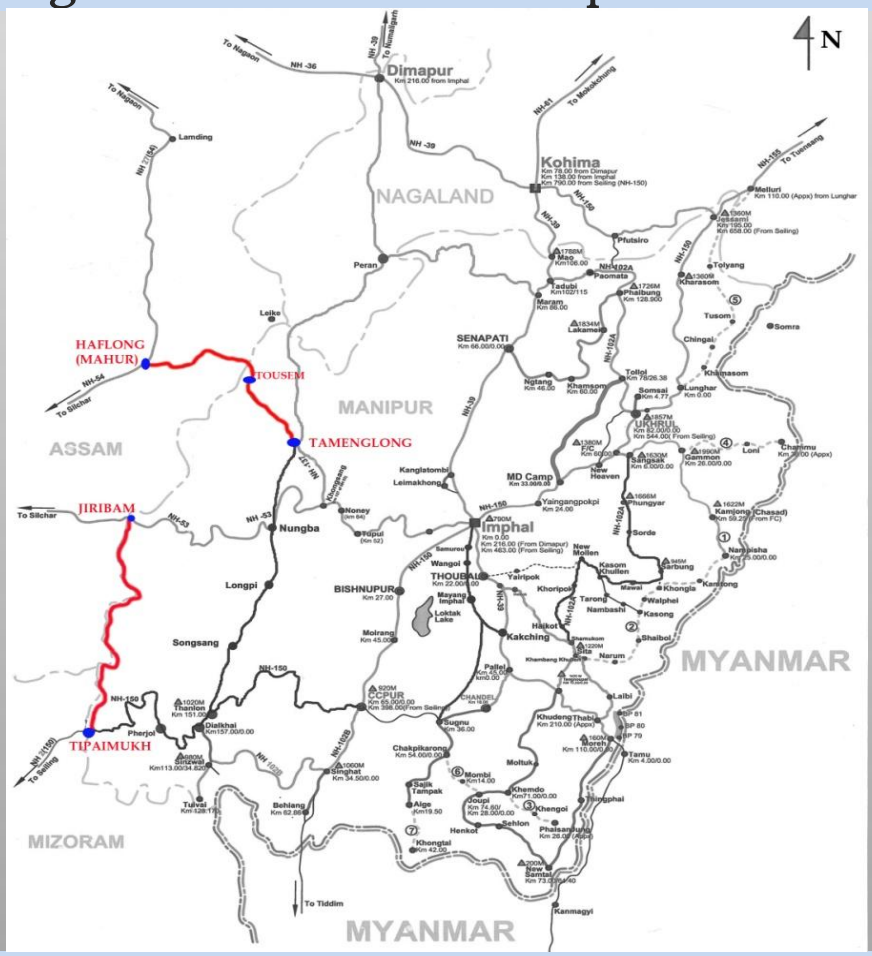
NATIONAL HIGHWAY INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED

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-1
TAMENGLONG-DIALONG SECTION
(FROM KM 0+000 TO KM 10+000) LENGTH-10.0KM

M/s L.N Malviya Infra Projects PVT. LTD. Bhopal.
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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	In Principle NH	Km 0+000	Km 143+245	143.245	148km (Approx)

As per Authority instructions project road is divided in 6 Packages in Manipur State.

This report deals with the first Package i.e. **Tamenglong-Dialong 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

Sr. No.	Name of Road	NH No.	Chainage (in Km)		Length as per Design (in Km)
			From (in Km)	To (in Km)	
1	Tamenglong-Dialong Section	In Principle NH	Km 0+000	Km 10+000	10.000km

1.1. Tamenglong-Tousem-Haflong 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- Haflong Road on existing T – Junction with Imphal-Tamenglong Road (L/s Tamenglong, R/s Imphal) Near Tamenglong Town, Manipur and terminates on Km. 143.245 of Tamenglong- Tousem- Haflong road on existing Y – Junction with NH-54 (L/s Mahur, R/s Lumding) Near Mahur Town, 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.**

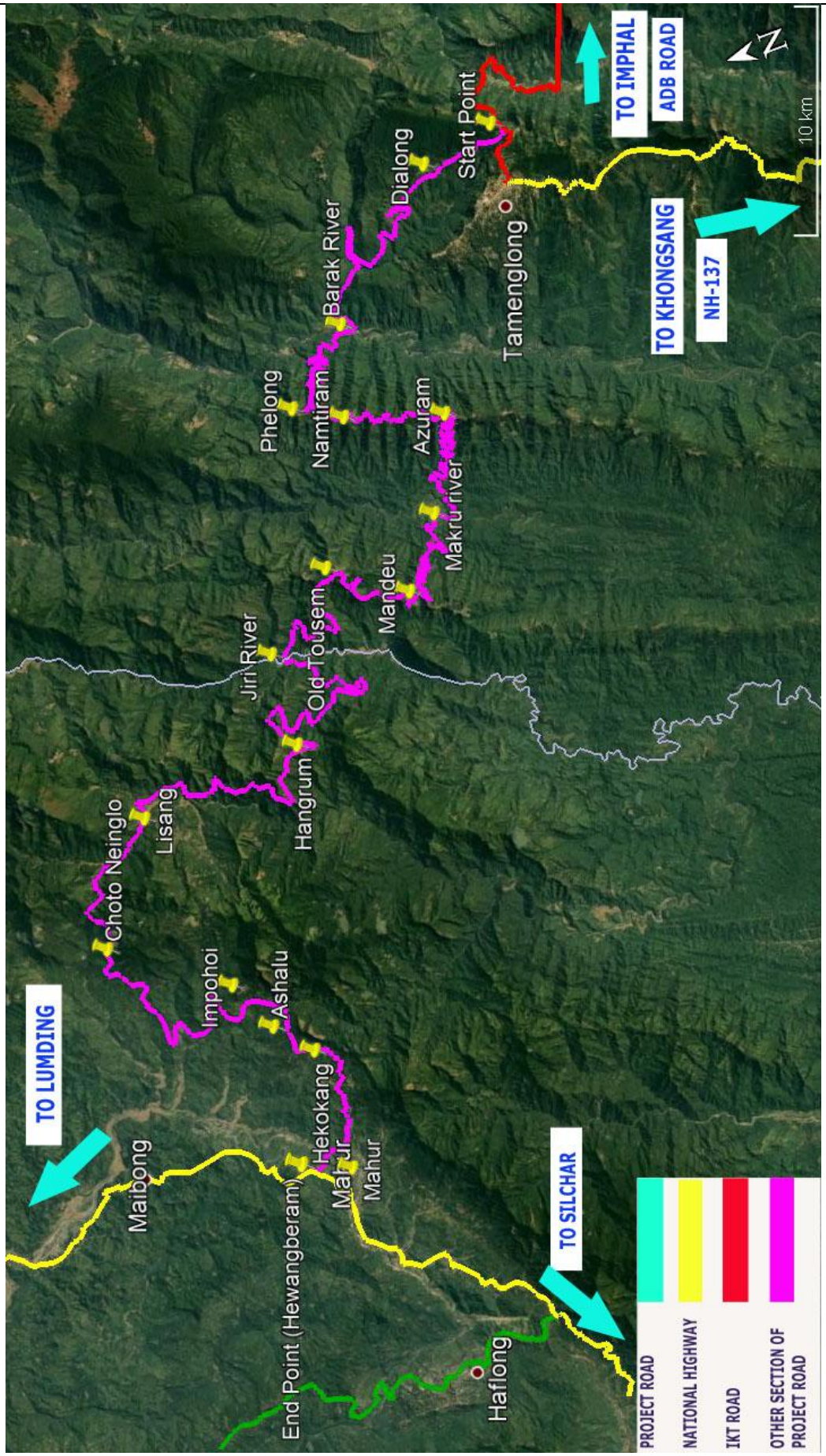


Figure1.1: Location Plan of full Project Road

1.1.1 Tamenglong-Dialong Section

The Project Stretch starts from Km. 0.000 of Tamenglong- Tousem- Haflong Road on existing T – Junction with Imphal-Tamenglong Road (L/s Tamenglong, R/s Imphal) Near Tamenglong Town, Manipur and terminates on Km. 10.00 of Tamenglong- Tousem- Haflong road near Old Tamenglong Village.

The project road traverses through Tamenglong District in Manipur. The location plan of the full project road section is illustrated in **Figure 1.1.**

Figure1.2: Location Plan of Pkg-1 (Tamenglong-Dialong 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 Km. 0.000 of Tamenglong- Tousem- Haflong Road on existing T – Junction with Imphal-Tamenglong-Road (L/s Tamenglong, R/s Imphal) Near Tamenglong Town, Manipur.	Start Point of Project Road Has been changed due to Dense Built-up of Tamenglong Town
2.	End Point	Terminates terminates on Km. 10.00 of Tamenglong- Tousem- Haflong road in Manipur	

SL. No.	Particulars	Existing Details	Remarks
3.	Total Length	10.000	Green Field alignment
4.	Districts	1No.	Tamenglong
5.	Category of Road	Major District Road	
6.	State	1 No.	Manipur
7.	Terrain	Hilly Terrain	
8.	Right of Way(m)	NIL	
9.	Carriage way	No Existing Alignment Exists	
10.	Major/Minor Bridge	At 5 locations Minor Bridge is required	
11.	FCW	0 No.	
12.	Pipe Culverts	0 Nos.	
13.	Slab / Cut Stone Culverts	0 Nos.	
14.	Burried	0 No.	
15.	Minor Junctions	3 Nos.	
16.	Major Junction	1 Nos.	
17.	Villages/Towns	2 Nos. (Away from Project Road)	
18.	Existing Drainage System	NIL	
19.	Miscellaneous Services	**Fuel Stations:** No 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.

Demographic Profile

Tamenglong District:

Important Demographic indicators of the District as per Census 2011(P) Figures are as follows:

An official Census 2011 detail of Tamenglong, a district of Manipur has been released by Directorate of Census Operations in Manipur. Enumeration of key persons was also done by census officials in Tamenglong District of Manipur.
In 2011, Tamenglong had population of 140,651 of which male and female were 72,371 and 68,280 respectively. In 2001 census, Tamenglong had a population of 111,499 of which males were 58,014 and remaining 53,485 were females. Tamenglong District population constituted 4.93 percent of total Maharashtra population. In 2001 census, this figure for Tamenglong District was at 4.86 percent of Maharashtra population.

There was change of 26.15 percent in the population compared to population as per 2001. In the previous census of India 2001, Tamenglong District recorded increase of 29.23 percent to its population compared to 1991.

Average literacy rate of Tamenglong in 2011 were 70.05 compared to 59.30 of 2001. If things are looked out at gender wise, male and female literacy were 76.09 and 63.69 respectively. For 2001 census, same figures stood at 68.70 and 49.00 in Tamenglong District. Total literate in Tamenglong District were 85,006 of which male and female were 47,403 and 37,603 respectively. In 2001, Tamenglong District had 56,819 in its district.

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.

IRC:37-2019 stated" If the data for the annual growth rate of commercial vehicles is not available or if it is less than 5 per cent, a growth rate of 5 per cent should be used".

Hence traffic growth rate is adopted 5% for projection of present traffic.

Vehicle Damage Factor

As per IRC: 37-2019 clause 4.4.6 stated" where the sufficient information on axle loads is not available the default values of vehicles of vehicle damage factor as given in table 4.2 may be used".

As per table 4.2 for CVPD more than 1500 adopted VDF should be 2.5 for Hilly terrain.

Hence, The Adopted VDF is 2.5.

Cumulative Mean Standard Axles (CMSA)

Summary of CMSA By Assumed Traffic		
Year	**Pkg-1**	**Design year**
2017 to 2020	Project Clearance	
2021	**0.21**	1
2022	**0.43**	2
2023	**0.67**	3
2024	**0.91**	4
2025	**1.17**	5
2026	**1.44**	6
2027	**1.73**	7
2028	**2.03**	8
2029	**2.35**	9
2030	**2.68**	10
2031	**3.02**	**11**
2032	**3.39**	12
2033	**3.77**	13
2034	**4.17**	14
2035	**4.59**	15
2036	**5.04**	16
2037	**5.50**	17
2038	**5.99**	18
2039	**6.50**	19
2040	**7.04**	20
2041	**7.60**	21
2042	**8.20**	22
2043	**8.82**	**23**
2044	**9.47**	**24**
2045	**10.16**	**25**

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.-4 of IRC-37:2019 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	GSB
0+000	10+000	10.000	8	20	30	90	250	200

As Per test results the average CBR Varies from 8-12%. So, the value of adopted CBR is 8%.

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	0.625	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	0.925	TCS-2.8
3	Reconstruction in Two-Lane Carriageway with Paved Shoulder in Hilly Terrain without retaining wall	8.450	TCS-2.9
	Total	**10.000 km**	

Proposed ROW

- In Mountainous and steep terrain
  Open Area- 45-60m
  Built-up Area-30m

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	00	00
2	New-construction	00	06	06
	Total	00	06	06

HPC & SLAB 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	-	-	-	38	38
Total		**-**	**-**	**-**	**38**	**38**

Drainage and Protection works

Lined drains are proposed to be constructed in urban areas.

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

Bus Bay & Bus Shelter

Considering the overall safety of traffic and minimum hindrance to through traffic, 1 nos. pick-up bus shelters & Bus Bay have been proposed both side along the project road. Details is given in table 1.9 below:

Table No. 1.9: Bus Bay & Shelter Location

Sr. No.	Design Chainage	Side	Location
1	3100-3200	RHS	Dialong

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 10m c/c on both side side 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 assessed from SOR, PWD, NH-Works -2018 and escalation of 5% per year is adopted.

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

Table No. 1.10:

General Abstract of Cost

Total Length 10 Kms

S. No.	Item	Total Cost in Crores
A	***ROAD WORKS***	
1	*SITE CLEARANCE*	0.07
2	*EARTHWORK*	47.14
3	*GRANULAR SUB-BASE*	6.38
4	*NON BITUMINOUS BASE-COURSE*	7.75
5	*BITUMINOUS BASE-COURSE*	10.37
6	*WEARING COAT*	3.83
	SUB TOTAL (A)	**75.55**
B	***CROSS DRAINAGE STRUCTURES***	
7	*Reconstruction/ New Construction of Culverts*	16.71
8	*Reconstruction/ New Construction of Minor bridges*	12.84
9	*Reconstruction/ New Construction of Major bridges*	-
	SUB TOTAL OF CROSS DRAINAGE STRUCTURES (B)	**29.55**
C	***OTHER ITEMS***	

10	*Traffic Signs, marking and Appurtenances*	2.09
11	*Project Facilities*	0.03
12	*Drainage Works*	3.21
13	*Protection Works*	28.22
	SUB TOTAL OF OTHER ITEMS (C)	**33.54**
D	***Total (D= A+B+C)***	**138.64**
E	*Add Price Escalation @ 5% per annum for 2 Years (2018-20) i.e. 10.05% on D (E)*	14.21
F	***Total Civil Construction Cost (F=D+E)***	**152.85**
	Cost Per Km	**15.28**
G	***Pre Construction Activities***	
	Add Cost of Utility Shifting (Approx)	0.00
	Cost of Land Acquisition(Approx)	0.00
	Add Cost of Forest Clearance (Approx)	10.00
	Total of Pre Construction Activities (G)	**10.00**
H	***GST/Contigencies and Centages***	
	GST @ 12% of F if the SOR does not include any component of VAT/GST	18.34
	Contigencies @ 2.8% of F above	4.28
	Agency Charges @ 3% of F above	4.59
	Supervision charges @ 3% of F above	4.59
	Price Escalation @ 5% of 'F' above as per phasing of the project execution only for the period beyond 1 year of the Bid submission date	7.64
	Maintenance during construction/Defect Liability Period (Calculate as per the rate prescribed in the latest Document on EPC Contract	3.82
	Total of GST/Contigencies and Centages (H)	**43.26**
Total Project Cost (F+G+H)		**206.10**
Cost per Km.		**20.61**

For Details of Cost Estimate Please refer Chapter-12

1.9. Environmental, Forest & Wildlife Clearance

- Environmental Clearance is not required.
- Forest Clearance is required.
- Wildlife Clearance & Eco-Sensitive Zone 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

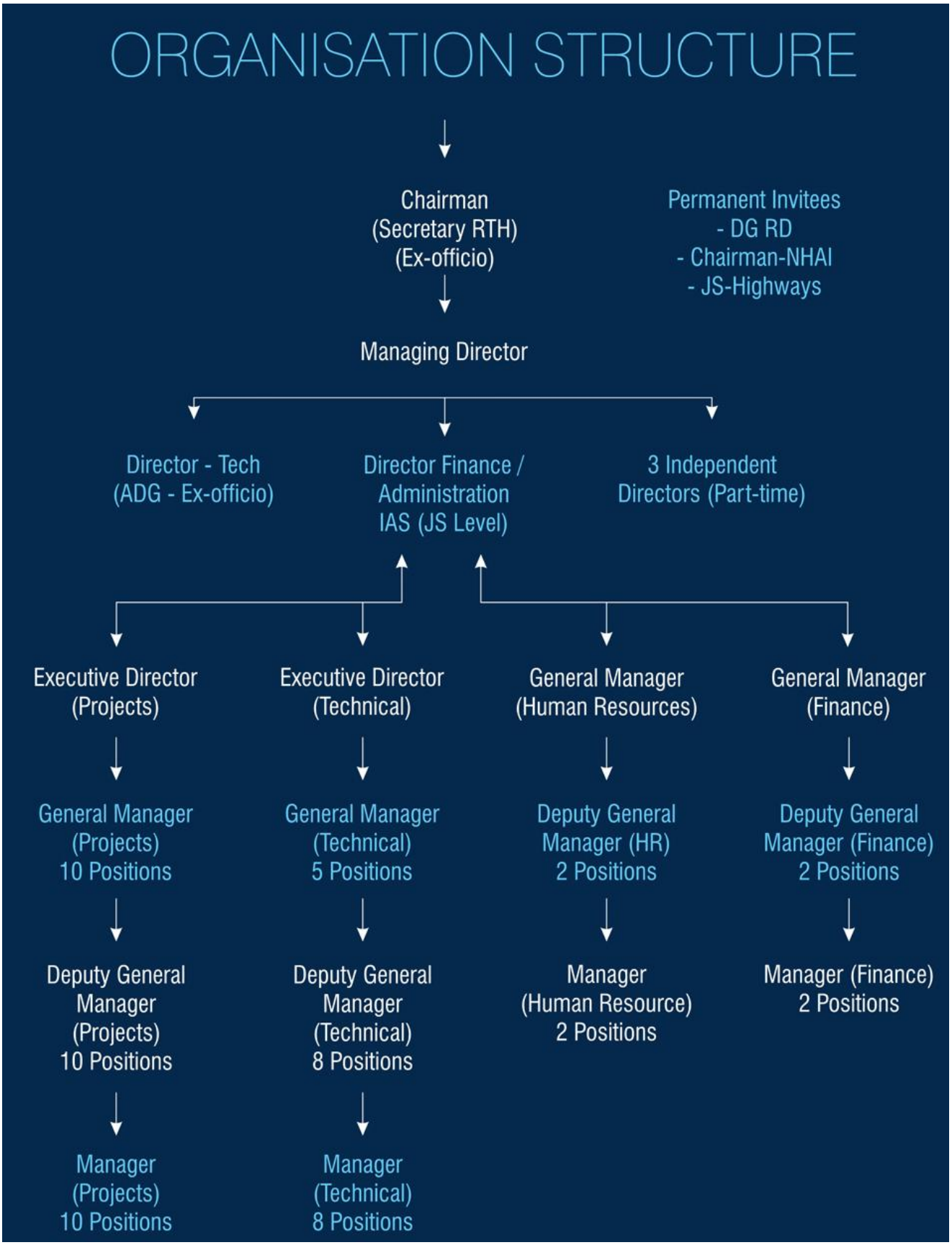
The company has a Mission to be a professional company which works in most efficient and transparent manner and designs, develops & delivers infrastructure projects in a time bound manner for maximizing benefits to all stakeholders.

