

Consultancy Services for Carrying out Feasibility Study, Preparation of Detailed Project Report and providing pre-construction services in respect of 2 laning of *Maram-Peren- Dimapur section on NH 129A* (Manipur & Nagaland) on Engineering, Procurement and Construction mode in the state of Manipur & Nagaland.
(Package No. NHIDCL/DPR/SN-DMP-PC/Manipur/2016)

FINAL DETAILED PROJECT REPORT

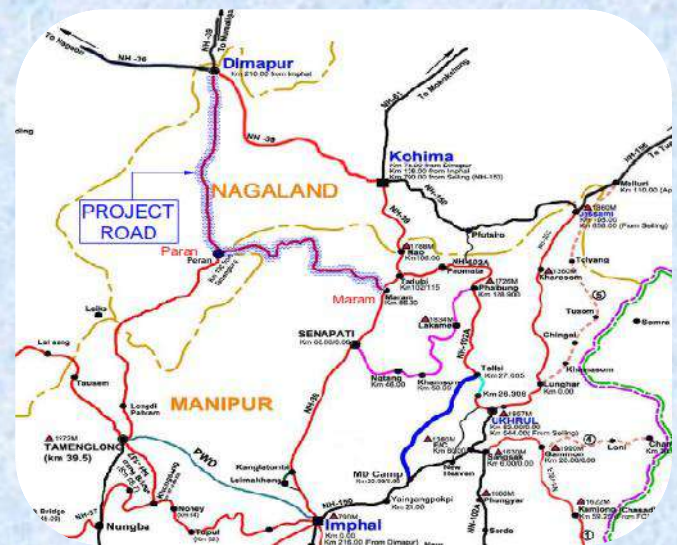
STAGE: IV

VOLUME - I: MAIN REPORT (MARAM-PEREN SECTION IN THE STATE OF MANIPUR)

- PKG-IIIA: KM 75+000 TO KM 87+350
- PKG-IIIB: KM 87+350 TO KM 109+494



**National Highways & Infrastructure
Development Corporation Ltd.**
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New Delhi-110001*

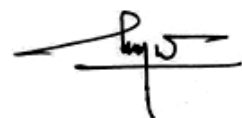


CETEST
Engineering Consultants

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CHAPTER – 1

EXECUTIVE SUMMARY

1.1 PROJECT BACKGROUND

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

As a part of the above mentioned endeavor, National Highways & Infrastructure Development Corporation Limited (NHIDCL) has been entrusted with the assignment of Consultancy Services for Carrying out Feasibility Study, Preparation of Detailed Project Report and providing pre-construction services in respect of 2 laning of Maram - Peren road Section of NH-129A on Engineering, Procurement and Construction mode in the state of Manipur.

National Highways & Infrastructure Development Corporation Ltd. is the employer and executing agency for the consultancy services and the standards of output required from the appointed consultants are of international level both in terms of quality and adherence to the agreed time schedule.

National Highways & Infrastructure Development Corporation Limited (NHIDCL), MoRT&H, New Delhi has appointed C.E. Testing Company Pvt. Ltd. (CETEST) as consultant to prepare the Detailed Project Report for the above road stretches vide Letter of Acceptance No. NHIDCL/DPR/SN-DMP-PC/Manipur/2016/Vol-II/390 dated 26.10.2017.

The project road starts near Ziumi village and ends at Dzuko Bridge near Peren town. The entire corridor falls under Senapati district in the state of Manipur. As per topographic survey the existing length of the project road comes out as 34.494 km. The entire road stretch falls in mountainous terrain.

The road passes through Ziumi Village, Tamphung Village before ends at Dzuko bridge near Peren town.

Package details are summarized in below table 1.1.

TABLE- 1.1: Package wise details

Package No	Existing Chainage (Km)		Existing Length (KM)	Design Chainage (Km)		Design Length (KM)
	From	To		From	To	
PKG-IIIA	74+800	87+496	12.696	75+000	87+350	12.350
PKG-IIIB	87+496	109+767	20.271	87+350	109+494	22.144
	Total existing length		32.967	Total design length		34.494

0.2 OBJECTIVES

The main objective of the Consultancy Service is to prepare the Detailed Project Report (DPR) for up gradation of existing Intermediate/two lane road to 2-lane configuration from Maram - Peren road Section of NH-129A in the State of Manipur ensuring –

- ✓ Minimum Land acquisition
- ✓ Enhanced road safety
- ✓ Minimum adverse impact on environment

Project preparation activities mainly comprises of six stages in accordance with Terms of reference (TOR)

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

Present report deals with Stage 4: Detailed Project Report (Draft DPR)

1.3 DEFICIENCIES AND ISSUES

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

a) Operation

- ✓ No access control
- ✓ Fast Moving Vehicles conflicts with slow moving vehicles due to bad pavement condition
- ✓ Deficient road surface conditions (roughness)
- ✓ No proper Geometry of road alignment
- ✓ Uncontrolled roadside developments and encroaching the area under ROW
- ✓ Cross-drainage structure require to be improved through reconstruction

b) Safety

- ✓ Shoulder drop-off at places.
- ✓ Exposed roadside hazards, specially a protective part throughout the road stretch.
- ✓ Inadequate traffic signs.
- ✓ Blind Curve on the project road.

c) Road

- ✓ Fair - Poor pavement condition and structurally inadequate
- ✓ Shoulder functionally and structurally inadequate
- ✓ Cross drainage - poor condition and inadequate
- ✓ Curve radii less than what is required for the ruling Design speed of 40 km / hr. in roads for mountainous terrain
- ✓ Deficient curves and reverse curves in roads of plain terrain without transition length for reversal of elevation.

