30.000
5	157.989	158.189	0.200	30.000	15.000	45.000
6	158.189	158.489	0.300	15.000	15.000	30.000
7	158.489	158.689	0.200	60.000	15.000	75.000
8	158.689	159.089	0.400	30.000	15.000	45.000
9	159.089	159.689	0.600	60.000	15.000	75.000
10	159.689	160.289	0.600	40.000	15.000	55.000
11	160.289	160.489	0.200	15.000	15.000	30.000
12	160.489	160.789	0.300	50.000	15.000	65.000
13	160.789	161.339	0.550	45.000	15.000	60.000
14	161.339	162.089	0.750	15.000	15.000	30.000
15	162.089	162.289	0.200	25.000	15.000	40.000
16	162.289	162.489	0.200	15.000	15.000	30.000
17	162.489	162.789	0.300	30.000	15.000	45.000
18	162.789	163.089	0.300	15.000	15.000	30.000
Total Length			**6.600**			

Sl.no	Chainage		Total length	Proposed ROW		Total ROW
	From	To		LHS	RHS	
19	163.089	163.389	0.300	20.000	15.000	35.000
20	163.389	163.689	0.300	30.000	15.000	45.000
21	163.689	163.889	0.200	20.000	15.000	35.000
22	163.889	164.889	1.000	45.000	15.000	60.000
23	164.889	165.289	0.400	60.000	15.000	75.000
24	165.289	165.689	0.400	45.000	15.000	60.000
25	165.689	167.089	1.400	30.000	15.000	45.000
26	167.089	167.189	0.100	40.000	15.000	55.000
27	167.189	167.789	0.600	75.000	40.000	115.000
28	167.789	167.889	0.100	40.000	25.000	65.000
29	167.889	168.089	0.200	20.000	25.000	45.000
30	168.089	169.600	1.511	20.000	20.000	40.000
31	169.600	170.600	1.000	15.000	15.000	30.000
32	170.600	171.449	0.849	10.000	10.000	20.000
33	171.449	172.749	1.300	20.000	10.000	30.000
34	172.749	172.949	0.200	30.000	15.000	45.000
35	172.949	174.734	1.785	15.000	15.000	30.000
36	174.734	175.434	0.700	15.000	30.000	45.000
37	175.434	176.581	1.147	15.000	15.000	30.000
Total Length			**13.492**			