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-Haflong for a length of about 143.245 km (as per topographic survey) the road primarily connects blocks viz, Tousem - Laisong and 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 Design (in Km)
			From (in Km)	To (in Km)		
1	Tamenglong-Tousem-Laisong-Haflong	In Principle NH	Km 0+000	Km 143+245	143.245	148km (Approx)

As per Authority instructions project road is divided in 6 Packages in Manipur State.

This report deals with the Package-1 i.e. **Tamenglong-Dialong 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

Sr. No.	Name of Road	NH No.	Chainage (in Km)		Length as per Design (in Km)
			From (in Km)	To (in Km)	
1	Tamenglong-Dialong Section	In Principle NH	Km 0+000	Km 10+000	10.000km

Pkg-1 Tamenglong-Dialong Section

The Project Stretch starts from Km. 0.000 of Tamenglong- Tousem- Haflong Road on existing T – Junction with Imphal-Tamenglong Road (L/s Tamenglong, R/s Imphal) Near Tamenglong Town, Manipur and terminates on Km. 10.00 of Tamenglong- Tousem- Haflong road.

The project road traverses through Tamenglong District in Manipur. The location plan of the full project road section is illustrated in **Figure 3.1,** Start & End point of the Project road have been shown in figure 3.2 to 3.4.

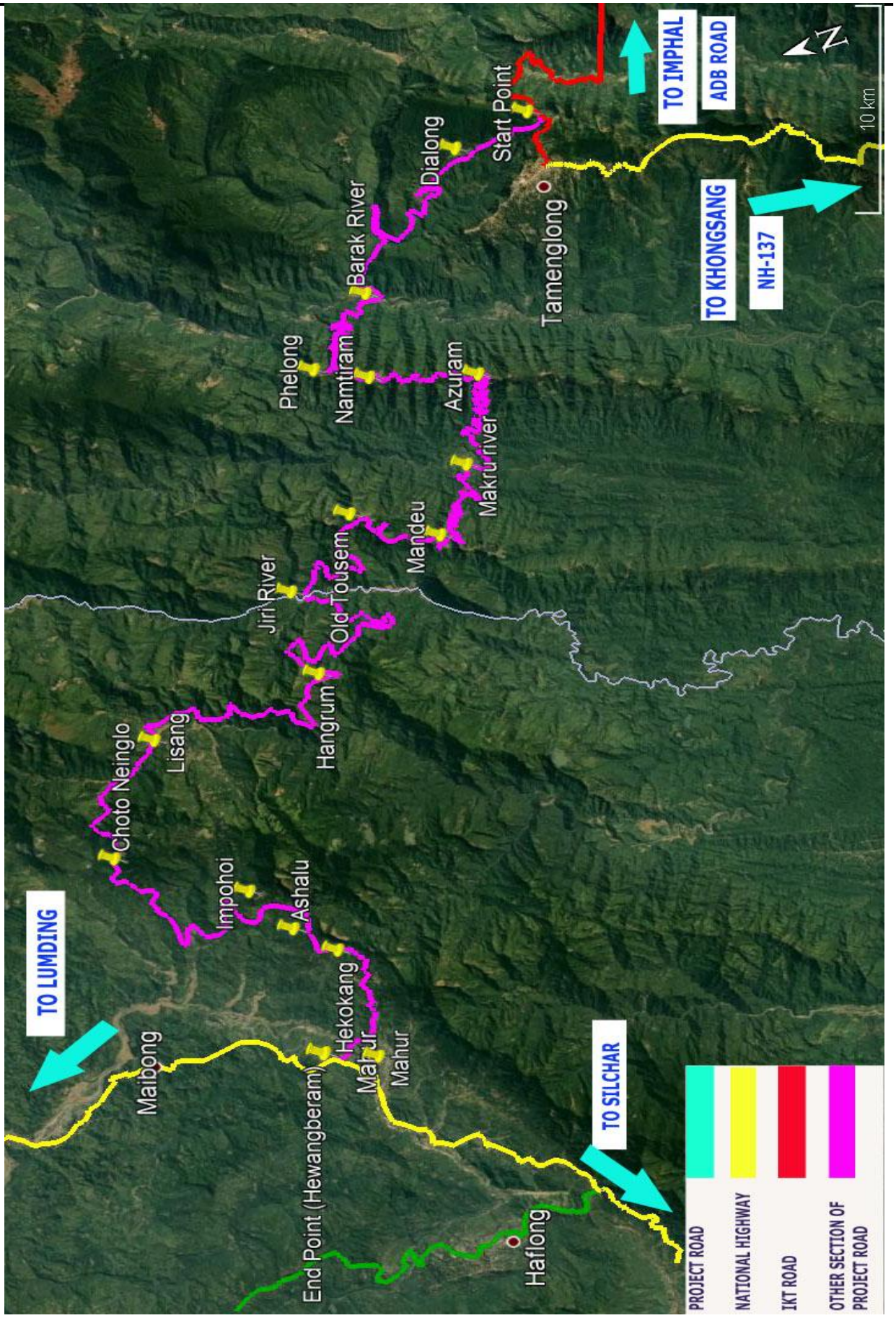


Figure 3.1: Location Map of Tamenglong-Tousem-Laisong-Haflong Road

Figure 3.2: Location Map of Tamenglong-Dialong Section

3.1 Start Point

The project road starts from Km. 0.000 of Tamenglong- Tousem- Haflong Road on existing Y – Junction with Imphal Tamenglong Road (L/s Tamenglong, R/sImphal) Near Tamenglong Town, Manipur.

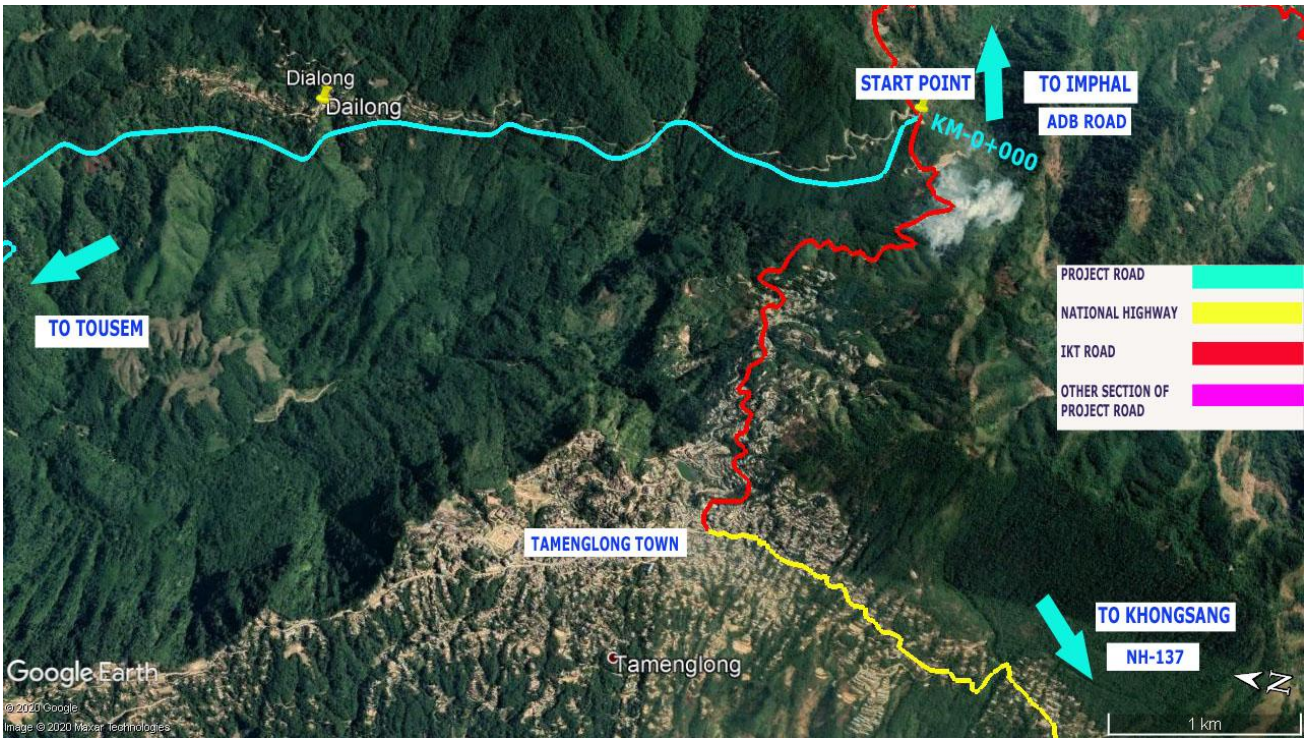


Figure 3.3: Aerial View of Start Point

3.2 End Point

Project Road terminates on Km. 10.00 of **Tamenglong- Tousem- Haflong** road.

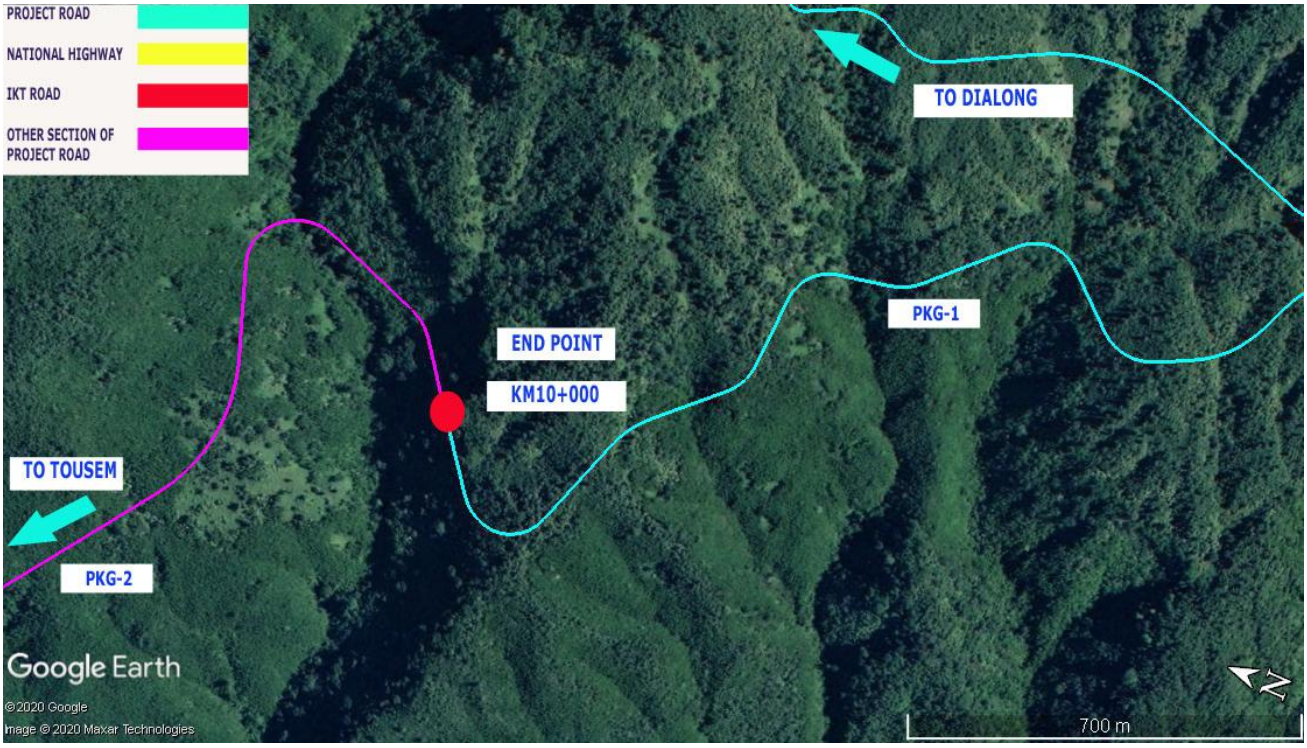


Figure 3.4: Aerial View of End Point

3.3 Importance of Road

- The population of Tamenglong & Dialong, Villages of Tamenglong District 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- 54 which 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 Category of project Road

As per PWD, Govt. of Manipur letter No. CE/PWD/NHIDCL/2017-18/3817 Imphal, dated 17TH Feb. 2018, the category of Tamenglong-Tousem -Haflong Road is Major District Road.

3.5 Altitude of Project Road

The altitude of project road varies from 180m to 1511m above MSL.

3.6 Junctions

The project road crosses different categories roads such as National Highways, State Highways, & Village roads. There are **01 numbers of Major Junctions and 4 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.	Chainage	TYPE of Junction (T,Y,X)	Detail of Destination of Junction
1	0	Y-Type	LHS- TAMENGLONG RHS- IMPHAL
2	0+850	Y-Type	To Dialong
3	1+650	X-Type	LHS- Tamenglong RHS- Dialong
4	3+200	X-Type	LHS- Ag Field RHS- Dialong
5	5+175	X-Type	LHS- Ag Field RHS- Dialong

3.7 Towns / Villages along the Project Highway

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

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

S. No.	Chainage		Length(m)	Village Name
	From	To		
1	0	10000	10000	Dialong Village
Total			10000	

3.8 Existing Road alignment

The road passes Mountainous & steep terrain throughout the stretch. There is no existing alignment.

Table 3.5 Terrain Details

Start Ch.	*End Ch.*	*Type of Terrain*
0.000	10.000	Mountainous /Steep

3.9 Pavement

The Project Stretch is green field Alignment. The existing condition of pavement and lane configuration is presented in Table 3.4.

Table 3.6: Summary of Existing Cross-section details

Carriageway Width	*Length (in km)*	*Type*
NA		

3.10 DRAINAGE

The Project Stretch is green field Alignment.

3.11 EXISTING ROW:

As the Project Stretch is green field Alignment there is no existing ROW at present.

3.12 Cross drainage structures

As the Project Stretch is green field Alignment there is no. structures found in 10 km length. It has been observed that there are 38no. locations where new culverts, 6no. location Minor Bridge are to 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*	*Hume Pipe Culvert*	*Burried*
NIL					

3.13 Road Length passing through Forest Area

As per information by forest department & Forest Map, full Project Road lies under forest area. Hence forest Clearance will be required.

3.14 RAIL-ROAD CROSSING:

There is no railway under pass exists at project Stretch.

3.15 ONGOING DEVELOPMENT PLANS

No development plan reported for this road during preliminary survey.

3.16 ENCROACHMENTS

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

3.17 SOIL STRATA

Table 3.7 shows variations in Soil of Project Road.

Table3.8

Ex. Start Ch.	Ex. End Ch.	Length (km)	Type of Soil	Remark
0+000	10+000	10.000	Reddish Clayey Silty Sand	Both Side

3.18 SERVICE ROADS

There are no service roads along the road.

3.19 LAND ACQUISITION

Land Acquisition process has been completed as all villagers are giving their land for free of cost.

3.20 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.

3.21 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 (Near Mahur 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 Maibong Village (Silchar-lumding Section)

C) Axle Load Spectrum Survey

1. At Tamenglong Town

3.22 TRAFFIC DATA

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

3.23 BYPASSES

No Bypasses required on project road section.

3.24 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 Station were observed on the project Road.

3.25 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 include Guava, Mango, Lichi, Zackfood, Banana, Mangroo, Baniyan, Supari (Plantation), Teakwood, Betal Nut, Manipuri Lily and Coconut Trees and Local Trees etc.

3.26 RESOURCES

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

Borrow Areas: -

Quarry Material	Quarry Location	Approx Lead (Km)
Ballast/Stone	Local	20km
Sand	Barak River	20km

Bitumen: - Bitumen VG-40- Haldia
Bitumen/Emulsion/ PMB- Haldia

Cement:-Cement from M/s Adhunik Cements, Jayantia Hills.

Steel:-Steel from local market of Imphal/Guwahati.

3.27 UTILITIES

Electrical Poles: - No Electrical poles are fixed on both 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-5: SOCIO ECONOMIC PROFILE

5.1 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	Type of Road	Chainage (in Km)		Length as per Design (in Km)
			From (in Km)	To (in Km)	
1	Tamenglong-Dialong Section	In-Principle NH	Km 0+000	Km 10+000	10.00km

5.2 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.

MANIPUR STATE

Manipur State Information	
Capital	Imphal
Date of formation	21 Jan. 1972
Governor	Najma heptulla
Chief Minister	Okram Ibobi singh
Tourist attractions	Imphal, Ukhrul, Bishnupur, Thoubal , Chandel , Senapati , Tamenglong, Churachandpur.
Festivals	Three kinds of Bihu are celebrated: the Bohag Bihu (Rongali Bihu), the Kati Bihu(Kangali Bihu), and the Magh Bihu (Bhogali Bihu).
Major dance and music forms	Lai Haroaba Manipur dance
Arts and crafts	Cane and Bamboo, Stone-Carving, Kauna (Water Reed) Crafts, Wood Carving, Textile Weaving, Dolls and Toys.
Languages	Manipuri
Size	8,621 sq m
Population (Census 2011)	2,855,794
Rivers	Imphal river, Barak river
Forests and wildlife sanctuaries	Khongjaingamba Ching WLS, Yangoupokpi-Lokchao WLS.
State animal	Sangai
State bird	Nongyen
State flower	Siroi lily
State tree	Uningthou
Major crops	Rice, Wheet, Maize, Sugarcane
No. of District	16

Historical Background

The ancient history of Manipur is unclear and disputed. According to one tradition, the Manipuri people are the Gandharvas – musicians and dancers – in the Vedic texts, and historic texts of Manipuri people calls the region as Gandharva-desa. The ancient Sanskrit texts such as the Mahabharata epic mentions Manipur, where Arjuna meets and falls in love with Chitragada. Shiva and Parvati are part of the legendary Khamba-Thoibi love story in Manipur tradition.

Another tradition describes the history of Manipur to be one of a trading route between Indian subcontinent, China and southeast Asia, where it witnessed not only economic activity, but also wars, along with movement of people, culture and ideas that made it a melting pot of Indo-Burman culture. By the medieval period, marriage alliances between royal families of Manipuri kingdom, Ahom (Assam) and Burma had become common. Medieval era Manipuri manuscripts discovered in 20th century, particularly the Puya, evidence that Hindus arrived from the Indian subcontinent with royal marriages at least by the 14th century, and in centuries thereafter, from what is now modern Assam, Bengal, Uttar Pradesh, Dravidian kingdoms, and other regions. Another manuscript suggests that Muslims arrived in Manipur in the 17th century, from what is now Bangladesh, during the reign of Meidingu Khagemba. The socio-political turmoil and wars affected the cultural and religious demography of Manipur, particularly the persistent and devastating Manipur-Burma wars.

Manipur was annexed and became a part of the British Empire, but as a princely state. During the World War II, Manipur was the scene of many fierce battles between the Japanese invaders and the British Indian forces. The Japanese were beaten back before they could enter Imphal, which was one of the turning points of the war. After the war, the Manipur Constitution Act of 1947 established a democratic form of government, with the Maharaja as the executive head. In 1949, Maharaja Bodhchandra was summoned to Shillong, where he signed the instrument of accession to merge the kingdom into India. Thereafter the legislative assembly was dissolved, and Manipur became part of the Republic of India in October 1949. It was made a Union Territory in 1956. and a fully-fledged State in 1972.