1.4 SALIENT FEATURES

This relates to the most suitable alignment for 2-laning of road sections and for optimum upgrading of existing road based on field data and detail study involving traffic, Geo-technical, topographic, pavement and road condition and socioeconomic aspects. Special attention has been given for augmentation of capacity for intended level of service in design period. A few appropriate design applications have been considered for operational efficiency and road safety.

TABLE- 1.2: SALIENT FEATURES OF THE PROPOSED ROAD

Descriptions	Existing	Proposed
Start Point	: Starts near Ziumi village under Senapati district in Manipur (Ch. 74+800 km)	Starts near Ziumi village under Senapati district in Manipur (Ch. 74+800 km)
End Point	: Ends at Dzuko Bridge near Peren under Senapati district in Manipur (Ch. 109+767 km)	Ends at Dzuko Bridge near Peren under Senapati district in Manipur (Ch. 109+494 km)
Terrain	: Mountainous Terrain	Mountainous Terrain
Length	: Existing Length = 32.967 Km	Total Design Length =34.494 Km

Descriptions		Existing	Proposed																				
Alignment	:	The horizontal alignment of the existing road has many sub-standard and sharp curves including reverse S-curves. There is also deficiency in transition length as per MoRT&H standards. The details are given below –	Proposed alignment has been designed based on the design speed adopted for mountainous terrain as per standard specified in IRC SP 73-2015 and hill road manual(IRC: SP 48-1998) Details of horizontal curves have been enclosed in “Chapter–3: Project Description”.																				
		<table><tr><th>Types of Curves</th><th>From (km)</th><th>To (km)</th></tr><tr><td rowspan="3">Sharp Curves/Blind Curves</td><td colspan="2">Package : III</td></tr><tr><td>74+800</td><td>85+000</td></tr><tr><td>89+500</td><td>99+250</td></tr><tr><td rowspan="3">Hair- Pin Bends</td><td colspan="2">Package : III</td></tr><tr><td>85+750</td><td>88+250</td></tr><tr><td>99+250</td><td>105+577</td></tr></table>		Types of Curves	From (km)	To (km)	Sharp Curves/Blind Curves	Package : III		74+800	85+000	89+500	99+250	Hair- Pin Bends	Package : III		85+750	88+250	99+250	105+577			
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Design speed	:	Avg. 20-40 kmph in entire stretch.	Considering mountainous terrain in general design speed has been adopted as 40 Kmph. However, speed has been reduced up to 20kmph in case of hair pin bends location.																				
Cross-Section	:	<table><tr><th colspan="2">Chainage (km)</th><th rowspan="2">Average Carriageway Width (m)</th></tr><tr><th>From</th><th>To</th></tr><tr><td colspan="3">Package : III</td></tr><tr><td>74.800</td><td>84.500</td><td>7.0</td></tr><tr><td>84.500</td><td>105.930</td><td>3.5-6.0</td></tr><tr><td>105.930</td><td>107.916</td><td>No existing road</td></tr><tr><td>107.916</td><td>109.538</td><td>3.5-5.5</td></tr></table>	Chainage (km)		Average Carriageway Width (m)	From	To	Package : III			74.800	84.500	7.0	84.500	105.930	3.5-6.0	105.930	107.916	No existing road	107.916	109.538	3.5-5.5	(1) Open area with one side hill and opposite side valley a)Carriageway Width = 7.0 m b)Hard Shoulder Width = 2 x 1.5 m c)Earthen Shoulder Width on Valley side= 1.0m d)Roadway Width= 11.0 m (2) Open Area with both side hill a) Carriageway Width = 7.0 m b) Hard Shoulder Width = 2 x 1.5 m c)Roadway Width= 10.0 m (3) Built-up Area a) Carriageway Width= 7.0 m b) Hard Shoulder Width = 2 x 1.5 m c)Footpath cum Drain = 2 x 1.0 m d)Roadway Width= 12.0 m
		Chainage (km)		Average Carriageway Width (m)																			
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Earthen /Gravel Shoulder: 0.50 m – 2.5 m Total Formation width: 4.5 m to 10.5 m																							
CBR Considered	:	-	10%(For all Packages)																				
Traffic	:	<u>Base Year Traffic (Yr. 2018)</u> Total Vehicle in numbers = 596 nos. Total Vehicles in PCU = 796 PCU Total CVPD = 164 nos.	<u>Projected traffic (Yr. 2042)</u> Total Vehicle in numbers = 3381 nos. Total Vehicles in PCU = 4517 PCU Total CVPD = 926 nos.																				
Traffic Growth Rate	:	-	7.5%																				
Pavement Design Life	:	-	Flexible Pavement - 20 Years																				
Design msa	:	-	Calculated MSA = 3 MSA for entire stretch Adopted MSA = 20 MSA (as per IRC: SP:73- 2015 clause no. 5.4.1)																				

Descriptions	Existing	Proposed
Pavement Thickness	From km 0.000 to km 20.000: Bituminous Surface = 20 – 80 mm Stone Aggregate + Sand = 240 – 360 mm Total Pavement Thickness = 260 – 440 mm From km 20.000 to km 109.767: Bituminous Surface = 20 – 60 mm Stone Aggregate + Sand = 80 – 400 mm Total Pavement Thickness = 100 – 460 mm	<u>Conventional Method (Flexible Pavement)</u> (For New/Widening & Strengthening portion) • BC = 40 mm • DBM = 70 mm • WMM = 250 mm • GSB = 200 mm Total = 560 mm for all packages.
Bridges	Total 1 no. major bridge and 1 nos. minor bridge is found in project stretch. <u>Package : III</u> Major Bridge – 1 no. (Steel Truss Bridge) Minor Bridge – 01 no. (RCC T Girder Bridge)	1 no. major bridge and 1 no. minor bridge is retained <u>Package : III</u> • Major Bridge -1 no. Retained (Existing Steel Truss Bridge) • Minor Bridge -1 no. Retained (Existing RCC T Girder Bridge)
Culverts	<u>Package : III</u> Total Culvert = 142 nos. • Pipe Culverts = 107 nos. • Slab Culverts = 31 nos. • Arch Culverts = 1 no. • Culvert Covered by Soil = 3 nos.	<u>Package: III (Total =144 Nos.)</u> • Reconstruction with Box culverts =111 nos. • Additional new Box culverts =33 nos. • Removal of existing culvert=31 nos.
Protection Work	Breast Wall = 65 m Retaining Wall = 4963 m	<u>Package – IIIA</u> a)Total length of Retaining Wall=3042 m • Length of 1.5m Retaining Wall=984 m • Length of 2.0m Retaining Wall=1516 m • Length of 3.0m Retaining Wall=345 m • Length of 4.0m Retaining Wall=147 m • Length of 8.0m Retaining Wall=50 m b)Length of Breast Wall = 1319 m <u>Package – IIIB</u> a)Total length of Retaining Wall=6841 m • Length of 1.5m Retaining Wall=1422 m • Length of 2.0m Retaining Wall=3778 m • Length of 3.0m Retaining Wall=691 m • Length of 4.0m Retaining Wall=615 m • Length of 5.0m Retaining Wall=97 m • Length of 6.0m Retaining Wall=147 m • Length of 8.0m Retaining Wall=91 m b)Length of Breast Wall = 1988 m
Longitudinal Drains	Length of Lined Drain = 60 m Length of Earthen Drain = 12685 m (on hilly side)	<u>Package – IIIA</u> • Length of RR Masonry Trapezoidal Drain = 16998 m <u>Package – IIIB</u> • Length of RR Masonry Trapezoidal Drain = 32350 m

Descriptions		Existing	Proposed																				
Bus Bay with Passenger Shelter	:	Nil	2 Numbers (1 location) <table><tr><th>Sl. No.</th><th>Chainage</th><th>Side</th><th>Name of the Habitation</th></tr><tr><td colspan="4">Package-III A</td></tr><tr><td colspan="4">Nil</td></tr><tr><td colspan="4">Package-III: 2 Nos. (1 location)</td></tr><tr><td>1</td><td>96+780</td><td>Both</td><td>Tamphung</td></tr></table>	Sl. No.	Chainage	Side	Name of the Habitation	Package-III A				Nil				Package-III: 2 Nos. (1 location)				1	96+780	Both	Tamphung
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Package-III A																							
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1	96+780	Both	Tamphung																				
ROW	:	Average Right of Way 10.00 m (Varies from 7.0m to 16.40m)	Open Area = 18m-24m Built-up Area= 14m																				
Land Details	:	Package : IIIA Available land 10.2526 Ha. (Approx) Package : IIIB Available land 15.0512 Ha. (Approx)	Package: IIIA Land to be acquired 17.4570 Ha. (Approx.) Package: IIIB Land to be acquired 33.7598 Ha. (Approx.)																				
Land Required for Muck Disposal	:	Nil	Package : III 35.03 Ha. (Approx)																				
Forest Stretch	:	Project road passes through forest area. However, the stretch does not pass through any wildlife sanctuary or eco sensitive zone.	Project road passes through forest area. However, the stretch does not pass through any wildlife sanctuary or eco sensitive zone.																				
Major Intersection	:	Nil	Nil																				
Minor intersection	:	Package: III (6 Nos.) • 5 Nos. (3 legged) • 1 No. (4 legged)	Package: IIIA (6 Nos.) • 1 No. (3 legged) Package: IIIB (6 Nos.) • 4 Nos. (3 legged) 1 No. (4 legged)																				
Total Civil Cost (Rs.)	:	-	Package: IIIA Rs. 105.21 Cr. (Rs. 8.52 Cr. / Km) Package: IIIB Rs. 205.81 Cr. (Rs. 9.29 Cr. / Km)																				

1.5 COST ESTIMATES

Rate Analysis of each item of work has been carried out as per Manipur Schedule of Rates, 2018 for National Highways works published by Public Works Department, Govt. of Manipur. The standard Data Book for Analysis of Rates revised in 2010 by MoRT&H has essentially been taken as the basis for the publication for this schedule. The rates for materials and labour has been collected from the market and the other sources and rationalized for the entire state.