A separatist movement has been active in Manipur since 1964, when United National Liberation Front was founded. Several groups have used violence toward achieving their goal of a sovereign Manipur. In addition, tribal peoples have demanded division of the present state into two or three Indian states along ethnic lines. This is considered one of India's "sensitive areas", due to its political troubles and isolated geography. Foreign travellers must gain permission from the government to enter the state.

Manipur has had a long record of insurgency and inter-ethnic violence.[35][36] The first armed opposition group in Manipur, the United National Liberation Front (UNLF), was founded in 1964, which declared that it wanted to gain independence from India and form Manipur as a new

country. Over time, many more groups formed in Manipur, each with different goals, and deriving support from diverse ethnic groups in Manipur. For example, in 1977 the People's Revolutionary Party of Kangleipak (PREPAK) was formed, the People's Liberation Army (PLA) was formed in 1978 which Human Rights Watch states as having received arms and training from China. In 1980, the Kangleipak Communist Party (KCP) was formed. These groups began a spree of bank robberies and attacks on police officers and government buildings. The state government appealed to the central government in New Delhi for support in combating this violence.

In 1980, the central government brought the entire state of Manipur under the Armed Forces (Special Powers) Act, 1958 (AFSPA) because its state government claimed that the use of the Armed Forces in aid of the state and local police is necessary to prevent violent deaths and to maintain law and order.

Since 1980, the application of AFSPA has been at the heart of concerns about human rights violations in the region, such as arbitrary killings, torture, cruel, inhuman and degrading treatment and enforced disappearances. Its continued application has led to numerous protests, notably the longstanding hunger strike by Irom Sharmila Chanu.

4.2 Geography, Topology & Forests

Geography:

The state lies at a latitude of 23°83'N – 25°68'N and a longitude of 93°03'E – 94°78'E. The total area covered by the state is 22,347 square kilometres (8,628 sq mi). The capital lies in an oval-shaped valley of approximately 700 square miles (2,000 km2) surrounded by blue mountains and is at an elevation of 790 metres (2,590 ft) above sea level. The slope of the valley is from north to south. The mountain ranges create a moderated climate, preventing the cold winds from the north from reaching the valley and barring cyclonic storms originating from the Bay of Bengal.

The state has four major river basins: the Barak River Basin (Barak Valley) to the west, the Manipur River Basin in central Manipur, the Yu River Basin in the east, and a portion of the Lanye River Basin in the north.[38] The water resources of Barak and Manipur river basins are about 1.8487 Mham. The overall water balance of the state amounts to 0.7236 Mham in the annual water budget. (By comparison, India receives 400 Mham (million hectare meters) of rain annually.

The Barak River, the largest of Manipur, originates in the Manipur Hills and is joined by tributaries, such as the Irang, Maku, and Tuivai. After its junction with the Tuivai, the Barak River turns north, forms the border with Assam State, and then enters the Cachar Assam just above Lakhipur. The Manipur river basin has eight major rivers: the Manipur, Imphal, Iril, Nambul, Sekmai, Chakpi, Thoubal and Khuga. All these rivers originate from the surrounding hills.

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:

Manipur is a state in northeastern India, with the city of Imphal as its capital. Manipur is sometimes called alternative names such as Kangleipak or Sanaleibak. It is bounded by Nagaland to the north, Mizoram to the south, and Assam to the west; Burma (Myanmar) lies to its east.

Climate:

The climate of Manipur is largely influenced by the topography of this hilly region. Lying 790 meters above sea level, Manipur is wedged among hills on all sides. This northeastern corner of India enjoys a generally amiable climate, though the winters can be a chilly. The maximum temperature in the summer months is 32 °C (90 °F). In winter the temperature often falls below 0 °C (32 °F), bringing frost. Snow sometimes falls in hilly regions due to the Western Disturbance.[citation needed] The coldest month is January, and the warmest July .

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.

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. The normal rainfall of Manipur enriches the soil and helps in agriculture and irrigation. 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).

Transport:.

Three National Highways, viz., N.H-39, N.H- 53 and N.H-150 criss-cross the State connecting all districts. The Saurashtra-Silchar Super Highway project is being extended to Moreh. With the proposed Moreh to Mae Sot (Thailand) highway coming up, Manipur will become India's Gateway to South-East Asia.

Economy

The 2012–2013 gross state domestic product of Manipur at market prices was about ₹ 10,188 crore (US$1.5 billion). Its economy is primarily agriculture, forestry, cottage and trade driven.

Manipur acts as India's "Gateway to the East" through Moreh and Tamu towns, the land route for trade between India and Burma and other Southeast Asian countries.

Manipur has the highest number of handicrafts units and the highest number of craftspersons in the northeastern region of India.

Manipur produced about 0.1 gigawatt-hours (0.36 TJ) of electricity in 2010 with its infrastructure.[58] The state has hydroelectric power generation potential, estimated to be over 2 gigawatt-hours. As of 2010, if half of this potential is realised, it is estimated that this would supply 24/7 electricity to all residents, with a surplus for sale, as well as supplying the Burma power grid.

Manipur's climate and soil conditions make it ideally suited for horticultural crops. Growing there are rare and exotic medicinal and aromatic plants.[57] Some cash crops suited for Manipur include litchi, cashew nuts, walnuts, orange, lemon, pineapple, papaya, passion fruit, peach, pear and plum.

The state is covered with over 3,000 square kilometres (1,200 sq mi) of bamboo forests, making it one of India's largest contributor to its bamboo industry.

Tulihal Airport, Changangei, Imphal, the only airport of Manipur, connects directly with Delhi, Kolkata, Guwahati, and Agartala. It has been upgraded as an International airport. As

India's second largest airport in the northeast, it serves as a key logistical centre for northeastern states. National Highway NH-39 links Manipur with the rest of the country through the railway stations at Dimapur in Nagaland at a distance of 215 km (134 mi) from Imphal. National Highway 53 (India) connects Manipur with another railway station at Silchar in Assam, which is 269 km (167 mi) away from Imphal. The road network of Manipur, with a length of 7,170 km (4,460 mi) connects all the important towns and distant villages. However, the road condition throughout the state is often deplorable.

In 2010, Indian government announced that it is considering an Asian infrastructure network from Manipur to Vietnam.

4.7 Education

Manipur schools are run by the state and central government or by private organisation. Instruction is mainly in English. Under the 10+2+3 plan, students may enroll in general or professional degree programs after passing the Higher Secondary Examination (the grade 12 examination). The main universities are Manipur University, Central Agricultural University and National Institute of Technology, Manipur.

4.8 Demography

An order has been issued by the chief minister Okram Ibobi-headed Congress government to appoint Deputy Commissioners and Superintendents of Police for the new districts.

Sr. No.	District	District HQ	Population (2011)	Growth	Sex Ratio	Literacy	Area (km2)	Density (/km2)
1	Bishnupur	Bishnupur	2,40,363	0.1393	999	75.85	496	485
2	Chandel	Chandel	1,44,028	0.2185	933	71.11	3317	43
3	Churachandpur	Churachandpur	271.274	0.2029	975	82.78	4574	59
4	Imphal East	Porompat	4,52,661	0.1551	1017	81.95	710	638
5	Imphal West	Lamphelpat	5,14,683	0.1656	1031	86.08	519	992
6	Senapati	Senapati	3,54,772	-0.3169	959	74.13	3269	109
7	Tamenglong	Tamenglong	1,40,143	0.2615	943	70.05	4391	32

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.

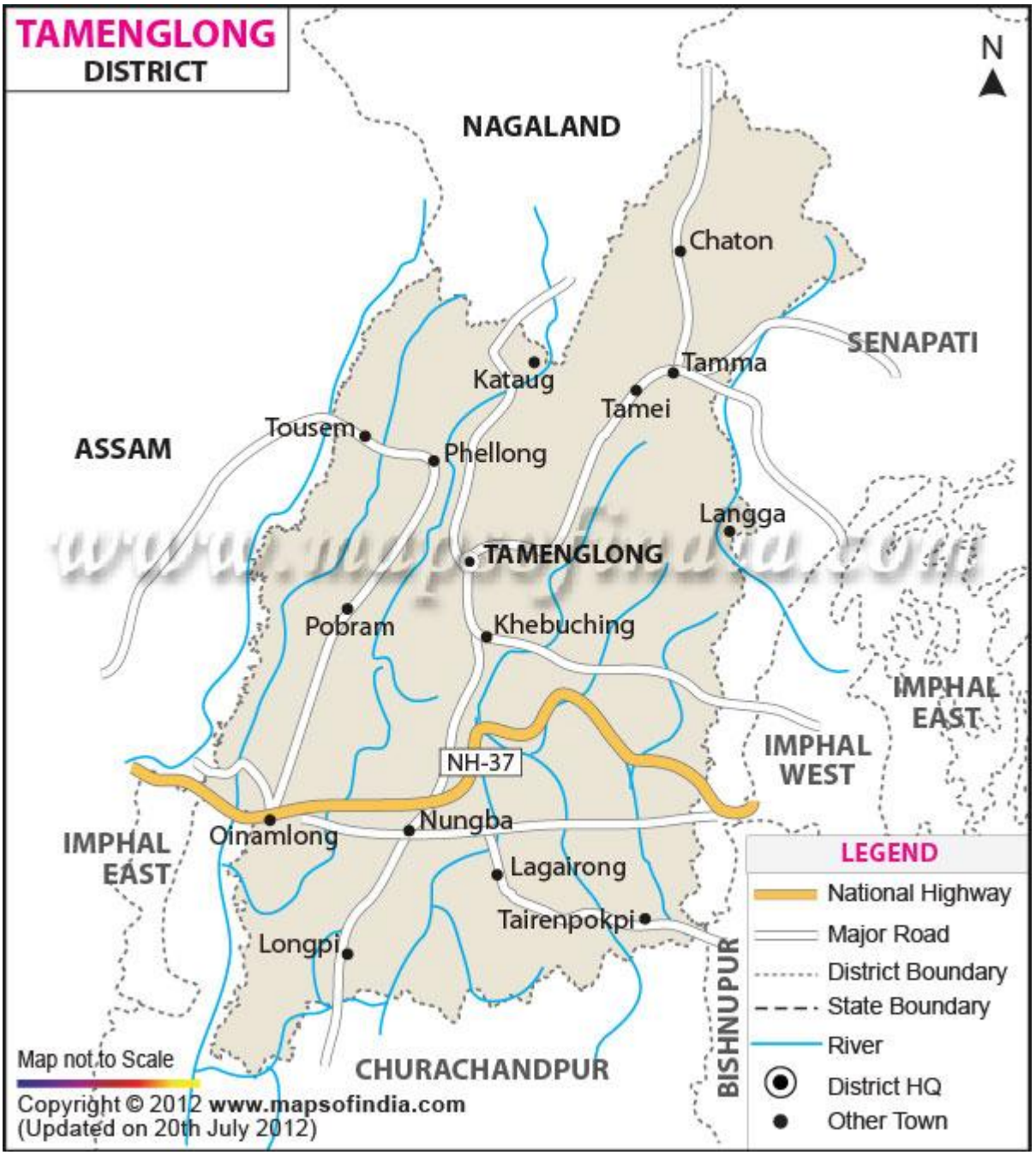
Economy:

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.

5.9 DISTRICT TAMENGLONG



History:

Tripura a hilly, picturesque, princely state was first conquered by the Britishers in 1761. However, no political agent was appointed till 1871 and the Maharaja ruled hill territory "Hill Tipperah" almost independently. The State acceded to the Indian union on 13.08.1947, the agreement of merger being signed on 09.09.1949. The administration was formally taken over on 15.10.1949.Tripura, initially a one district state, was trifurcated into three Districts w.e.f. 01.09.1970. The North Tripura District started functioning in the office of the Sub-divisional officer at Kailashahar and partly at Kumarghat, later the whole office was shifted to Kailashahar. The Collectorate was shifted to the newly constructed complex at Gournagar on 13.11.1987, subsequently North Tripura District has been bifurcated and a new District namely "DHALAI DISTRICT" has been inaugurated on 14.04.1995 with district head quarter at Ambassa. On 21.01.2012 the decision to further bifurcate North Tripura District was accepted and the district "UNAKOTI DISTRICT" has been created with its headquarter at Kailashahar & North Tripura district headquarter shifted to Dharmanagar.

Geography:

This district is bounded by Nagaland state on the north, by Senapati district on the north and east, by Churchandpur district on the south and by Imphal West district and Assam state on the west. Tamenglong town is the headquarters of this district. The district occupies an area of 4391 km

Economy:

In 2006 the Ministry of Panchayati Raj named Tamenglong one of the country's 250 most backward districts (out of a total of 640). It is one of the three districts in Manipur currently receiving funds from the Backward Regions Grant Fund Programme (BRGF).

Demographics:

According to the 2011 census Tamenglong district has a population of 140,651. Roughly equal to the nation of Saint Lucia. This gives it a ranking of 607th in India (out of a total of 640). The district has a population density of 32 inhabitants per square kilometre (83/sq mi). Its population growth rate over the decade 2001-2011 was 25.69%. Tamenglong has a sex ratio of 953 females for every 1000 males, and a literacy rate of 70.4%.

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. 0.000 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. 143.245 of Tamenglong- Haflong near Haflong Town, Assam. The length of the homogenous section is 143.245 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 Tamenglong Town	Km-0+300	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	Bicycle		0.5

Moving Vehicles	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.

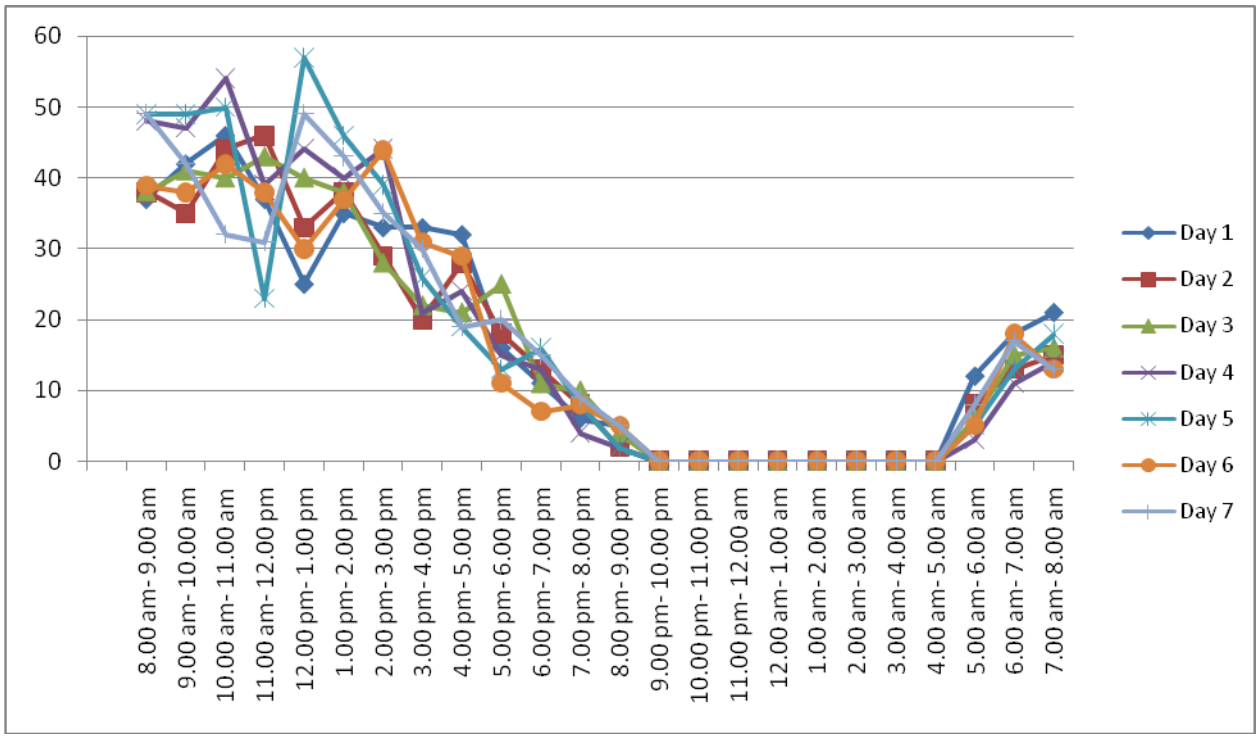


Figure 6.2: Daily and Hourly Variation at Tamenglong Town at Km 0+300

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

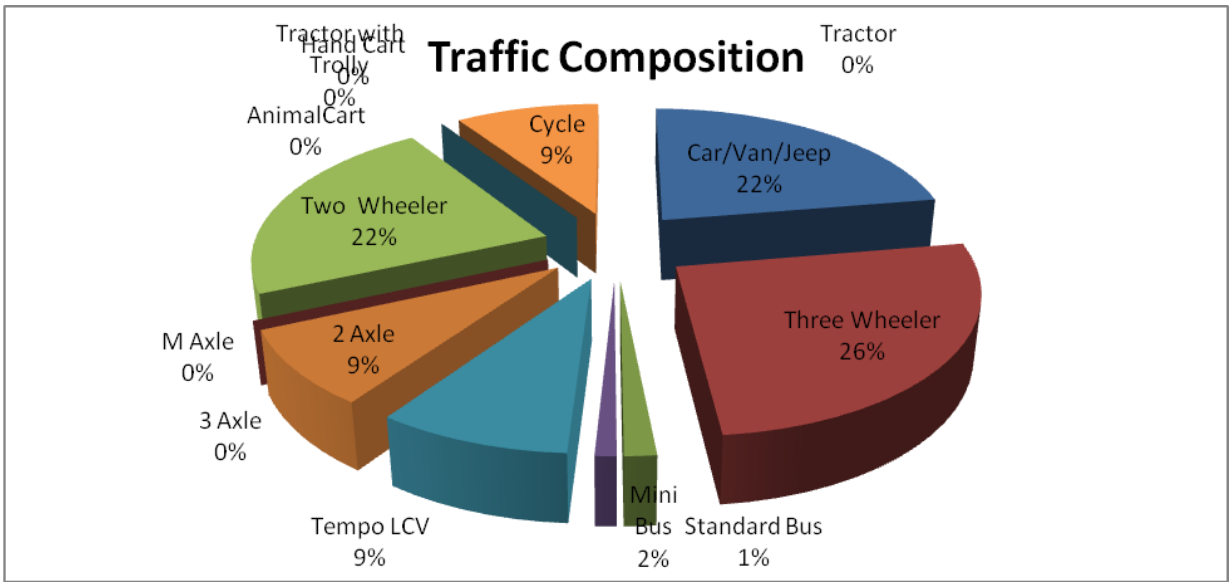


Figure 6.3: Composition of Traffic (By Volume) at Tamenglong Town at Km 0+300

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.