TABLE 1.2a: ABSTRACT OF COST ESTIMATE (Package – IIIA)

DESCRIPTION OF WORKS		TOTAL COST (In Cr.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	% of Cost of Civil Works (% of C)
A.	ROAD WORKS			
1	Site Clearance and Dismantling	0.84	0.07	0.80%
2	Earth work ,Subgrade and Erosion control	33.55	2.72	31.89%
3	Sub-Base & Base	22.00	1.78	20.91%
4	Bituminous Courses	13.77	1.11	13.09%
5	Junction Improvement (Major & Minor)	0.03	0.00	0.03%
6	Traffic signs, Road marking & other road appurtenances	1.07	0.09	1.02%
	Drainage and Protective Works			
7	Longitudinal Drains	8.31	0.67	7.90%
8	Retaining wall	8.90	0.72	8.46%
9	Breast wall	4.17	0.34	3.96%
B.	BRIDGES & CULVERTS			
10	Culvert	9.51	0.77	9.04%
11	Major Bridges		0.00	0.00%
12	Repairing & Rehabilitation of Minor Bridges		0.00	0.00%
C.	COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)	102.15	8.27	
D.	Escalation @ 3% WPI	3.0645		
E.	Total Civil Cost including Escalation@3%	105.21	8.52	
F.	Maintenance for 5 years, i.e 2.5% on civil cost (E)	2.63		
G.	GST @ 12% of (E)	12.63		
H.	Contingencies @ 2.8% over Civil Cost (E)	2.95		
I.	Supervision Charges @ 3% of (E)	3.16		
J.	Agency Charges @3% of (E)	3.16		
K	Escalation Cost @ 2.5% during Construction Period(For 1.5 Yrs. of construction period, No escalation in 1st Year and 2.5% for 0.5 Years)	2.63		
L.	TOTAL CONSTRUCTION COST (E+F+G+H+I+J+K)=L	132.37	10.72	
K.	DEPARTMENTAL COST			
a.	LA Cost	8.46		
b.	R&R Cost	1.87		
c.	Utility Shifting (Electrical+PHE)	1.05		
d.	Environmental Budget +Forest Clearance	1.52		
L.	Sub Total (K)	12.90		
M.	TOTAL CAPITAL COST (K+L)=M	145.27	11.76	

TABLE 1.2b: ABSTRACT OF COST ESTIMATE (Package – IIIB)

DESCRIPTION OF WORKS		TOTAL COST (In Cr.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	% of Cost of Civil Works (% of C)
A.	ROAD WORKS			
1	Site Clearance and Dismantling	0.95	0.04	0.48%
2	Earth work ,Subgrade and Erosion control	74.83	3.38	37.45%
3	Sub-Base & Base	37.92	1.71	18.98%
4	Bituminous Courses	24.14	1.09	12.08%
5	Junction Improvement (Major & Minor)	0.17	0.01	0.09%
6	Traffic signs, Road marking & other road appurtenances	1.61	0.07	0.81%
7	Passenger Shelter	0.04	0.00	0.02%
8	Busbay	0.27	0.01	0.14%
	Drainage and Protective Works			
9	Longitudinal Drains	15.03	0.68	7.52%
10	Retaining wall	21.63	0.98	10.82%
11	Breast wall	5.97	0.27	2.99%
B.	BRIDGES & CULVERTS			
12	Culvert	17.26	0.78	8.64%
C.	COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)	199.82	9.02	
D.	Escalation @ 3% WPI	5.99		
E.	Total Civil Cost including Escalation@3%	205.81	9.29	
F.	Maintenance for 5 years, i.e 2.5% on civil cost (E)	5.15		
G.	GST @ 12% of (E)	24.70		
H.	Contingencies @ 2.8% over Civil Cost (E)	5.76		
I.	Supervision Charges @ 3% of (E)	6.17		
J.	Agency Charges @3% of (E)	6.17		
K.	Escalation Cost @ 2.5% during Construction Period (For 1.5 Yrs of construction period, No escalation in 1st Year and 2.5% for 0.5 Years)	5.15		
J.	TOTAL CONSTRUCTION COST * (C+D+E+F+G+H+I)=J	258.91	11.69	
K.	DEPARTMENTAL COST			
a.	LA Cost	16.35		
b.	R&R Cost	3.33		
c.	Utility Shifting (Electrical+PHE)	2.00		
d.	Environmental Budget+Forest Clearance	2.90		
L.	Sub Total (K)	24.58		
M.	TOTAL CAPITAL COST (K+L) = M	283.49	12.80	

1.6 FINANCIAL ANALYSIS

The project fails to generate the desired level of return, even with a grant of 40% on TPC. Thus the project does not qualify to be implemented on the BOT - Toll mode. It's recommended that the project to be implemented through EPC mode.

CHAPTER – 2

INTRODUCTION

2.1 General

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

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Present report deals with the final detailed project report stage of **Maram-Peren** Road stretch.

2.2 Project Background

State Profile

Manipur is one of the Border States in the northeastern part of the country having an international boundary of about 352 km long stretch of land with Myanmar in the southeast. It is bounded by Nagaland in the north, Assam in the west and Mizoram in the south. It has a total area of 22,327 sq km. It lies between 23.8°N to 25.7°N latitude and 93.5°E to 94.8°E longitude.

Geographically, the state of Manipur could be divided into two regions, viz. the hill and the valley. The valley lies in the central part of the state and the hills surround the valley. The average elevation of the valley is about 790m above the sea level and that of the hills is between 1500m and 1800m. The hill region comprises of ten districts viz. Senapati, Kangpokpi, Tamenglong, Noney, Churachandpur, Pherzawl, Chandel, Tengnoupal, Ukhrul, Kamjong and the valley region consists of six districts, viz. Imphal East, Imphal West, Thoubal, Jiribam, Kakching and Bishnupur. The hill



districts occupy about 90 percent (20,089 sq km) of the total area of the state and the valley occupies only about tenth (2,238 sq km) of the total area of the state.

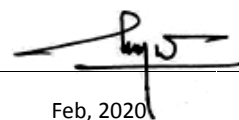
Manipur in northeast India is a small beautiful state with Imphal as its capital. The name Manipur literally means "Land of Jewels" and the state has a rich culture which can be seen in martial arts, dance, theatre and sculpture. Renowned for its greenery and pleasant climate, Manipur has been a popular tourist destination.

Manipur has been at the crossroads of Asian economic and cultural exchange for more than 2,500 years. It has long connected the Indian subcontinent to Southeast Asia, enabling migration of people, cultures and religions. It has also witnessed many wars, including fighting during World War II.

Agriculture is the main mode of living of the people. People of Manipur are also engaged in handloom sector which is the largest cottage industry in Manipur.

The state is the birth place of the game Polo which was known as Sagol Kangjei or Pulu and is also famous for its Manipuri dance the Ras Lila created by Rajashree Bhagyachandra. Manipur also boasts of its rich culture and tradition. People of Manipur are very enthusiastic about their traditional art and dance forms. Ras Lila is the highest expression of artistic genius, devotion and excellence. Manipur is a land of festivities. Throughout the year different festivals are celebrated by the different tribes of the state. Followings are some facts & figures regarding the state:

Location	:	Approximately lies between 23.8° to 25.7° latitude, North of Equator and between the longitudinal lines 93.5°E to 94.8°E.
Area	:	22,327 Sq. km.
Capital	:	Imphal (790 m above sea level)
District	:	<i>Bishnupur, Churachandpur, Chandel, Imphal East, Senapati, Tamenglong, Thoubal, Ukhrul, Imphal West, Kangpokpi, Tengnoupal, Pherzawl, Noney, Kamjong, Jiribam and Kakching.</i>
Population	:	28,55,794 (According to 2011 census)
Density of Population	:	128 persons per sq.km.
Male	:	14,38,586
Female	:	14,17,208
Sex Ratio	:	985 (Female per 1000 Male)
Main languages	:	Meitei/Meeteilon (Manipuri), Tangkhul, Kabui Kuki, Hmar, Paite, Thadou, Bishnupriya Manipuri, English, Hindi and local dialects



Tribes	:	The Meitei constitute a majority of the state's population. According to 1891 census Meitei were recorded as a forest tribe. In 1901 Meitei were listed as main tribe of Manipur. They live primarily in the state's valley region. Besides the Meitei people, the Thadous have the second highest percentage of the population. The third is the Nagas who are further sub-divided into subtribes: Tangkhul, Maram, Poumai Naga, Sumi, Angami, Ao, Chakhesang, Chang, Khiamniungan, Konyak, Liangmai, Lotha, Pochury, Rongmei, Zeme and Mao.		
Literacy	:	79.21% (According to 2011 census)		
Per capita income	:	Rs. 36,474/- (2012-2013)		
Climate	:	Rainfall 1467.5 mm average		
Temperature	:	15°C to 32°C in Summer & 4°C to 28°C in Winter		
Surfaced Roads Length	:	National Highways - 968 km, out of which the length of NH under PWD, Manipur is 283 kms only. The remaining 685 km is under BRO. State Highways - 668 km		
Crops	:	There are forests of teak, pine, oak, uningthou, leihao, bamboo, and cane. Rubber, tea, coffee, and cardamom are grown in hill areas. Rice and cash crops make up the main vegetation cover in the valley.		
Fruits	:	Litchi, cashew nuts, walnuts, orange, lemon, pineapple, papaya, peach, pear, banana and plum.		
Vegetable	:	Cauliflower, Cabbage, Tomato, Pea etc.		
Major Minerals	:	Limestone, Asbestos, Copper, Lignite, Nickel, Chromites, Salts etc.		
Forests	:	17,086 sq km (76.53% of total land area).		
Livestock & Poultry	:	Category	Year	Stock / Population
		1. Cattle	2012	263843 Nos.
		2. Buffalo	2012	66369 Nos.
		3. Mithun	2012	10131 Nos.
		4. Sheep	2012	11463 Nos.
		5. Goats	2012	65158 Nos.
		6. Horses	2012	1101 Nos.
		7. Pigs	2012	277215 Nos.
		8. Dogs	2012	161818 Nos.
		9. Rabbits	2012	2039 Nos.
		Poultry		

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	1. Fowls	2012	1851109 Nos.
	2. Ducks	2012	551433 Nos.
	2. Others	2012	19778 Nos.
Industries	:	Handlooms, Handicrafts, Sericulture, Food Processing, Bamboo Processing, IT, Hydro Power and Tourism.	

Project Road

Project Road of Maram to Peren starts from 3-Legged junction with NH 2 (Old NH-39) at Maram village (Ch.0.000 km) and ends at Dzuko Bridge near Peren town (Ch. 109.767 km). The entire corridor falls under Senapati district in the state of Manipur.