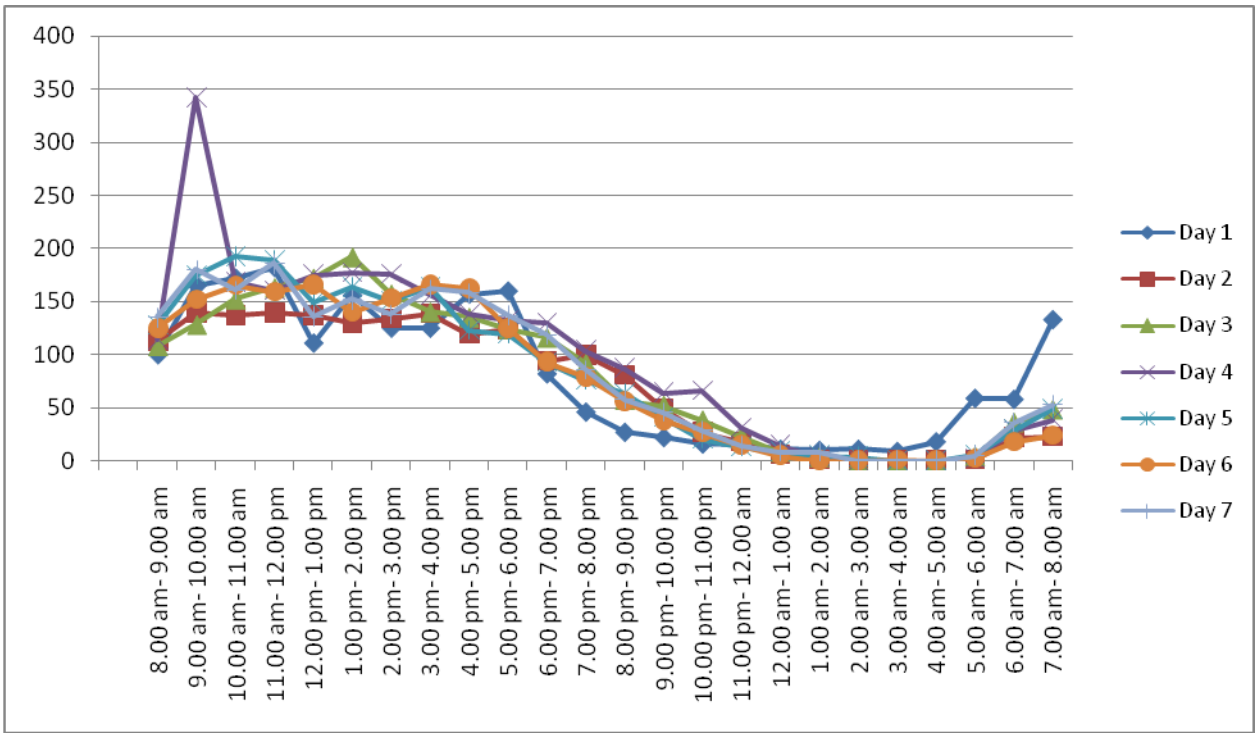


Figure 6.5: Daily and Hourly Variation at km - 136+650 near Mahur Town

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

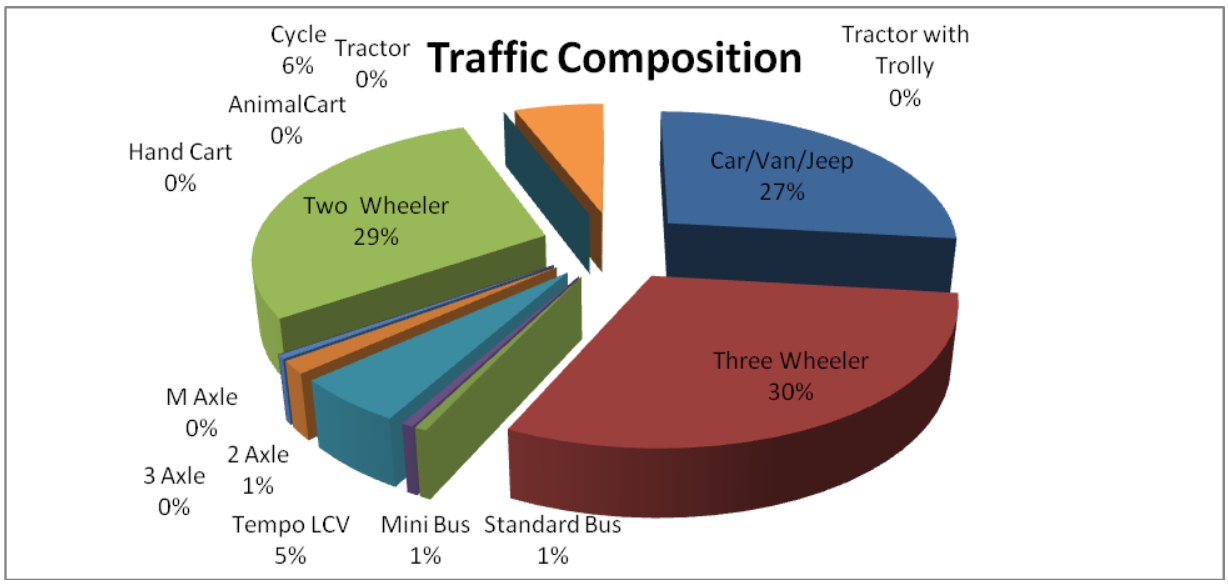


Figure 6.6: Composition of Traffic (By Volume) at km – 136+650 near Mahur Town

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-137) for the period 2016 to 2017 (1 year). The data on monthly fuel consumption at both the fuel stations are presented in Table 6.9

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.

For the present Study, Fuel sales data on the project road was collected and it was considered for analyzing SCF.

The value of SCF considered is 1.2. 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	491	11	12	101	30	10	5	660
AADT	2453	53	57	503	148	47	22	3283
% 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)	30.6	31.2	36.4	32.1	42
Haflong, Silchar	15.8	20.2	23.2	30.2	14
Lumding	18.7	24.5	25.1	22.1	14
Nagaland	14.8	9.3	9.1	8.2	18
Other Towns of Assam	15.9	10.2	4.8	6	12
Tripura	1.8	4.6	1.4	1.4	0

Meghalaya	0	0	0	0	0
Arunachal Pradesh	0	0	0	0	0
Assam	0	0	0	0	0
Other States	2.4	0	0	0	0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

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-37:2012 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 two locations.

As per IRC: 37-2012 clause 4.4.6 stated" where the sufficient information on axle loads is not available the default values of vehicles of vehicle damage factor as given in table 6.2 may be used".
As per table 6.2 for CVPD more than 1500 adopted VDF should be 2.5 for Hilly terrain.
Hence, The Adopted VDF is 2.5.

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 a 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 coast.

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 @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 AADT @growth rate 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	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		372	419	10	9	84	39	6	0	396	0	0	92	0	0	4	1431	1356
	2018	5%	391	440	11	9	88	41	6	0	416	0	0	97	0	0	4	1503	1422
	2019	5%	411	462	12	9	92	43	6	0	437	0	0	102	0	0	4	1578	1491
	2020	5%	432	485	13	9	97	45	6	0	459	0	0	107	0	0	4	1657	1563
1	2021	5%	454	509	14	9	102	47	6	0	482	0	0	112	0	0	4	1739	1638
2	2022	5%	477	534	15	9	107	49	6	0	506	0	0	118	0	0	4	1825	1716
3	2023	5%	501	561	16	9	112	51	6	0	531	0	0	124	0	0	4	1915	1798
4	2024	5%	526	589	17	9	118	54	6	0	558	0	0	130	0	0	4	2011	1887
5	2025	5%	552	618	18	9	124	57	6	0	586	0	0	137	0	0	4	2111	1979
6	2026	5%	580	649	19	9	130	60	6	0	615	0	0	144	0	0	4	2216	2075
7	2027	5%	609	681	20	9	137	63	6	0	646	0	0	151	0	0	4	2326	2176
8	2028	5%	639	715	21	9	144	66	6	0	678	0	0	159	0	0	4	2441	2281
9	2029	5%	671	751	22	9	151	69	6	0	712	0	0	167	0	0	4	2562	2391
10	2030	5%	705	789	23	9	159	72	6	0	748	0	0	175	0	0	4	2690	2508
11	2031	5%	740	828	24	9	167	76	6	0	785	0	0	184	0	0	4	2823	2630

12	2032	5%	777	869	25	9	175	80	6	0	824	0	0	193	0	0	4	2962	2758
13	2033	5%	816	912	26	9	184	84	6	0	865	0	0	203	0	0	4	3109	2892
14	2034	5%	857	958	27	9	193	88	6	0	908	0	0	213	0	0	4	3263	3033
15	2035	5%	900	1006	28	9	203	92	6	0	953	0	0	224	0	0	4	3425	3180
16	2036	5%	945	1056	29	9	213	97	6	0	1001	0	0	235	0	0	4	3595	3336
17	2037	5%	992	1109	30	9	224	102	6	0	1051	0	0	247	0	0	4	3774	3500
18	2038	5%	1042	1164	32	9	235	107	6	0	1104	0	0	259	0	0	4	3962	3672
19	2039	5%	1094	1222	34	9	247	112	6	0	1159	0	0	272	0	0	4	4159	3852
20	2040	5%	1149	1283	36	9	259	118	6	0	1217	0	0	286	0	0	4	4367	4043
21	2041	5%	1206	1347	38	9	272	124	6	0	1278	0	0	300	0	0	4	4584	4242
22	2042	5%	1266	1414	40	9	286	130	6	0	1342	0	0	315	0	0	4	4812	4451
23	2043	5%	1329	1485	42	9	300	137	6	0	1409	0	0	331	0	0	4	5052	4671
24	2044	5%	1395	1559	44	9	315	144	6	0	1479	0	0	348	0	0	4	5303	4901
25	2045	5%	1465	1637	46	9	331	151	6	0	1553	0	0	365	0	0	4	5567	5143

Table 6.15: Projection of AADT including diverted and induced traffic

		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	372	419	10	9	84	39	6	0	396	0	0	92	0	0	4	1431	1356
	2018	391	440	11	9	88	41	6	0	416	0	0	97	0	0	4	1503	1422
	2019	411	462	12	9	92	43	6	0	437	0	0	102	0	0	4	1578	1491
	2020	432	485	13	9	97	45	6	0	459	0	0	107	0	0	4	1657	1563
1	2021	1080	1213	33	50	243	113	15	0	1148	0	0	268	0	0	10	4173	3994
2	2022	1134	1274	35	53	255	119	16	0	1205	0	0	281	0	0	11	4383	4200
3	2023	1191	1338	37	56	268	125	17	0	1265	0	0	295	0	0	12	4604	4415
4	2024	1251	1405	39	59	281	131	18	0	1328	0	0	310	0	0	13	4835	4638
5	2025	1314	1475	41	62	295	138	19	0	1394	0	0	326	0	0	14	5078	4873
6	2026	1380	1549	43	65	310	145	20	0	1464	0	0	342	0	0	15	5333	5119
7	2027	1449	1626	45	68	326	152	21	0	1537	0	0	359	0	0	16	5599	5375
8	2028	1521	1707	47	71	342	160	22	0	1614	0	0	377	0	0	17	5878	5643
9	2029	1597	1792	49	75	359	168	23	0	1695	0	0	396	0	0	18	6172	5926
10	2030	1677	1882	51	79	377	176	24	0	1780	0	0	416	0	0	19	6481	6222

11	2031	1761	1976	54	83	396	185	25	0	1869	0	0	437	0	0	20	6806	6534
12	2032	1849	2075	57	87	416	194	26	0	1962	0	0	459	0	0	21	7146	6860
13	2033	1941	2179	60	91	437	204	27	0	2060	0	0	482	0	0	22	7503	7202
14	2034	2038	2288	63	96	459	214	28	0	2163	0	0	506	0	0	23	7878	7561
15	2035	2140	2402	66	101	482	225	29	0	2271	0	0	531	0	0	24	8271	7938
16	2036	2247	2522	69	106	506	236	30	0	2385	0	0	558	0	0	25	8684	8332
17	2037	2359	2648	72	111	531	248	32	0	2504	0	0	586	0	0	26	9117	8747
18	2038	2477	2780	76	117	558	260	34	0	2629	0	0	615	0	0	27	9573	9185
19	2039	2601	2919	80	123	586	273	36	0	2760	0	0	646	0	0	28	10052	9644
20	2040	2731	3065	84	129	615	287	38	0	2898	0	0	678	0	0	29	10554	10125
21	2041	2868	3218	88	135	646	301	40	0	3043	0	0	712	0	0	30	11081	10628
22	2042	3011	3379	92	142	678	316	42	0	3195	0	0	748	0	0	32	11635	11161
23	2043	3162	3548	97	149	712	332	44	0	3355	0	0	785	0	0	34	12218	11722
24	2044	3320	3725	102	156	748	349	46	0	3523	0	0	824	0	0	36	12829	12309
25	2045	3486	3911	107	164	785	366	48	0	3699	0	0	865	0	0	38	13469	12922

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 Km. 0.000 of Tamenglong- Tousem- Haflong Road on existing T – Junction with Imphal-Tamenglong Road (L/s Tamenglong, R/s Imphal) Near Tamenglong Town, Manipur and terminates on Km. 10.00 of Tamenglong- Tousem- Haflong road

6.2 TERRAIN :

The terrain along the road is mountainous/ steep. 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)*
0.000	10.000	10.000	mountainous/steep.
Total		10.000	

6.3 LAND USE:

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

Table: 6.2 Land use

S. No.	Chainage		Length	Land Use
	From	To		
1	0	10.000	10.000 km	Forest/Agriculture

6.4 CARRIAGEWAY WIDTH:

The project road is Green Field Alignment. 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	0.000	10.000	10.000	Green Field Alignment	

6.5 SURFACING TYPE:

The project road is Green Field Alignment.

6.6 SHOULDER:

The project road is Green Field Alignment.

6.7 EMBANKMENT HEIGHT:

The project road is Green Field Alignment.

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	0	10000	10000	Dialong Village
Total			10000	

6.9 ROAD JUNCTIONS:

There are 01 Major Junction & 4 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	0+000	Imphal-Tamenglong Road (L/s Tamenglong, R/s Imphali)	Y-Type	

Table 6.6: Minor Junctions

S.NO.	Chainage	TYPE of Junction (T,Y,X)	Type of Crossing (NH/SH/MDR/VR)	SIDE (LHS/RHS)	Detail of Destination of Junction
1	850	Y-Type	Village Road	RHS	To Dialong
2	1650	X-Type	Village Road	BS	LHS- Tamenglong RHS- Dialong
3	3200	X-Type	Village Road	BS	LHS- Ag Field RHS- Dialong
4	5175	X-Type	Village Road	BS	LHS- Ag Field RHS- Dialong

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 CONDITION SURVEY:

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

6.12 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

6.13 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*
0.000	10.000	10.000	Green Field		
Total		**10.00 km**			

6.14 SHOULDER CONDITION:

The project road is Green Field Alignment.

6.15 DRAINAGE CONDITION:

There are no CD structures across the project alignment. There is no road exists on Proposed Alignment. Hence, no Drain exists presently.

6.16 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.

6.17 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)
Green Field Alignment			

6.18 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.

6.18.1 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

6.18.2 Laboratory Test on Subgrade Samples

As Per test results the CBR Varies from 8-15%. So, the value of adopted CBR is 8%.

6.19 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".

6.19.1 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.

6.19.1.1 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.

6.19.1.2 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.

6.19.1.3 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.

6.19.1.4 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.

6.19.1.5 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.

6.19.1.6 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.

6.19.2 Recommendations / Findings

6.19.2.1 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.	Desing Chanage(Km)	Existing Chainage as per Survey drawng (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	115	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
2	425	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
3	565	–	–	–	–	–	New Construction	Box	1x2x2	12.00	

4	650	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
5	825	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
6	1065	–	–	–	–	–	New Construction	Box	2x4x4	16.00	MNB
7	1335	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
8	1425	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
9	1575	–	–	–	–	–	New Construction	Bow String Steel Girder	1x48	16.00	MNB
10	1725	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
11	2060	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
12	2450	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
13	2700	–	–	–	–	–	New Construction	Box	2x4x4	16.00	MNB
14	2980	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
15	3425	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
16	3735	–	–	–	–	–	New Construction	Box	2x4x4	16.00	MNB
17	4125	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
18	4325	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
19	4580	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
20	4925	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
21	5075	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
22	5350	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
23	5575	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
24	5950	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
25	6075	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
26	6250	–	–	–	–	–	New Construction	Box	1x3x3	12.00	

27	6375	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
28	6565	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
29	6780	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
30	6845	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
31	7125	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
32	7425	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
33	7550	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
34	7665	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
35	7775	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
36	7900	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
37	8010	–	–	–	–	–	New Construction	Box	1x3x3	12.00	
38	8150	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
39	8350	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
40	8650	–	–	–	–	–	New Construction	Box	2x4x4	16.00	MNB
41	9025	–	–	–	–	–	New Construction	Box	2x4x4	16.00	MNB
42	9375	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
43	9875	–	–	–	–	–	New Construction	Box	1x2x2	12.00	
44	10000	–	–	–	–	–	New Construction	Box	1x2x2	12.00	

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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 Concrete Pavement : 2.5% Earthen Shoulder : 3.5% (min)	Bituminous Concrete Pavement :2.5%	Bituminous: : 2.5% Concrete Pavement : 2.5% Earthen : 3.5% Shoulder : 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 73-2019, are as follows:

Table 8.2: Design Speed Standards

Terrain	IRC SP:73:2019
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 73-2019, 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 Hilly terrain	12 m 10 m	14m	 11m
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 73-2019 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 73-2019 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 37-2018 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: 37 - 2012 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 73-2019 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 37-2012 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 73-2019 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 73-2019 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.