Location Map of the project road stretch is enclosed in **Figure 2.1**

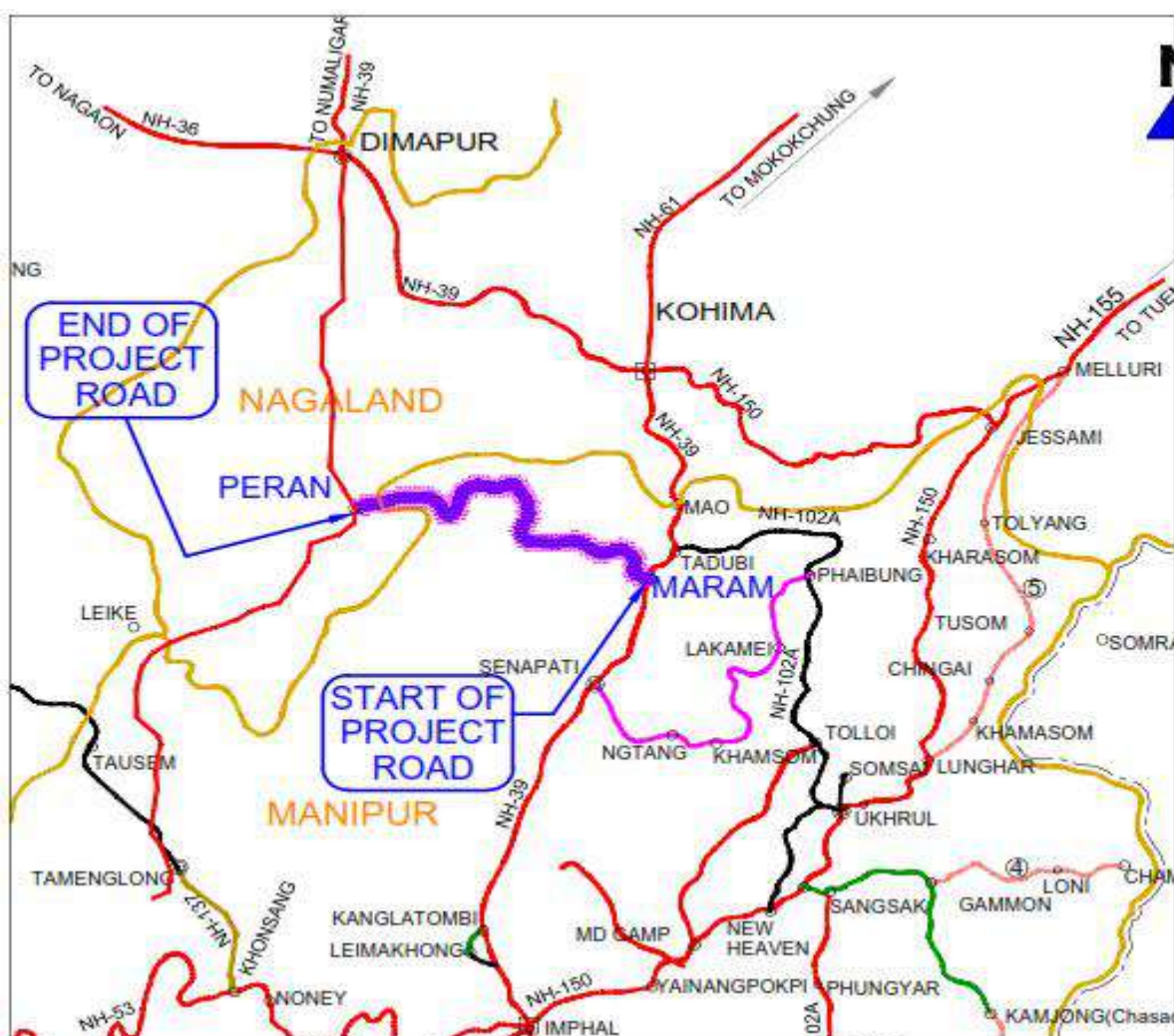


Figure 2.1: Location Map of Maram – Peren Road

The Project Districts

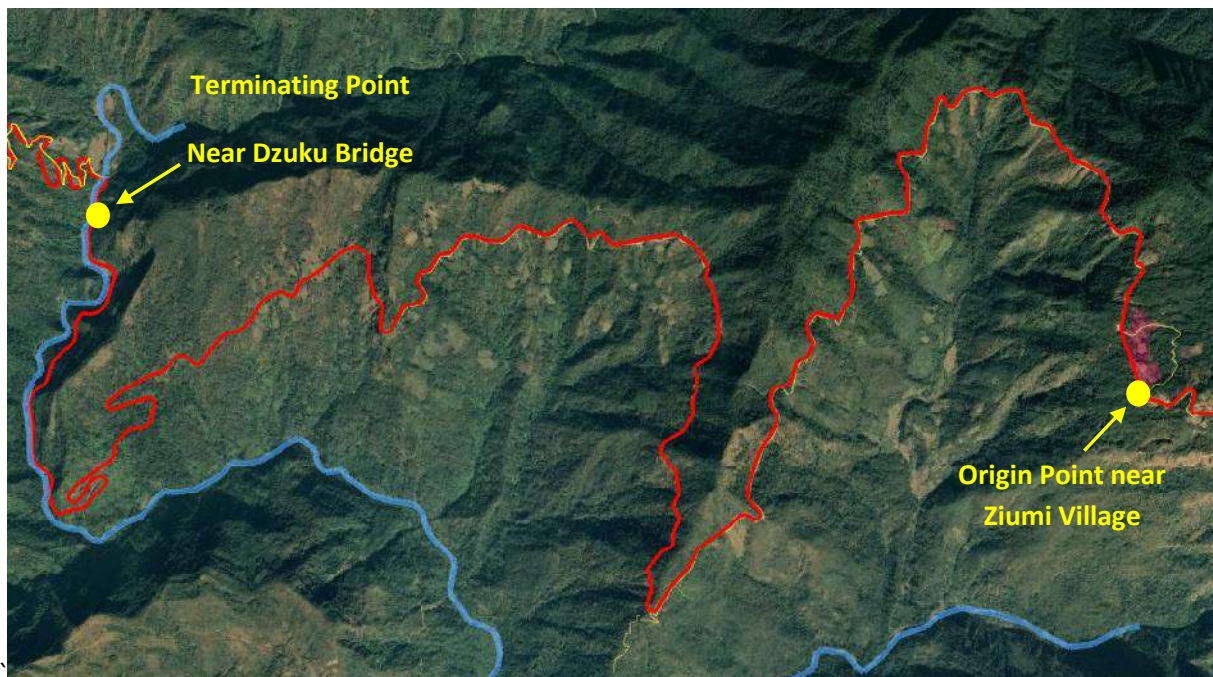
The project road stretch from Maram-Peren falls under Senapati district of Manipur.

Senapati District

The Senapati District was earlier known as Manipur North District which came into existence on 14 November 1969 with its headquarters at Karong. Later the district headquarter was shifted to Senapati on 13 December 1976. The District came to be known as Senapati District on 15 July 1983. The Senapati District is located in the northern part of the state of Manipur. It is bounded on the east by the Ukhrul District; on the west by Tamenglong District; on the north by the Phek District, state of Manipur; and on the south by the Imphal East and Imphal West Districts. The District is at an altitude varying from 1061 m to 1788 m above sea level. The hills run along the north south direction and gradually slope down towards south and meet the Imphal Valley.

A Key plan of Maran - Peren road is shown in **Figure 2.2**

Figure 2.2: Key Plan of Package – III of Maram-Peren Road



2.3 Over view of NHIDCL Organization & Activities

National Highways and Infrastructure Development Corporation is a fully owned company of the Ministry of Road Transport & Highways, Government of India. The company promotes surveys, establishes, designs, builds, operates, maintains and upgrades National Highways and Strategic Roads including interconnecting roads in parts of the country which share international boundaries with neighboring countries. The regional connectivity so enhanced would promote cross border trade and commerce and help safeguard India's international borders. This would lead to the formation of a more integrated and economically consolidated South and South East Asia. In addition, there would be overall economic benefits for the local population and help integrate the peripheral areas with the mainstream in a more robust manner. An approximate aggregate length of 10,000 kms has been identified to begin with for development through this company. The company

envisages creating customized and specialized skills in terms of addressing issues like complexities of geographical terrains and addressing extensive coordination requirements with security agencies. The company would also endeavor to undertake infrastructure projects including but not restricted to urban infrastructure and urban or city transport and to act as an agency for development of all types of Infrastructure. The company envisages working towards cross sharing of technical know-how and enhancing opportunities for business development with other nations and their agencies including the multilateral organizations and institutions.