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

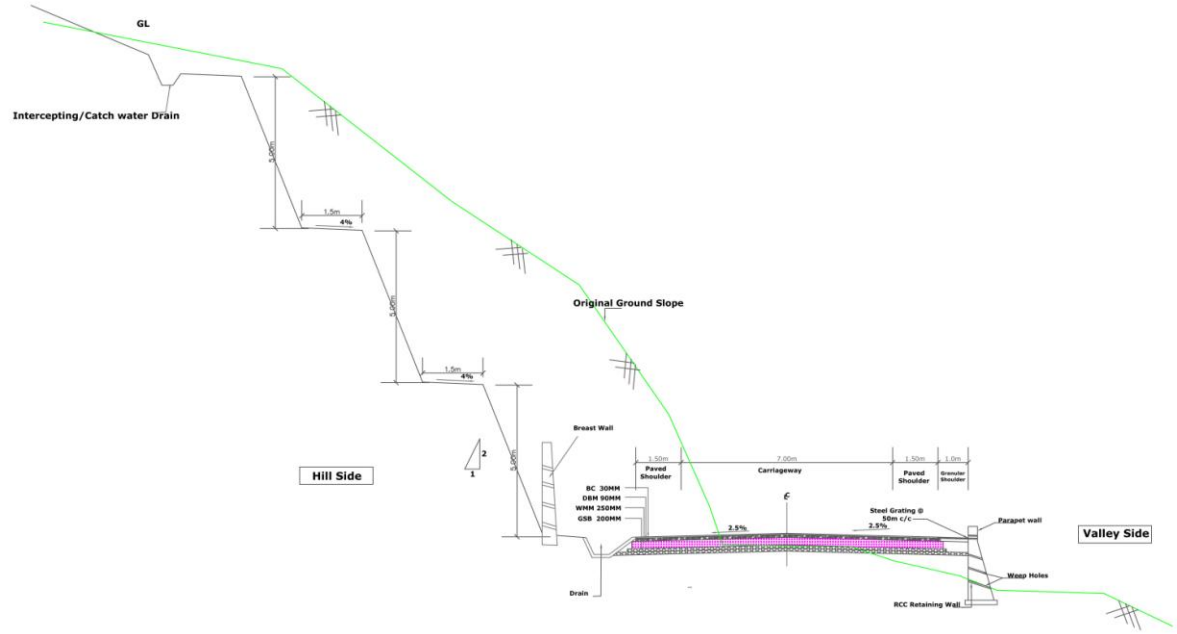

Fig - 2.8
Typical Cross Section
2- lane Carriageway WithOne Side Retaining Wall
(Open Country - Mountainous Terrain)

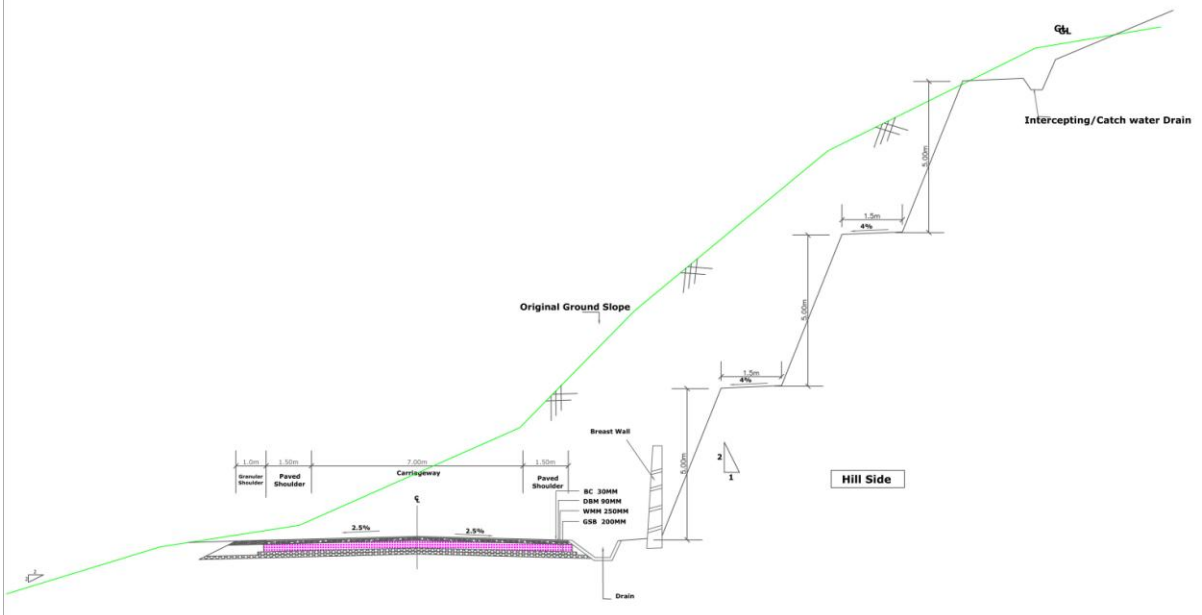

Fig - 2.9
Typical Cross Section
2- lane Carriageway Without Retaining Wall
(Open Country - Mountainous Terrain)

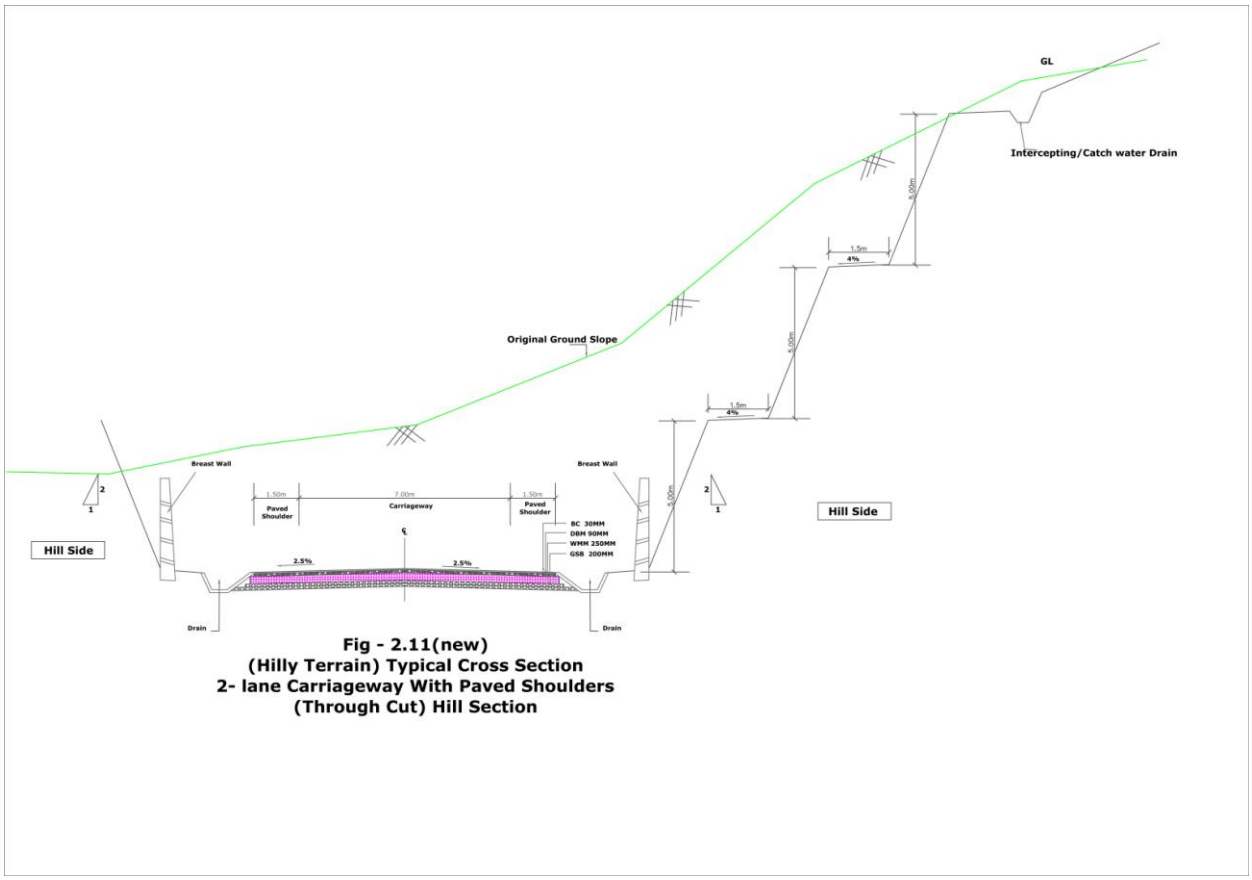

Fig - 2.11(new)
(Hilly Terrain) Typical Cross Section
2- lane Carriageway With Paved Shoulders
(Through Cut) Hill Section

8.3 Details of Retaining wall-: 0.925 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.	Existing Chainage (In km.)		Design Chainage (In km.)		Length (m)	Remarks
	From	To	From	To		
1.	-	-	1700	1750	50	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
2.	-	-	2675	2725	50	
3.	-	-	2975	3000	25	
4.	-	-	3725	3750	25	
5.	-	-	6050	6100	50	
6.	-	-	6225	6275	50	
7.	-	-	6350	6375	25	
8.	-	-	6550	6575	25	
9.	-	-	6800	7000	200	
10.	-	-	7100	7150	50	
11.			7750	7775	25	
12.			7875	8050	175	
13.			8325	8350	25	
14.			8625	8675	50	

15.			9000	9050	50	925 meter.
16.	-	-	9350	9400	50	
Total					**=925m**	

8.4 Details of Breast wall-: 2.250 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 8.1A Breast wall Details

S.No.	Des. Chainage		Length in (m)
	From	To	
1	650	1000	350
2	7500	8000	500
3	8600	10000	1400
		Total	**2250m**

8.5 Details of Gabian Structure-: 2.750 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 8.1B Gabian Structure Details

S.No.	Des. Chainage		Length in (m)
	From	To	
1	0	650	650
2	1000	2000	1000
3	6000	6600	600
4	7000	7500	500
		Total	**2750m**

8.6 Details of Seeding & Mulching-: 5.000 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 8.1C Seeding & Mulching Details

S.No.	Des. Chainage		Length in (m)
	From	To	
1	2000	6000	4000
2	6600	7000	400
3	8000	8600	600
		Total	**5000m**

8.7 Hill Side Drain & Catch Water Drain-: 10625m

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

Table 8.2 Hill Side Drain & Catch water Drain Details

S.No.	TCS Type	Des. Chainage		Side	Length in (m)
		From	To		
1	Fig 2.9	0	1700	One Side	1700

2	Fig 2.8	1700	1750	One Side	50
3	Fig 2.9	1750	2675	One Side	925
4	Fig 2.8	2675	2725	One Side	50
5	Fig 2.9	2725	2975	One Side	250
6	Fig 2.8	2975	3000	One Side	25
7	Fig 2.9	3000	3725	One Side	725
8	Fig 2.8	3725	3750	One Side	25
9	Fig 2.11(new)	3750	3950	Both Side	400
10	Fig 2.9	3950	6050	One Side	2100
11	Fig 2.8	6050	6100	One Side	50
12	Fig 2.9	6100	6225	One Side	125
13	Fig 2.8	6225	6275	One Side	50
14	Fig 2.9	6275	6350	One Side	75
15	Fig 2.8	6350	6375	One Side	25
16	Fig 2.9	6375	6550	One Side	175
17	Fig 2.8	6550	6575	One Side	25
18	Fig 2.9	6575	6800	One Side	225
19	Fig 2.8	6800	7000	One Side	200
20	Fig 2.9	7000	7100	One Side	100
21	Fig 2.8	7100	7150	One Side	50
22	Fig 2.9	7150	7750	One Side	600
23	Fig 2.8	7750	7775	One Side	25
24	Fig 2.9	7775	7875	One Side	100
25	Fig 2.8	7875	8050	One Side	175
26	Fig 2.9	8050	8325	One Side	275
27	Fig 2.8	8325	8350	One Side	25
28	Fig 2.9	8350	8625	One Side	275
29	Fig 2.8	8625	8675	One Side	50
30	Fig 2.11(new)	8675	8800	Both Side	250
31	Fig 2.9	8800	9000	One Side	200
32	Fig 2.8	9000	9050	One Side	50
33	Fig 2.11(new)	9050	9150	Both Side	200
34	Fig 2.9	9150	9350	One Side	200
35	Fig 2.8	9350	9400	One Side	50
36	Fig 2.9	9400	9650	One Side	250
37	Fig 2.11(new)	9650	9850	Both Side	400
38	Fig 2.9	9850	10000	One Side	150
			Total		**10625m**

8.8 Metal Beam Crash Barriers

Table 8.4 Crash Barriers Details

Sl. No.	Location stretch		Length in (m)
	From	To	
1	0	1700	1700

2	1700	1750	50
3	1750	2675	925
4	2675	2725	50
5	2725	2975	250
6	2975	3000	25
7	3000	3725	725
8	3725	3750	25
9	3950	6050	2100
10	6050	6100	50
11	6100	6225	125
12	6225	6275	50
13	6275	6350	75
14	6350	6375	25
15	6375	6550	175
16	6550	6575	25
17	6575	6800	225
18	6800	7000	200
19	7000	7100	100
20	7100	7150	50
21	7150	7750	600
22	7750	7775	25
23	7775	7875	100
24	7875	8050	175
25	8050	8325	275
26	8325	8350	25
27	8350	8625	275
28	8625	8675	50
29	8800	9000	200
30	9000	9050	50
31	9150	9350	200
32	9350	9400	50
33	9400	9650	250
34	9850	10000	150
Total			**9375m**

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	=	45.00 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	=	45 m-60m	-

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 (m)	Remark
	From	To		
1.	0	10000	10000	-
Total			**10000m**	

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	925
2	Fig 2.9	8450
3	Fig 2.11(new)	625
	Total	**10000m**

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.	1700	1750	50	Fig 2.8
2.	2675	2725	50	Fig 2.8
3.	2975	3000	25	Fig 2.8
4.	3725	3750	25	Fig 2.8
5.	6050	6100	50	Fig 2.8
6.	6225	6275	50	Fig 2.8
7.	6350	6375	25	Fig 2.8
8.	6550	6575	25	Fig 2.8
9.	6800	7000	200	Fig 2.8
10.	7100	7150	50	Fig 2.8
11.	7750	7775	25	Fig 2.8
12.	7875	8050	175	Fig 2.8
13.	8325	8350	25	Fig 2.8
14.	8625	8675	50	Fig 2.8
15.	9000	9050	50	Fig 2.8
16.	9350	9400	50	Fig 2.8
Total			**925m**	

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	0	1700	1700	Fig 2.9
2	1750	2675	925	Fig 2.9
3	2725	2975	250	Fig 2.9
4	3000	3725	725	Fig 2.9
5	3950	6050	2100	Fig 2.9
6	6100	6225	125	Fig 2.9
7	6275	6350	75	Fig 2.9
8	6375	6550	175	Fig 2.9
9	6575	6800	225	Fig 2.9
10	7000	7100	100	Fig 2.9
11	7150	7750	600	Fig 2.9
12	7775	7875	100	Fig 2.9
13	8050	8325	275	Fig 2.9

14	8350	8625	275	Fig 2.9
15	8800	9000	200	Fig 2.9
16	9150	9350	200	Fig 2.9
17	9400	9650	250	Fig 2.9
18	9850	10000	150	Fig 2.9
Total			**8450m**	

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	3750	3950	200	Fig 2.11(new)
2	8675	8800	125	Fig 2.11(new)
3	9050	9150	100	Fig 2.11(new)
4	9650	9850	200	Fig 2.11(new)
Total			**625m**	

8.13 Geometric Improvement/ Realignment

As the project Stretch is a green Field alignment. No Geometric Improvement & Realignment has been done.

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	0	10000	Mountaneous/Steep

8.15 Horizontal Curve details

Table 8.13 Horizontal Curve Details

S.NO.	Type	Start Station	End Station	Length	Radius
1	Line	00.000m	46.856m	46.856m	
2	Spiral-Curve-Spiral	46.856m	71.856m	25.000m	
2	Spiral-Curve-Spiral	71.856m	107.336m	35.480m	75.000m
2	Spiral-Curve-Spiral	107.336m	132.336m	25.000m	
3	Line	132.336m	316.845m	184.509m	
4	Spiral-Curve-Spiral	316.845m	361.845m	45.000m	
4	Spiral-Curve-Spiral	361.845m	413.730m	51.885m	90.000m
4	Spiral-Curve-Spiral	413.730m	458.730m	45.000m	
5	Line	458.730m	572.165m	113.435m	

6	Spiral-Curve-Spiral	572.165m	592.165m	20.000m	
6	Spiral-Curve-Spiral	592.165m	731.449m	139.284m	500.000m
6	Spiral-Curve-Spiral	731.449m	751.449m	20.000m	
7	Line	751.449m	826.114m	74.665m	
8	Spiral-Curve-Spiral	826.114m	856.114m	30.000m	
8	Spiral-Curve-Spiral	856.114m	938.760m	82.646m	300.000m
8	Spiral-Curve-Spiral	938.760m	968.760m	30.000m	
9	Line	968.760m	1009.142m	40.382m	
10	Spiral-Curve-Spiral	1009.142m	1024.142m	15.000m	
10	Spiral-Curve-Spiral	1024.142m	1076.560m	52.418m	300.000m
10	Spiral-Curve-Spiral	1076.560m	1091.560m	15.000m	
11	Line	1091.560m	1183.974m	92.414m	
12	Spiral-Curve-Spiral	1183.974m	1198.974m	15.000m	
12	Spiral-Curve-Spiral	1198.974m	1324.117m	125.143m	400.000m
12	Spiral-Curve-Spiral	1324.117m	1339.117m	15.000m	
13	Line	1339.117m	1494.752m	155.636m	
14	Spiral-Curve-Spiral	1494.752m	1524.752m	30.000m	
14	Spiral-Curve-Spiral	1524.752m	1723.228m	198.475m	150.000m
14	Spiral-Curve-Spiral	1723.228m	1753.228m	30.000m	
15	Line	1753.228m	1790.675m	37.448m	
16	Spiral-Curve-Spiral	1790.675m	1820.675m	30.000m	
16	Spiral-Curve-Spiral	1820.675m	1879.605m	58.929m	200.000m
16	Spiral-Curve-Spiral	1879.605m	1909.605m	30.000m	
17	Line	1909.605m	1965.290m	55.685m	
18	Spiral-Curve-Spiral	1965.290m	1995.290m	30.000m	
18	Spiral-Curve-Spiral	1995.290m	2114.757m	119.467m	150.000m
18	Spiral-Curve-Spiral	2114.757m	2144.757m	30.000m	
19	Line	2144.757m	2236.765m	92.008m	
20	Spiral-Curve-Spiral	2236.765m	2266.765m	30.000m	
20	Spiral-Curve-Spiral	2266.765m	2298.082m	31.318m	150.000m
20	Spiral-Curve-Spiral	2298.082m	2328.082m	30.000m	
21	Line	2328.082m	2557.450m	229.368m	
22	Spiral-Curve-Spiral	2557.450m	2587.450m	30.000m	
22	Spiral-Curve-Spiral	2587.450m	2594.269m	6.819m	150.000m
22	Spiral-Curve-Spiral	2594.269m	2624.269m	30.000m	
23	Line	2624.269m	2648.261m	23.992m	
24	Spiral-Curve-Spiral	2648.261m	2678.261m	30.000m	
24	Spiral-Curve-Spiral	2678.261m	2724.546m	46.285m	70.000m
24	Spiral-Curve-Spiral	2724.546m	2754.546m	30.000m	
25	Line	2754.546m	2756.774m	2.228m	
26	Spiral-Curve-Spiral	2756.774m	2781.774m	25.000m	
26	Spiral-Curve-Spiral	2781.774m	2853.083m	71.309m	120.000m
26	Spiral-Curve-Spiral	2853.083m	2878.083m	25.000m	
27	Line	2878.083m	3158.074m	279.991m	
28	Spiral-Curve-Spiral	3158.074m	3168.074m	10.000m	

28	Spiral-Curve-Spiral	3168.074m	3188.623m	20.549m	500.000m
28	Spiral-Curve-Spiral	3188.623m	3198.623m	10.000m	
29	Line	3198.623m	3301.291m	102.667m	
30	Spiral-Curve-Spiral	3301.291m	3331.291m	30.000m	
30	Spiral-Curve-Spiral	3331.291m	3518.911m	187.620m	500.000m
30	Spiral-Curve-Spiral	3518.911m	3548.911m	30.000m	
31	Line	3548.911m	3723.950m	175.040m	
32	Spiral-Curve-Spiral	3723.950m	3753.950m	30.000m	
32	Spiral-Curve-Spiral	3753.950m	3829.434m	75.484m	150.000m
32	Spiral-Curve-Spiral	3829.434m	3859.434m	30.000m	
33	Line	3859.434m	3900.051m	40.617m	
34	Spiral-Curve-Spiral	3900.051m	3930.051m	30.000m	
34	Spiral-Curve-Spiral	3930.051m	4004.415m	74.365m	75.000m
34	Spiral-Curve-Spiral	4004.415m	4034.415m	30.000m	
35	Line	4034.415m	4218.194m	183.778m	
36	Spiral-Curve-Spiral	4218.194m	4248.194m	30.000m	
36	Spiral-Curve-Spiral	4248.194m	4266.652m	18.458m	250.000m
36	Spiral-Curve-Spiral	4266.652m	4296.652m	30.000m	
37	Line	4296.652m	4506.969m	210.318m	
38	Spiral-Curve-Spiral	4506.969m	4551.969m	45.000m	
38	Spiral-Curve-Spiral	4551.969m	4555.598m	3.628m	150.000m
38	Spiral-Curve-Spiral	4555.598m	4600.598m	45.000m	
39	Line	4600.598m	5004.246m	403.648m	
40	Spiral-Curve-Spiral	5004.246m	5034.246m	30.000m	
40	Spiral-Curve-Spiral	5034.246m	5077.984m	43.738m	150.000m
40	Spiral-Curve-Spiral	5077.984m	5107.984m	30.000m	
41	Line	5107.984m	5199.543m	91.559m	
42	Spiral-Curve-Spiral	5199.543m	5229.543m	30.000m	
42	Spiral-Curve-Spiral	5229.543m	5351.375m	121.832m	150.000m
42	Spiral-Curve-Spiral	5351.375m	5381.375m	30.000m	
43	Line	5381.375m	5424.518m	43.143m	
44	Spiral-Curve-Spiral	5424.518m	5454.518m	30.000m	
44	Spiral-Curve-Spiral	5454.518m	5503.097m	48.579m	75.000m
44	Spiral-Curve-Spiral	5503.097m	5533.097m	30.000m	
45	Line	5533.097m	5956.373m	423.276m	
46	Spiral-Curve-Spiral	5956.373m	5986.373m	30.000m	
46	Spiral-Curve-Spiral	5986.373m	6010.831m	24.458m	75.000m
46	Spiral-Curve-Spiral	6010.831m	6040.831m	30.000m	
47	Line	6040.831m	6311.097m	270.265m	
48	Spiral-Curve-Spiral	6311.097m	6341.097m	30.000m	
48	Spiral-Curve-Spiral	6341.097m	6361.109m	20.012m	150.000m
48	Spiral-Curve-Spiral	6361.109m	6391.109m	30.000m	
49	Line	6391.109m	6577.235m	186.127m	
50	Spiral-Curve-Spiral	6577.235m	6607.235m	30.000m	
50	Spiral-Curve-Spiral	6607.235m	6628.644m	21.409m	150.000m

50	Spiral-Curve-Spiral	6628.644m	6658.644m	30.000m	
51	Line	6658.644m	6692.839m	34.195m	
52	Spiral-Curve-Spiral	6692.839m	6722.839m	30.000m	
52	Spiral-Curve-Spiral	6722.839m	6730.039m	7.200m	75.000m
52	Spiral-Curve-Spiral	6730.039m	6760.039m	30.000m	
53	Line	6760.039m	6818.498m	58.459m	
54	Spiral-Curve-Spiral	6818.498m	6843.498m	25.000m	
54	Spiral-Curve-Spiral	6843.498m	6854.457m	10.960m	75.000m
54	Spiral-Curve-Spiral	6854.457m	6879.457m	25.000m	
55	Line	6879.457m	6926.441m	46.983m	
56	Spiral-Curve-Spiral	6926.441m	6936.441m	10.000m	
56	Spiral-Curve-Spiral	6936.441m	7014.080m	77.640m	30.000m
56	Spiral-Curve-Spiral	7014.080m	7024.080m	10.000m	
57	Line	7024.080m	7074.181m	50.101m	
58	Spiral-Curve-Spiral	7074.181m	7094.181m	20.000m	
58	Spiral-Curve-Spiral	7094.181m	7148.633m	54.452m	75.000m
58	Spiral-Curve-Spiral	7148.633m	7168.633m	20.000m	
59	Line	7168.633m	7170.434m	1.801m	
60	Spiral-Curve-Spiral	7170.434m	7200.434m	30.000m	
60	Spiral-Curve-Spiral	7200.434m	7245.491m	45.057m	75.000m
60	Spiral-Curve-Spiral	7245.491m	7275.491m	30.000m	
61	Line	7275.491m	7393.058m	117.567m	
62	Spiral-Curve-Spiral	7393.058m	7423.058m	30.000m	
62	Spiral-Curve-Spiral	7423.058m	7639.909m	216.851m	300.000m
62	Spiral-Curve-Spiral	7639.909m	7669.909m	30.000m	
63	Line	7669.909m	7875.495m	205.586m	
64	Spiral-Curve-Spiral	7875.495m	7905.495m	30.000m	
64	Spiral-Curve-Spiral	7905.495m	7925.706m	20.211m	75.000m
64	Spiral-Curve-Spiral	7925.706m	7955.706m	30.000m	
65	Line	7955.706m	7982.977m	27.271m	
66	Spiral-Curve-Spiral	7982.977m	8012.977m	30.000m	
66	Spiral-Curve-Spiral	8012.977m	8061.100m	48.123m	30.000m
66	Spiral-Curve-Spiral	8061.100m	8091.100m	30.000m	
67	Line	8091.100m	8158.057m	66.956m	
68	Spiral-Curve-Spiral	8158.057m	8188.057m	30.000m	
68	Spiral-Curve-Spiral	8188.057m	8209.247m	21.191m	150.000m
68	Spiral-Curve-Spiral	8209.247m	8239.247m	30.000m	
69	Line	8239.247m	8249.635m	10.388m	
70	Spiral-Curve-Spiral	8249.635m	8279.635m	30.000m	
70	Spiral-Curve-Spiral	8279.635m	8364.673m	85.038m	150.000m
70	Spiral-Curve-Spiral	8364.673m	8394.673m	30.000m	
71	Line	8394.673m	8422.517m	27.844m	
72	Spiral-Curve-Spiral	8422.517m	8452.517m	30.000m	
72	Spiral-Curve-Spiral	8452.517m	8512.171m	59.654m	75.000m
72	Spiral-Curve-Spiral	8512.171m	8542.171m	30.000m	

73	Line	8542.171m	8624.505m	82.334m	
74	Spiral-Curve-Spiral	8624.505m	8654.505m	30.000m	
74	Spiral-Curve-Spiral	8654.505m	8737.643m	83.138m	75.000m
74	Spiral-Curve-Spiral	8737.643m	8767.643m	30.000m	
75	Line	8767.643m	8901.561m	133.918m	
76	Spiral-Curve-Spiral	8901.561m	8931.561m	30.000m	
76	Spiral-Curve-Spiral	8931.561m	8944.265m	12.703m	75.000m
76	Spiral-Curve-Spiral	8944.265m	8974.265m	30.000m	
77	Line	8974.265m	9036.550m	62.286m	
78	Spiral-Curve-Spiral	9036.550m	9066.550m	30.000m	
78	Spiral-Curve-Spiral	9066.550m	9136.190m	69.640m	75.000m
78	Spiral-Curve-Spiral	9136.190m	9166.190m	30.000m	
79	Line	9166.190m	9251.769m	85.579m	
80	Spiral-Curve-Spiral	9251.769m	9281.769m	30.000m	
80	Spiral-Curve-Spiral	9281.769m	9310.362m	28.593m	75.000m
80	Spiral-Curve-Spiral	9310.362m	9340.362m	30.000m	
81	Line	9340.362m	9444.192m	103.830m	
82	Spiral-Curve-Spiral	9444.192m	9474.192m	30.000m	
82	Spiral-Curve-Spiral	9474.192m	9516.832m	42.640m	150.000m
82	Spiral-Curve-Spiral	9516.832m	9546.832m	30.000m	
83	Line	9546.832m	9681.150m	134.319m	
84	Spiral-Curve-Spiral	9681.150m	9711.150m	30.000m	
84	Spiral-Curve-Spiral	9711.150m	9843.651m	132.500m	75.000m
84	Spiral-Curve-Spiral	9843.651m	9873.651m	30.000m	
85	Line	9873.651m	10000.00m	126.349m	

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

S.NO.	Type	Start Station	End Station	Length	Radius
1	Spiral-Curve-Spiral	2678.261m	2724.546m	46.285m	70.000m
2	Spiral-Curve-Spiral	6936.441m	7014.080m	77.640m	30.000m
3	Spiral-Curve-Spiral	8012.977m	8061.100m	48.123m	30.000m

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	0+000	0+000	Imphal- Tamenglong Road (LHS-TAMENGLONG RHS- IMPHAL)	Y-Type	**Major**

8.19 Minor Junctions:

There are a number of intersections along the project corridor with various categories of roads. There is approx. 4 Nos. of minor junction in our project road. Details are given below.

Table 8.16: List of Minor Junctions

S.No	Design Chainage	Survey Chainage	TYPE of Junction (T,Y,X)	Detail of Destination of Junction
1	0+850	-	Y-Type	To Dialong
2	1+650	-	X-Type	LHS- Tamenglong RHS- Dialong
3	3+200	-	X-Type	LHS- Ag Field RHS- Dialong
4	5+175	-	X-Type	LHS- Ag Field RHS- Dialong

8.20 Bus Bay & Bus Shelter:

As per provisions total Nos. 1 Bus Bay & bus shelter provided along the Project Corridor.

Table 9.17: List of Bus Bay & Bus Shelter

S. No.	Design Chainage	Location	Project Facility	Other essential details
1.	3100-3200	Dailong Village	Bus Bay & Bus Shelter	-

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 – 00

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 – 6no.

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		
					Total (m)	Recommendation	Type	Span
1	1065	_	_	_	_	New Construction	Box	2x4x4
2	1575	_	_	_	_	New Construction	Steel Girder	1x48
3	2700	_	_	_	_	New Construction	Box	2x4x4
4	3735	_	_	_	_	New Construction	Box	2x4x4
5	8650	_	_	_	_	New Construction	Box	2x4x4
6	9025	_	_	_	_	New Construction	Box	2x4x4

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 – 0 nos.

Table 8.20: Reconstruction Culverts Details

S.No	Desing Chainage	Existing Chainage	Existing	Proposed		
			Structure Type	Structure	Span/Dia. Of Pipe (m)	Proposed width
NIL						

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** –38 Nos.

Table 8.23: Box Culverts Details (New Construction)

S.No.	Location (Design Chainage)	Dia. Of Pipe/Span Length (m)	Width of Culvert (m)
1.	115	1x3x3	12.00
2.	425	1x2x2	12.00
3.	565	1x2x2	12.00
4.	650	1x3x3	12.00

5.	825	1x2x2	12.00
6.	1335	1x3x3	12.00
7.	1425	1x3x3	12.00
8.	1725	1x3x3	12.00
9.	2060	1x3x3	12.00
10.	2450	1x3x3	12.00
11.	2980	1x3x3	12.00
12.	3425	1x3x3	12.00
13.	4125	1x2x2	12.00
14.	4325	1x2x2	12.00
15.	4580	1x2x2	12.00
16.	4925	1x2x2	12.00
17.	5075	1x2x2	12.00
18.	5350	1x2x2	12.00
19.	5575	1x2x2	12.00
20.	5950	1x2x2	12.00
21.	6075	1x3x3	12.00
22.	6250	1x3x3	12.00
23.	6375	1x3x3	12.00
24.	6565	1x3x3	12.00
25.	6780	1x3x3	12.00
26.	6845	1x3x3	12.00
27.	7125	1x3x3	12.00
28.	7425	1x3x3	12.00
29.	7550	1x3x3	12.00
30.	7665	1x3x3	12.00
31.	7775	1x3x3	12.00
32.	7900	1x3x3	12.00
33.	8010	1x3x3	12.00
34.	8150	1x2x2	12.00
35.	8350	1x2x2	12.00
36.	9375	1x2x2	12.00
37.	9875	1x2x2	12.00
38.	10000	1x2x2	12.00

Table 8.24: Summary of Culvert Proposal

Reconstruction	**0**
New construction (Box Culverts)	**38**

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. Total design length of the project is 124.468km.

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 Near Haflong 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 Manipur**

The climate of Manipur is largely influenced by the topography of this hilly region. Lying 790 meters above sea level, Manipur is wedged among hills on all sides. This northeastern corner of India enjoys a generally amiable climate, though the winters can be a chilly. The maximum temperature in the summer months is 32 °C (90 °F). In winter the temperature often falls below 0 °C (32 °F), bringing frost. Snow sometimes falls in hilly regions due to the Western Disturbance.[citation needed] The coldest month is January, and the warmest July .

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. The normal rainfall of Manipur enriches the soil and helps in agriculture and irrigation. 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).

- **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 Manipur**

The word Manipur literally means a 'jeweled town', a name that rightly justifies the small and picturesque land. The people here are very polite and hospitable. Rich in its culture, tradition, and ethnicity, Manipur is one of the seven northeastern states of India. The Raasleelas and the classical dance of Manipur hold a very significant position in the cultural map of India. With sites like the Loktak Lake and the Khonghampat Orchidarium, Manipur is also famous for its natural beauty. Manipur has a lot to offer to the tourists visiting this state. Some of the places worth visiting are the Shree Govindajee Temple (a

pilgrimage as well as historic center of the Vaishnavite), Kaina (a sacred place of Hindus), Khwairamand Bazaar (a market place run by women), Manipur Zoological Garden (renowned for the rare sangai deer), apart from the beautiful Loktak Lake and Sendra Island. Besides, Langthabal (historic sites), Moirang, Moreh, Phubala, Singda, Khongjom, Sahid Mandir, Khonghampat Orchidarium, Keibul Lamjao National Park, Sekta Archeological Living Museum, and the Manipur State Museum are surely worth a visit.

- **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 NH – 44A

Road Sectior **Tamenglong-Tousem-Laisong-Haflong Road, Distt. Tamenglong & Dima Hasao in the State of Assam & Manipur – 127.403 km**

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.

X		should be categorized as an A project.
		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 'A'

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.**

Manipur State Information

Geography :

The state lies at a latitude of 23°83'N – 25°68'N and a longitude of 93°03'E – 94°78'E. The total area covered by the state is 22,347 square kilometres (8,628 sq mi). The capital lies in an oval-shaped valley of approximately 700 square miles (2,000 km2) surrounded by blue mountains and is at an elevation of 790 metres (2,590 ft) above sea level.[41] The slope of the valley is from north to south. The mountain ranges create a moderated climate, preventing the cold winds from the north from reaching the valley and barring

cyclonic storms originating from the Bay of Bengal.

The state is bordered by the Indian states of Nagaland to its north, Mizoram to its south, Assam to its west, and shares international border with Myanmar to its east.

The state has four major river basins: the Barak River Basin (Barak Valley) to the west, the Manipur River Basin in central Manipur, the Yu River Basin in the east, and a portion of the Lanye River Basin in the north.The water resources of Barak and Manipur river basins are about 1.8487 Mham. The overall water balance of the state amounts to 0.7236 Mham in the annual water budget.(By comparison, India receives 400 Mham (million hectare meters) of rain annually.

The Barak River, the largest of Manipur, originates in the Manipur Hills and is joined by tributaries, such as the Irang, Maku, and Tuivai. After its junction with the Tuivai, the Barak River turns north, forms the border with Assam State, and then enters the Cachar Assam just above Lakhipur. The Manipur river basin has eight major rivers: the Manipur, Imphal, Iril, Nambul, Sekmai, Chakpi, Thoubal and Khuga. All these rivers originate from the surrounding hills.

Almost all the rivers in the valley area are in the mature stage and therefore deposit their sediment load in the Loktak lake. The rivers draining the Manipur Hills are comparatively young, due to the hilly terrain through which they flow. These rivers are corrosive and assume turbulent form in the rainy season. Important rivers draining the western area include the Maku, Barak, Jiri, Irang and Leimatak. Rivers draining the eastern part of the state, the Yu River Basin, include the Chamu, Khunou and other short streams.

Manipur may be characterised as two distinct physical regions: an outlying area of rugged hills and narrow valleys, and the inner area of flat plain, with all associated land forms. These two areas are distinct in physical features and are conspicuous in flora and fauna. The valley region has hills and mounds rising above the flat surface. The Loktak lake is an important feature of the central plain. The total area occupied by all the lakes is about 600 km2. The altitude ranges from 40 m at Jiribam to 2,994 m at Mt. Iso(Tempü) Peak near Mao Songsong.

The soil cover can be divided into two broad types, viz. the red ferruginous soil in the hill area and the alluvium in the valley. The valley soils generally contain loam, small rock fragments, sand and sandy clay, and are varied. On the plains, especially flood plains and deltas, the soil is quite thick. The top soil on the steep slopes is very thin. Soil on the steep hill slopes is subject to high erosion, resulting in gullies and barren rock slopes. The normal pH value ranges from 5.4 to 6.8.

Economy:

The 2012–2013 gross state domestic product of Manipur at market prices was about ₹ 10,188 crore (US$1.6 billion). Its economy is primarily agriculture, forestry, cottage and trade driven. Manipur acts as India's "Gateway to the East" through Moreh and Tamu towns, the land route for trade between India and Burma and other Southeast Asian countries. Manipur has the highest number of handicrafts units and the highest number of craftspersons in the northeastern region of India.

Demographis:

Manipur has a population of 2,855,794 as per 2011 census. Of this total, 58.9% live in the valley and the remaining 41.1% in the hilly regions. The hills are inhabited mainly by the Kuki, and Naga, and Smaller tribal communities and the valley(plains) mainly by the Meiteis, Manipuri Brahmins(Bamons) and Pangal (Manipuri Muslims). Bishnupriya Manipuri, Naga and Kuki settlements are also found in the valley region, though less in numbers.

The Meitei (synonymous to Manipuri) constitute the majority of the state's population. According to 1891 census Meitei were recorded as a forest tribe. In 1901, the Meitei were recorded as the main ethnicity of Manipur. They live primarily in the state's valley region. The Meitei are not recognized as a scheduled tribe in the Indian constitution.

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, will cerate 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 Tamenglong-Tousem-Laisong-Haflong Section to two lane with paved shoulder**

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

11.1 ENVIRONMENTAL CLEARANCE

As per MOEF guideline presently, Project Road does not require environmental clearance. The reasons are as follows-:

a) Present category of road is Major District Road.

11.2 FOREST CLEARANCE

As per confirmation with the forest department, road traverse through forest land. Hence, Forest clearance will be required **From Km 0+000 to Km 10+000 Tamenglong- Dialong Section (Pkg-1)** of Tamenglong-Tousem-Laisong-Haflong Road in the state of **Manipur**.

11.3 WILD LIFE CLEARANCE

As per confirmation from forest department, No Wildlife Clearance will be required **From Km 0+000 to Km 10+000 Tamenglong- Dialong (Pkg-1)** of Tamenglong-Tousem-Laisong-Haflong Road in the state of **Manipur**.

11.4 ECO-SENSITIVE ZONE CLEARANCE

As per confirmation from forest department, No Eco-sensitive zone Clearance will be required **From Km 0+000 to Km 10+000 Tamenglong- Dialong Section (Pkg-1)** of Tamenglong-Tousem-Laisong-Haflong Road in the state of **Manipur**.

Chapter-12: COST ESTIMATE

12.1 General

This chapter provides a cost estimate **From Km 0+000 to Km 10+000 Tamenglong-Dialong Section (Pkg-1)** of Tamenglong-Tousem-Laisong-Haflong Road in the state of **Manipur**. 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, Manipur (Revision-2018).

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	0.625	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	0.925	TCS-2.8
3	Reconstruction in Two-Lane Carriageway with Paved Shoulder in Hilly Terrain without retaining wall	8.450	TCS-2.9
	Total	**10.000 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 2.11(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.

12.5 Project Cost

The summary of cost estimate is presented as below:

General Abstract of Cost
Total Length 10 Kms

S. No.	Item	Total Cost in Crores
A	***ROAD WORKS***	
1	*SITE CLEARANCE*	0.07
2	*EARTHWORK*	47.14
3	*GRANULAR SUB-BASE*	6.38
4	*NON BITUMINOUS BASE-COURSE*	7.75
5	*BITUMINOUS BASE-COURSE*	10.37
6	*WEARING COAT*	3.83
	SUB TOTAL (A)	**75.55**
B	***CROSS DRAINAGE STRUCTURES***	
7	*Reconstruction/ New Construction of Culverts*	16.71
8	*Reconstruction/ New Construction of Minor bridges*	12.84
9	*Reconstruction/ New Construction of Major bridges*	-
	SUB TOTAL OF CROSS DRAINAGE STRUCTURES (B)	**29.55**
C	***OTHER ITEMS***	
10	*Traffic Signs, marking and Appurtenances*	2.09
11	*Project Facilities*	0.03
12	*Drainage Works*	3.21
13	*Protection Works*	28.22
	SUB TOTAL OF OTHER ITEMS (C)	**33.54**
D	***Total (D= A+B+C)***	**138.64**
E	*Add Price Escalation @ 5% per annum for 2 Years (2018-20) i.e. 10.05% on D (E)*	14.21
F	***Total Civil Construction Cost (F=D+E)***	**152.85**
	Cost Per Km	**15.28**
G	***Pre Construction Activities***	
	Add Cost of Utility Shifting (Approx)	0.00
	Cost of Land Acquisition(Approx)	0.00

	Add Cost of Forest Clearance (Approx)	10.00
	Total of Pre Construction Activities (G)	**10.00**
H	***GST/Contigencies and Centages***	
	GST @ 12% of F if the SOR does not include any component of VAT/GST	18.34
	Contigencies @ 2.8% of F above	4.28
	Agency Charges @ 3% of F above	4.59
	Supervision charges @ 3% of F above	4.59
	Price Escalation @ 5% of 'F' above as per phasing of the project execution only for the period beyond 1 year of the Bid submission date	7.64
	Maintenance during construction/Defect Liability Period (Calculate as per the rate prescribed in the latest Document on EPC Contract	3.82
	Total of GST/Contigencies and Centages (H)	**43.26**
Total Project Cost (F+G+H)		**206.10**
Cost per Km.		**20.61**

CHAPTER – 13 CONCLUSION & RECOMMENDATION

13.1 General

National Highways and Infrastructure Development Corporation Limited, has decided to take up up-gradation & rehabilitation of Tamenglong-Tousem-Laisong-Haflong Road in the Assam/Manipur 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 30 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 with Tamenglong-Dialong-Old tamenglong Section of Tamenglong-Haflong 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

Contents	Items	Provisions
		points. Conflict points will be addressed by providing 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 40km/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 18 months period with strategic planning and through one construction package. The construction work may begin from Jan,2021.
- 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 **206.10** Crores.,
- The Project is to be developed on EPC Mode. Schedules of Concession Agreement (EPC) are presented in Vol-VII.

ANNEXURES TO

MAIN REPORT

1. Road Inventory & Condition Survey

DETAIL ROAD INVENTORY & CONDITION SURVEY

Project road: Tamanglong-Dialong Section
Section:- From Km 0+000 to 10+000
District: Tamenglong
State: Manipur

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	0.000	10000.000	Green Field Alignment														0+000	Y	LHS-Tamenglong,RHS-Imphal	NH

2. Terrain Details

Terrain Details

Project road: Tamanglong-Dialong Section

Section:- From Km 0+000 to 10+000

District: Tamenglong

State: Manipur

S. No.	Existing Chainage		Length (in m)	Terrain
	From	To		
1	0	10000	10000	Hilly
Total Length (in m)			10000	

Land Use Pattern

Project road: Tamanglong-Dialong Section

Section:- From Km 0+000 to 10+000

District: Tamenglong

State: Manipur

S. No.	Chainage		Length (in m)	Land Use
	From	To		
1	0	1000	1000	Forest/Agricultrure

Land Use Pattern

Project road: Tamanglong-Dialong Section

Section:- From Km 0+000 to 10+000

District: Tamenglong

State: Manipur

S. No.	Chainage		Length (in m)	Land Use
	From	To		
1	0	1000	1000	Forest/Agricultrure

4. Village Detail

Village Details

Project road: Tamanglong-Dialong Section

Section:- From Km 0+000 to 10+000

District: Tamenglong

State: Manipur

S. No.	Chainage		Length (in m)	Village Name
	From	To		
1	0	10000	10000	Dailong Village

5. Junction Detail

Junction Detail

Project road: Tamanglong-Dialong Section
Section:- From Km 0+000 to 10+000
District: Tamenglong
State: Manipur

S.NO.	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	0	Y-Type	NH	RHS	BT	LHS- TAMENGLONG RHS- IMPHAL
2	0+850	Y-Type	Village Road	RHS	ER	To Dialong
3	1+650	X-Type	Village Road	BS	BT	LHS- Tamenglong RHS- Dialong
4	3+200	X-Type	Village Road	BS	ER	LHS- Ag Field RHS- Dialong
5	5+175	X-Type	Village Road	BS	ER	LHS- Ag Field RHS- Dialong

6. Culvert & Bridge Inventory

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

Project road: Tamanglong-Dialong Section

Section:- From Km 0+000 to 10+000

District: Tamenglong

State: Manipur

Sl. No.	Desing Chanage(Km)	Existing Chainage as per Survey drawng (Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	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	115	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
2	425	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
3	565	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
4	650	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
5	825	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
6	1065	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	2x4x4	16.00	MNB
7	1335	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
8	1425	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
9	1575	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Bow String Steel Girder	1x48	16.00	MNB
10	1725	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
11	2060	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
12	2450	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
13	2700	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	2x4x4	16.00	MNB
14	2980	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
15	3425	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
16	3735	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	2x4x4	16.00	MNB
17	4125	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
18	4325	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
19	4580	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

Project road: Tamanglong-Dialong Section

Section:- From Km 0+000 to 10+000

District: Tamenglong

State: Manipur

Sl. No.	Desing Chanage(Km)	Existing Chainage as per Survey drawng (Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	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)	
20	4925	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
21	5075	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
22	5350	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
23	5575	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
24	5950	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
25	6075	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
26	6250	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
27	6375	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
28	6565	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
29	6780	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
30	6845	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
31	7125	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
32	7425	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
33	7550	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
34	7665	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
35	7775	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
36	7900	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
37	8010	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x3x3	12.00	
38	8150	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	

INVENTORY & CONDITION SURVEY FOR CULVERTS & BRIDGES

Project road: Tamanglong-Dialong Section

Section:- From Km 0+000 to 10+000

District: Tamenglong

State: Manipur

Sl. No.	Desing Chanage(Km)	Existing Chainage as per Survey drawng (Km)	Type of structures (RCC Box, Pipe, Slab Box, Masonry Arch)	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)	
39	8350	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
40	8650	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	2x4x4	16.00	MNB
41	9025	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	2x4x4	16.00	MNB
42	9375	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
43	9875	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	
44	10000	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	New Construction	Box	1x2x2	12.00	

7. Traffic Survey Data & Projections

& MSA CALCULATIONS

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)	109	127	7	5	43	42	0	0	109	0	0	46	0	0	2	490
Location-2 (Ch-26+100)	634	710	13	13	124	35	11	0	682	0	0	138	0	0	6	2366
Average of Both Location	372	419	10	9	84	39	6	0	396	0	0	92	0	0	4	1431
ADT	***372***	***419***	***10***	***9***	***84***	***39***	***6***	***0***	***396***	***0***		***92***	***0***	***0***	***4***	***1431***
PCU	***372***	***419***	***15***	***27***	***126***	***117***	***18***	***0***	***198***	***0***		***46***	***0***	***0***	***18***	***1356***

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		372	419	10	9	84	39	6	0	396	0	0	92	0	0	4	1431	1356
	2018	5%	391	440	11	9	88	41	6	0	416	0	0	97	0	0	4	1503	1422
	2019	5%	411	462	12	9	92	43	6	0	437	0	0	102	0	0	4	1578	1491
	2020	5%	432	485	13	9	97	45	6	0	459	0	0	107	0	0	4	1657	1563
1	2021	5%	454	509	14	9	102	47	6	0	482	0	0	112	0	0	4	1739	1638
2	2022	5%	477	534	15	9	107	49	6	0	506	0	0	118	0	0	4	1825	1716
3	2023	5%	501	561	16	9	112	51	6	0	531	0	0	124	0	0	4	1915	1798
4	2024	5%	526	589	17	9	118	54	6	0	558	0	0	130	0	0	4	2011	1887
5	2025	5%	552	618	18	9	124	57	6	0	586	0	0	137	0	0	4	2111	1979
6	2026	5%	580	649	19	9	130	60	6	0	615	0	0	144	0	0	4	2216	2075
7	2027	5%	609	681	20	9	137	63	6	0	646	0	0	151	0	0	4	2326	2176
8	2028	5%	639	715	21	9	144	66	6	0	678	0	0	159	0	0	4	2441	2281
9	2029	5%	671	751	22	9	151	69	6	0	712	0	0	167	0	0	4	2562	2391
10	2030	5%	705	789	23	9	159	72	6	0	748	0	0	175	0	0	4	2690	2508
11	2031	5%	740	828	24	9	167	76	6	0	785	0	0	184	0	0	4	2823	2630
12	2032	5%	777	869	25	9	175	80	6	0	824	0	0	193	0	0	4	2962	2758
13	2033	5%	816	912	26	9	184	84	6	0	865	0	0	203	0	0	4	3109	2892
14	2034	5%	857	958	27	9	193	88	6	0	908	0	0	213	0	0	4	3263	3033
15	2035	5%	900	1006	28	9	203	92	6	0	953	0	0	224	0	0	4	3425	3180
16	2036	5%	945	1056	29	9	213	97	6	0	1001	0	0	235	0	0	4	3595	3336
17	2037	5%	992	1109	30	9	224	102	6	0	1051	0	0	247	0	0	4	3774	3500
18	2038	5%	1042	1164	32	9	235	107	6	0	1104	0	0	259	0	0	4	3962	3672
19	2039	5%	1094	1222	34	9	247	112	6	0	1159	0	0	272	0	0	4	4159	3852
20	2040	5%	1149	1283	36	9	259	118	6	0	1217	0	0	286	0	0	4	4367	4043
21	2041	5%	1206	1347	38	9	272	124	6	0	1278	0	0	300	0	0	4	4584	4242
22	2042	5%	1266	1414	40	9	286	130	6	0	1342	0	0	315	0	0	4	4812	4451
23	2043	5%	1329	1485	42	9	300	137	6	0	1409	0	0	331	0	0	4	5052	4671
24	2044	5%	1395	1559	44	9	315	144	6	0	1479	0	0	348	0	0	4	5303	4901
25	2045	5%	1465	1637	46	9	331	151	6	0	1553	0	0	365	0	0	4	5567	5143

Traffic Volume Count Survey																		
Tamenglong- Tousem-Liasang-Haflong Road																		
Projections of AADT including Diverted & Induced Traffic																		
		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	372	419	10	9	84	39	6	0	396	0	0	92	0	0	4	1431	1356
	2018	391	440	11	9	88	41	6	0	416	0	0	97	0	0	4	1503	1422
	2019	411	462	12	9	92	43	6	0	437	0	0	102	0	0	4	1578	1491
	2020	432	485	13	9	97	45	6	0	459	0	0	107	0	0	4	1657	1563
1	2021	1080	1213	33	50	243	113	15	0	1148	0	0	268	0	0	10	4173	3994
2	2022	1134	1274	35	53	255	119	16	0	1205	0	0	281	0	0	11	4383	4200
3	2023	1191	1338	37	56	268	125	17	0	1265	0	0	295	0	0	12	4604	4415
4	2024	1251	1405	39	59	281	131	18	0	1328	0	0	310	0	0	13	4835	4638
5	2025	1314	1475	41	62	295	138	19	0	1394	0	0	326	0	0	14	5078	4873
6	2026	1380	1549	43	65	310	145	20	0	1464	0	0	342	0	0	15	5333	5119
7	2027	1449	1626	45	68	326	152	21	0	1537	0	0	359	0	0	16	5599	5375
8	2028	1521	1707	47	71	342	160	22	0	1614	0	0	377	0	0	17	5878	5643
9	2029	1597	1792	49	75	359	168	23	0	1695	0	0	396	0	0	18	6172	5926
10	2030	1677	1882	51	79	377	176	24	0	1780	0	0	416	0	0	19	6481	6222
11	2031	1761	1976	54	83	396	185	25	0	1869	0	0	437	0	0	20	6806	6534
12	2032	1849	2075	57	87	416	194	26	0	1962	0	0	459	0	0	21	7146	6860
13	2033	1941	2179	60	91	437	204	27	0	2060	0	0	482	0	0	22	7503	7202
14	2034	2038	2288	63	96	459	214	28	0	2163	0	0	506	0	0	23	7878	7561
15	2035	2140	2402	66	101	482	225	29	0	2271	0	0	531	0	0	24	8271	7938
16	2036	2247	2522	69	106	506	236	30	0	2385	0	0	558	0	0	25	8684	8332
17	2037	2359	2648	72	111	531	248	32	0	2504	0	0	586	0	0	26	9117	8747
18	2038	2477	2780	76	117	558	260	34	0	2629	0	0	615	0	0	27	9573	9185
19	2039	2601	2919	80	123	586	273	36	0	2760	0	0	646	0	0	28	10052	9644
20	2040	2731	3065	84	129	615	287	38	0	2898	0	0	678	0	0	29	10554	10125
21	2041	2868	3218	88	135	646	301	40	0	3043	0	0	712	0	0	30	11081	10628
22	2042	3011	3379	92	142	678	316	42	0	3195	0	0	748	0	0	32	11635	11161
23	2043	3162	3548	97	149	712	332	44	0	3355	0	0	785	0	0	34	12218	11722
24	2044	3320	3725	102	156	748	349	46	0	3523	0	0	824	0	0	36	12829	12309
25	2045	3486	3911	107	164	785	366	48	0	3699	0	0	865	0	0	38	13469	12922

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

Traffic Volume Count Survey

Tamenglong-Tousem-Liasang-Haflong Road

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

Projections of Average Daily Traffic

Year		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			
			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		91	106	6	4	36	35	0	0	91	0	0	38	0	0	2	409	451
	2018	5%	96	111	6	4	38	37	0	0	96	0	0	40	0	0	2	430	473
	2019	5%	101	117	6	4	40	39	0	0	101	0	0	42	0	0	2	452	497
	2020	5%	106	123	6	4	42	41	0	0	1697	0	0	732	0	0	2	2753	1660
1	2021	30%	138	160	8	5	55	53	0	0	131	0	0	55	0	0	3	608	673
2	2022	5%	145	168	8	5	58	56	0	0	138	0	0	58	0	0	3	639	707
3	2023	5%	152	176	8	5	61	59	0	0	145	0	0	61	0	0	3	670	740
4	2024	5%	160	185	8	5	64	62	0	0	152	0	0	64	0	0	3	703	776
5	2025	5%	168	194	8	5	67	65	0	0	160	0	0	67	0	0	3	737	812
6	2026	5%	176	204	8	5	70	68	0	0	168	0	0	70	0	0	3	772	849
7	2027	5%	185	214	8	5	74	71	0	0	176	0	0	74	0	0	3	810	889
8	2028	5%	194	225	8	5	78	75	0	0	185	0	0	78	0	0	3	851	933
9	2029	5%	204	236	8	5	82	79	0	0	194	0	0	82	0	0	3	893	979
10	2030	5%	214	248	8	5	86	83	0	0	204	0	0	86	0	0	3	937	1026
11	2031	5%	225	260	8	5	90	87	0	0	214	0	0	90	0	0	3	982	1074
12	2032	5%	236	273	8	5	95	91	0	0	225	0	0	95	0	0	3	1031	1125
13	2033	5%	248	287	8	5	100	96	0	0	236	0	0	100	0	0	3	1083	1182
14	2034	5%	260	301	8	5	105	101	0	0	248	0	0	105	0	0	3	1136	1239
15	2035	5%	273	316	8	5	110	106	0	0	260	0	0	110	0	0	3	1191	1298
16	2036	5%	287	332	8	5	116	111	0	0	273	0	0	116	0	0	3	1251	1361
17	2037	5%	301	349	8	5	122	117	0	0	287	0	0	122	0	0	3	1314	1429
18	2038	5%	316	366	8	5	128	123	0	0	301	0	0	128	0	0	3	1378	1498
19	2039	5%	332	384	8	5	134	129	0	0	316	0	0	134	0	0	3	1445	1570
20	2040	5%	349	403	8	5	141	135	0	0	332	0	0	141	0	0	3	1517	1646
21	2041	5%	366	423	8	5	148	142	0	0	349	0	0	148	0	0	3	1592	1726
22	2042	5%	384	444	8	5	155	149	0	0	366	0	0	155	0	0	3	1669	1809
23	2043	5%	403	466	8	5	163	156	0	0	384	0	0	163	0	0	3	1751	1896
24	2044	5%	423	489	8	5	171	164	0	0	403	0	0	171	0	0	3	1837	1988
25	2045	5%	444	513	8	5	180	172	0	0	423	0	0	180	0	0	3	1928	2085

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

Traffic Volume Count Survey

Tamenglong-Tousem-Liasang-Haflong Road

Location - Near Mahur Town | Date-16/3/17-23/3/17

Projections of Average Daily Traffic

Year		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			
			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		528	592	11	11	103	29	9	0	568	0	0	115	0	0	5	1971	1802
	2018	5%	554	622	12	12	108	30	9	0	596	0	0	121	0	0	5	2069	1890
	2019	5%	582	653	13	13	113	32	9	0	626	0	0	127	0	0	5	2173	1985
	2020	5%	611	686	14	14	119	34	9	0	1697	0	0	732	0	0	5	3921	2905
1	2021	30%	794	892	18	18	155	44	12	0	814	0	0	165	0	0	7	2919	2689
2	2022	5%	834	937	19	19	163	46	13	0	855	0	0	173	0	0	7	3066	2824
3	2023	5%	876	984	20	20	171	48	14	0	898	0	0	182	0	0	7	3220	2964
4	2024	5%	920	1033	21	21	180	50	15	0	943	0	0	191	0	0	7	3381	3111
5	2025	5%	966	1085	22	22	189	53	16	0	990	0	0	201	0	0	7	3551	3268
6	2026	5%	1014	1139	23	23	198	56	17	0	1040	0	0	211	0	0	7	3728	3430
7	2027	5%	1065	1196	24	24	208	59	18	0	1092	0	0	222	0	0	7	3915	3601
8	2028	5%	1118	1256	25	25	218	62	19	0	1147	0	0	233	0	0	7	4110	3778
9	2029	5%	1174	1319	26	26	229	65	20	0	1204	0	0	245	0	0	7	4315	3965
10	2030	5%	1233	1385	27	27	240	68	21	0	1264	0	0	257	0	0	7	4529	4159
11	2031	5%	1295	1454	28	28	252	71	22	0	1327	0	0	270	0	0	7	4754	4362
12	2032	5%	1360	1527	29	29	265	75	23	0	1393	0	0	284	0	0	7	4992	4579
13	2033	5%	1428	1603	30	30	278	79	24	0	1463	0	0	298	0	0	7	5240	4804
14	2034	5%	1499	1683	32	32	292	83	25	0	1536	0	0	313	0	0	7	5502	5044
15	2035	5%	1574	1767	34	34	307	87	26	0	1613	0	0	329	0	0	7	5778	5296
16	2036	5%	1653	1855	36	36	322	91	27	0	1694	0	0	345	0	0	7	6066	5558
17	2037	5%	1736	1948	38	38	338	96	28	0	1779	0	0	362	0	0	7	6370	5836
18	2038	5%	1823	2045	40	40	355	101	29	0	1868	0	0	380	0	0	7	6688	6126
19	2039	5%	1914	2147	42	42	373	106	30	0	1961	0	0	399	0	0	7	7021	6429
20	2040	5%	2010	2254	44	44	392	111	32	0	2059	0	0	419	0	0	7	7372	6750
21	2041	5%	2111	2367	46	46	412	117	34	0	2162	0	0	440	0	0	7	7742	7089
22	2042	5%	2217	2485	48	48	433	123	36	0	2270	0	0	462	0	0	7	8129	7442
23	2043	5%	2328	2609	50	50	455	129	38	0	2384	0	0	485	0	0	7	8535	7812
24	2044	5%	2444	2739	53	53	478	135	40	0	2503	0	0	509	0	0	7	8961	8201
25	2045	5%	2566	2876	56	56	502	142	42	0	2628	0	0	534	0	0	7	9409	8612

Summary of CMSA By Actual Traffic		
Year	**Pkg-1**	**Design year**
2017 to 2020	Project Clearance	
2021	**0.08**	1
2022	**0.17**	2
2023	**0.26**	3
2024	**0.35**	4
2025	**0.45**	5
2026	**0.56**	6
2027	**0.67**	7
2028	**0.78**	8
2029	**0.90**	9
2030	**1.03**	10
2031	**1.16**	**11**
2032	**1.30**	12
2033	**1.44**	13
2034	**1.59**	14
2035	**1.75**	15
2036	**1.92**	16
2037	**2.10**	17
2038	**2.28**	18
2039	**2.47**	19
2040	**2.67**	20
2041	**2.89**	21
2042	**3.11**	22
2043	**3.34**	**23**
2044	**3.59**	**24**
2045	**3.84**	**25**

MSA VALUES (Actual)

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	2.5	2.5	2.5	2.5	2.5						
2017	**84**	**39**	**6**	**4**	**19**	**Project Clearance & Construction period**					
2018	88	41	6	4	20						
2019	92	43	6	4	21						
2020	97	45	6	4	22						
2021	102	47	6	4	23	66430	66430	83037.5	83037.5	0.08	1
2022	107	49	6	4	24	69350	**135780**	86688	169725	**0.17**	2
2023	112	51	6	4	25	72270	**208050**	90338	260063	**0.26**	3
2024	118	54	6	4	26	75920	**283970**	94900	354963	**0.35**	4
2025	124	57	6	4	27	79570	**363540**	99463	454425	**0.45**	5
2026	130	60	6	4	28	83220	**446760**	104025	558450	**0.56**	6
2027	137	63	6	4	29	87235	**533995**	109044	667494	**0.67**	7
2028	144	66	6	4	30	91250	**625245**	114063	781556	**0.78**	8
2029	151	69	6	4	32	95630	**720875**	119538	901094	**0.90**	9
2030	159	72	6	4	34	100375	**821250**	125469	1026563	**1.03**	10
2031	167	76	6	4	36	105485	**926735**	131856	1158419	**1.16**	11
2032	175	80	6	4	38	110595	**1037330**	138244	1296663	**1.30**	12
2033	184	84	6	4	40	116070	**1153400**	145088	1441750	**1.44**	13
2034	193	88	6	4	42	121545	**1274945**	151931	1593681	**1.59**	14
2035	203	92	6	4	44	127385	1402330	159231.25	1752912.5	1.75	15
2036	213	97	6	4	46	133590	**1535920**	166988	1919900	**1.92**	16
2037	224	102	6	4	48	140160	**1676080**	175200	2095100	**2.10**	17
2038	235	107	6	4	50	146730	**1822810**	183413	2278513	**2.28**	18
2039	247	112	6	4	53	154030	**1976840**	192538	2471050	**2.47**	19
2040	259	118	6	4	56	161695	**2138535**	202119	2673169	**2.67**	20
2041	272	124	6	4	59	169725	**2308260**	212156	2885325	**2.89**	21
2042	286	130	6	4	62	178120	**2486380**	222650	3107975	**3.11**	22
2043	300	137	6	4	65	186880	**2673260**	233600	3341575	**3.34**	23
2044	315	144	6	4	68	196005	**2869265**	245006	3586581	**3.59**	24
2045	331	151	6	4	71	205495	**3074760**	256869	3843450	**3.84**	25

MSA VALUES (Assumed)

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	2.5	2.5	2.5	2.5	2.5						
2017	**84**	**39**	**6**	**4**	**19**	**Project Clearance & Construction period**					
2018	88	41	6	4	20						
2019	92	43	6	4	21						
2020	97	45	6	4	22						
2021	243	113	15	10	83	169360	169360	211700	211700	0.21	1
2022	255	119	16	11	87	178120	**347480**	222650	434350	**0.43**	2
2023	268	125	17	12	91	187245	**534725**	234056	668406	**0.67**	3
2024	281	131	18	13	96	196735	**731460**	245919	914325	**0.91**	4
2025	295	138	19	14	101	206955	**938415**	258694	1173019	**1.17**	5
2026	310	145	20	15	106	217540	**1155955**	271925	1444944	**1.44**	6
2027	326	152	21	16	111	228490	**1384445**	285613	1730556	**1.73**	7
2028	342	160	22	17	117	240170	**1624615**	300213	2030769	**2.03**	8
2029	359	168	23	18	123	252215	**1876830**	315269	2346038	**2.35**	9
2030	377	176	24	19	129	264625	**2141455**	330781	2676819	**2.68**	10
2031	396	185	25	20	135	277765	**2419220**	347206	3024025	**3.02**	11
2032	416	194	26	21	142	291635	**2710855**	364544	3388569	**3.39**	12
2033	437	204	27	22	149	306235	**3017090**	382794	3771363	**3.77**	13
2034	459	214	28	23	156	321200	**3338290**	401500	4172863	**4.17**	14
2035	482	225	29	24	164	337260	3675550	421575	4594437.5	4.59	15
2036	506	236	30	25	172	353685	**4029235**	442106	5036544	**5.04**	16
2037	531	248	32	26	181	371570	**4400805**	464463	5501006	**5.50**	17
2038	558	260	34	27	190	390185	**4790990**	487731	5988738	**5.99**	18
2039	586	273	36	28	200	409895	**5200885**	512369	6501106	**6.50**	19
2040	615	287	38	29	210	430335	**5631220**	537919	7039025	**7.04**	20
2041	646	301	40	30	221	451870	**6083090**	564838	7603863	**7.60**	21
2042	678	316	42	32	232	474500	**6557590**	593125	8196988	**8.20**	22
2043	712	332	44	34	244	498590	**7056180**	623238	8820225	**8.82**	23
2044	748	349	46	36	256	523775	**7579955**	654719	9474944	**9.47**	24
2045	785	366	48	38	269	549690	**8129645**	687113	10162056	**10.16**	25

Summary of CMSA By Assumed Traffic		
Year	**Pkg-1**	**Design year**
2017 to 2020	Project Clearance	
2021	**0.21**	1
2022	**0.43**	2
2023	**0.67**	3
2024	**0.91**	4
2025	**1.17**	5
2026	**1.44**	6
2027	**1.73**	7
2028	**2.03**	8
2029	**2.35**	9
2030	**2.68**	10
2031	**3.02**	**11**
2032	**3.39**	12
2033	**3.77**	13
2034	**4.17**	14
2035	**4.59**	15
2036	**5.04**	16
2037	**5.50**	17
2038	**5.99**	18
2039	**6.50**	19
2040	**7.04**	20
2041	**7.60**	21
2042	**8.20**	22
2043	**8.82**	**23**
2044	**9.47**	**24**
2045	**10.16**	**25**

8. Typical Cross sections

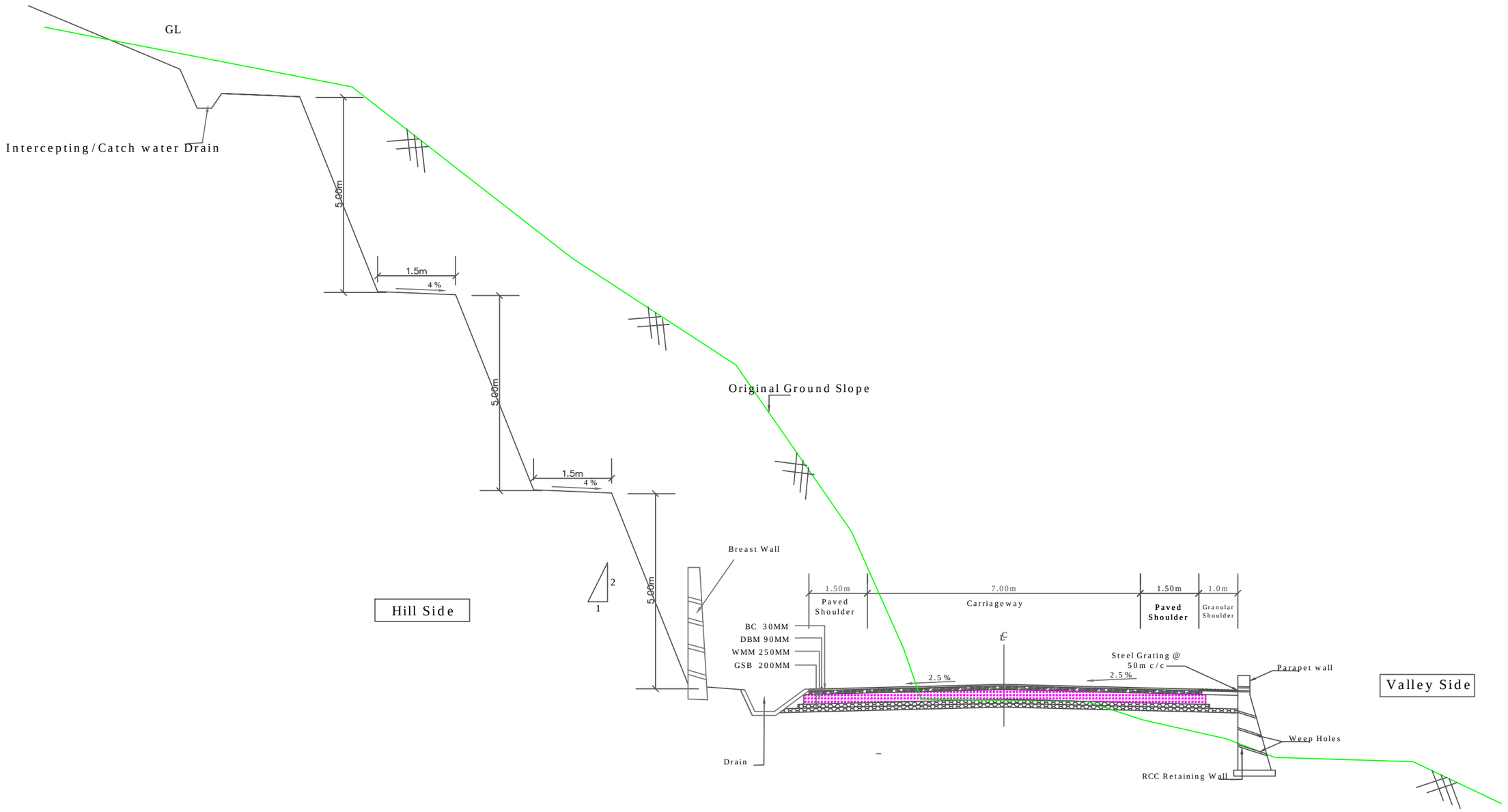

Fig - 2.8
Typical Cross Section
2- lane Carriageway WithOne Side Retaining Wall
(Open Country - Mountainous Terrain)

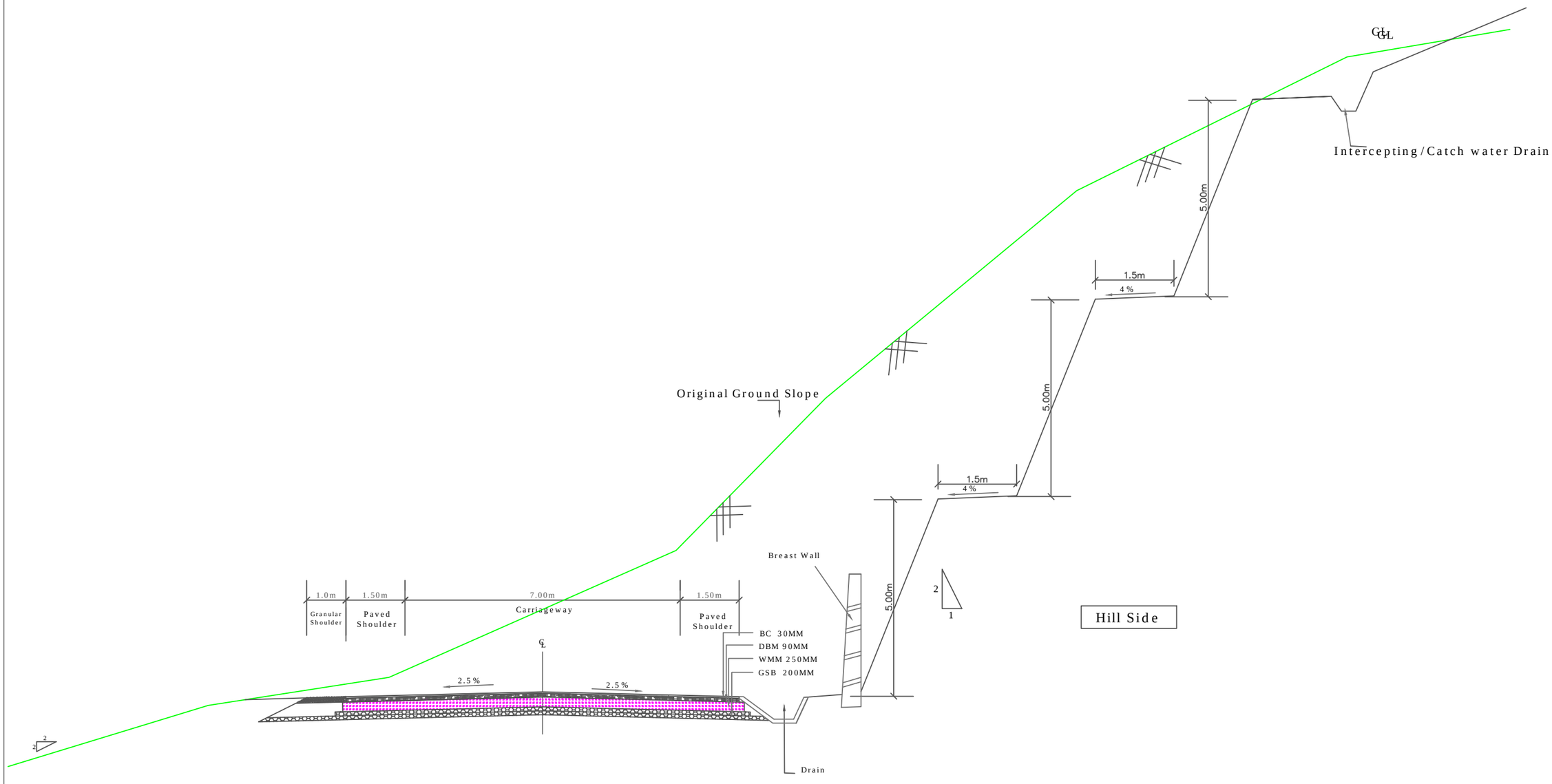

Fig - 2.9
Typical Cross Section
2- lane Carriageway Without Retaining Wall
(Open Country - Mountainous Terrain)

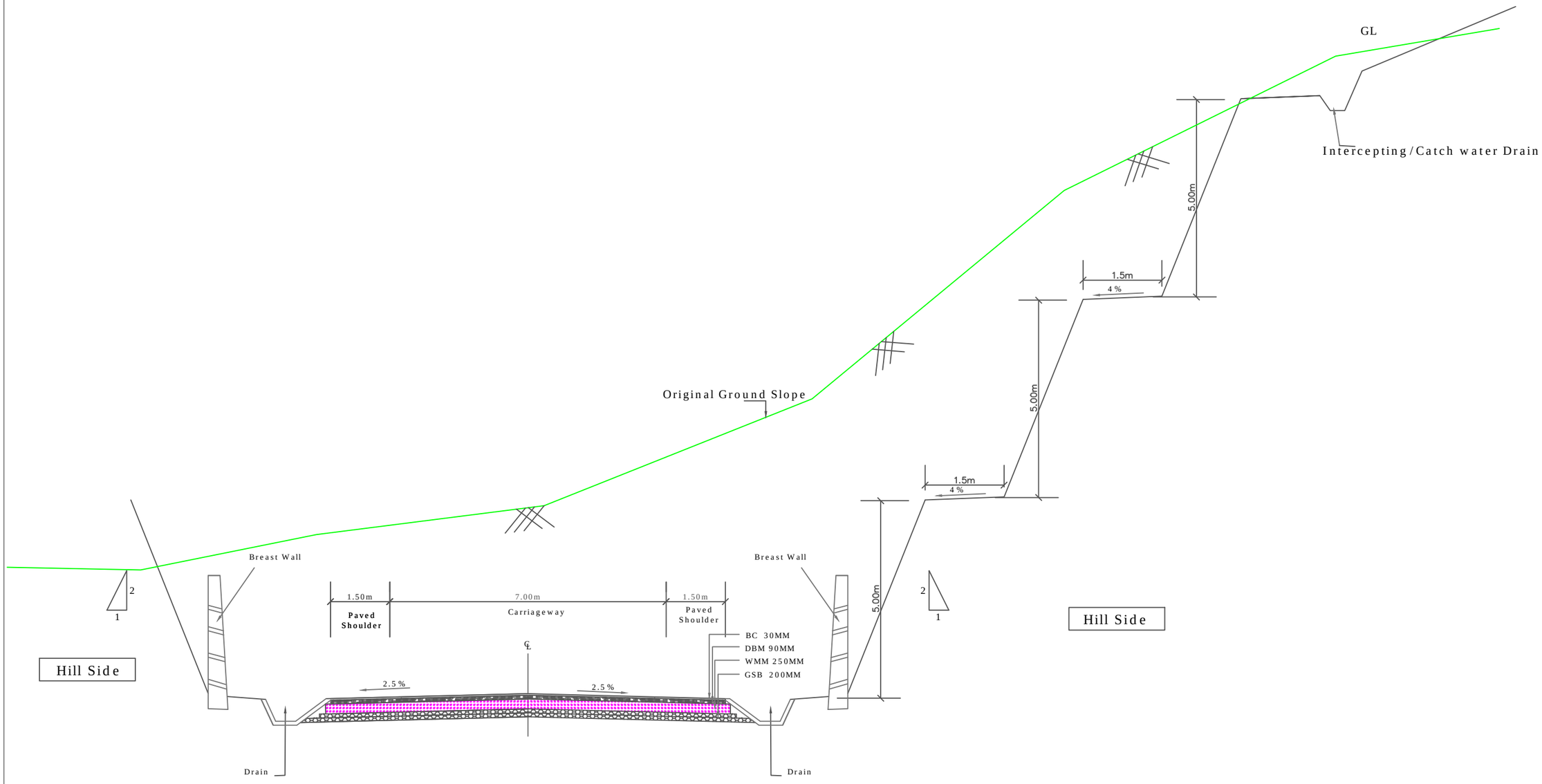

Fig - 2.11(new)
(Hilly Terrain) Typical Cross Section
2- lane Carriageway With Paved Shoulders
(Through Cut) Hill Section

9. Proposed ROW Details

Proposed ROW

Project road: Tamanglong-Dialong Section

Section:- From Km 0+000 to 10+000

District: Tamenglong

State: Manipur

S. No.	Chainage		Length (in m)	ROW(m)	ROW(m)	
	From	To			LHS	RHS
1	0	850	850	45	20	25
2	850	1375	525	60	20	40
3	1375	3100	1725	45	20	25
4	3100	3200	100	60	20	40
5	3200	4525	1325	45	20	25
6	4525	4825	300	60	20	40
7	4825	5150	325	45	20	25
8	5150	5450	300	60	20	40
9	5450	6950	1500	45	20	25
10	6950	8075	1125	45	25	20
11	8075	10000	1925	45	20	25
Total Length (in m)			**10000**			