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

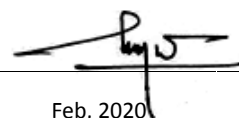
Mission of NHIDCL

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

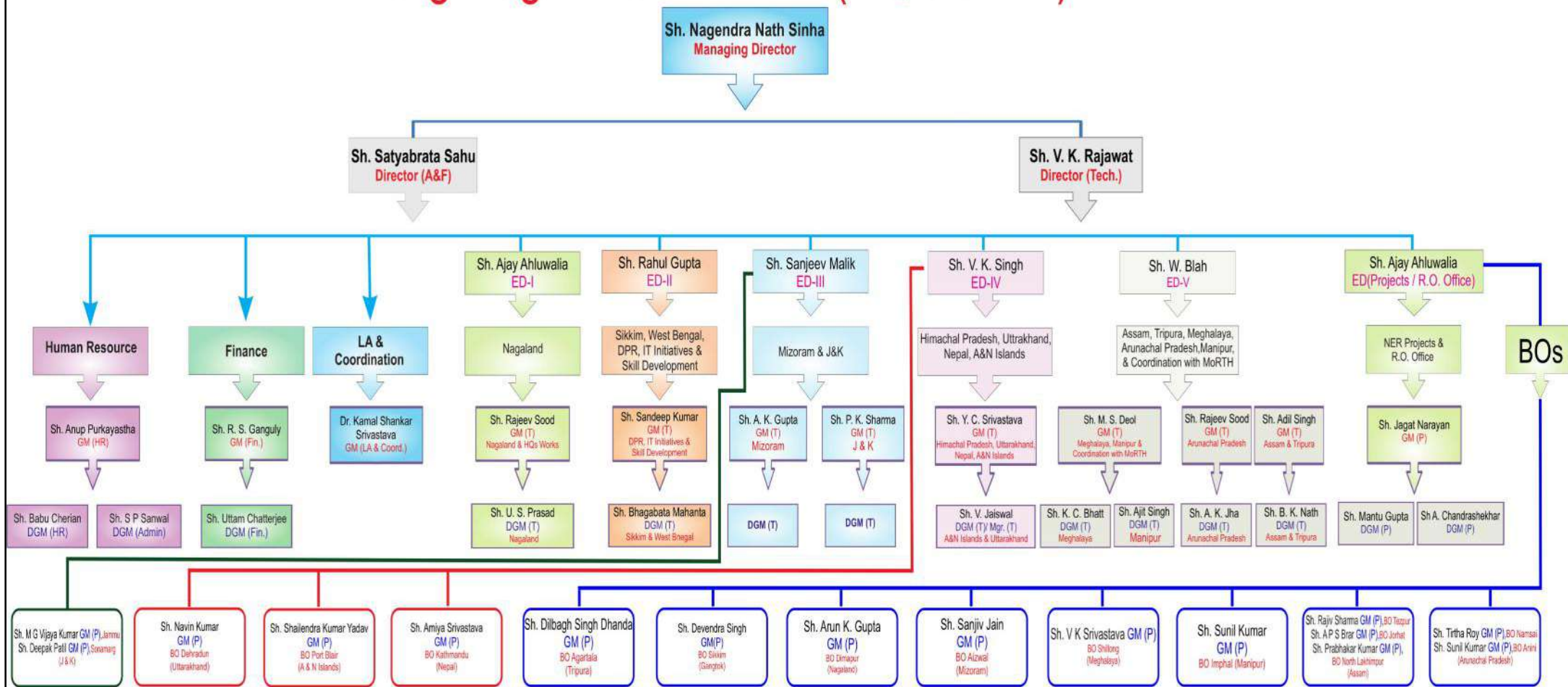
Vision of NHIDCL

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

Organizational Structure of NHIDCL is given below:



Organogram of NHIDCL (HQrs & RO)



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2.4 Objectives of Consultancy Services

The main objective of the consultancy service is to establish the technical, economical, and financial viability of the project and prepare detailed project reports for rehabilitation and upgrading of the existing road to 2-lane configuration.

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

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

Preparation of detailed project should incorporate aspects of value engineering, quality audit and safety audit requirement in design and implementation. Cost estimates along with Detailed Project Report should be given.

2.5 Scope of Consultancy Services

The broad area of scope of Consultancy services is given below:

- The widening/improvement work to 2 lane road shall be within the existing right of way avoiding land acquisition as far as possible with the provision of bypasses wherever required in urban areas. Proposal for land acquisition will be taken up as per revenue records for further processing of land acquisition document.
- Environmental Impact Assessment, Environmental Management Plan and Rehabilitation and Resettlement Studies shall be carried out as per the requirement and suggestion of NHIDCL.
- Preparation of the bid documents including required schedules preferably for EPC mode of documents. To assist the NHIDCL and its Financial Consultant and the Legal Adviser by furnishing clarifications as required for the financial appraisal and legal scrutiny of the Project Highway and Bid Documents.
- Review of all available reports and published information about the project road and the project influence area;
- Environmental and social impact assessment, including such as related to cultural properties, natural habitats, Involuntary resettlement etc.;
- Public consultation, including consultation with Communities located along the road, NGOs working in the area, other stake-holders and relevant Govt. departments at all the different stages of assignment (such as inception stage, feasibility stage, preliminary design stage and once final design are concretized).
- Detailed reconnaissance & reflection in the report;
- Identification of possible improvements in the existing alignment and bypassing congested locations with alternatives, evaluation of different alternatives comparison on techno-economic and other considerations and recommendations regarding most appropriate option.

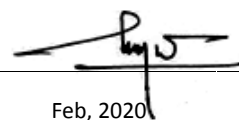
- Traffic studies including traffic surveys, Axle load survey and demand forecasting for next thirty years;
- Inventory and condition surveys for road;
- Inventory and condition surveys for bridges, cross-drainage structures, other structures, river bank training/protection works and drainage provisions;
- Detailed topographic surveys using mobile/aerial LiDAR or equivalent technology;
- Pavement investigations;
- Sub-grade characteristics and strength; investigation of required sub-grade and sub-soil characteristics and strength for road and embankment design all sub soil investigation;
- Identification of sources of construction materials;
- Detailed design of road, its x-sections, horizontal and vertical alignment and design of embankment of height more than 6m and also in poor soil conditions and where density consideration require, even lesser height embankment. Detailed design of structures preparation of GAD and construction drawings and cross-drainage structures and underpasses etc.
- Identification of the type and the design of intersections;
- Design of complete drainage system and disposal point for storm water.
- Value analysis / value engineering and project costing;
- Economic and financial analyses;
- Contract packaging and implementation schedule;
- Strip plan indicating the scheme for carriageway widening, location of all existing utility services (both over and underground) and the scheme for their relocation, trees to be felled; reports documents and drawings arrangement of estimates for cutting of trees and shifting of utilities from the concerned department;
- To find out financial viability of project for implementation and suggest the preferred mode on which the project is to be taken up.
- Preparation of detailed project report, cost estimate, approved for construction drawings, rate analysis, detailed bill of quantities, bid documents for execution of civil works through budgeting resources;
- Indicating the proposal of project facilities in the plan drawing
- Tie-in of on-going/sanctioned works of MORT&H/NHAI/other agencies;

Preparation of social plans for the project affected people as per policy of the lending agencies/Govt. of India R & R policy.

2.6 Stages of Submission

The project mainly comprises of 6 Stages from QAP/IR to DPR

- STAGE 1:** Inception Report
- STAGE 2:** Feasibility Report
- STAGE 3:** LA & Clearances I Report
- STAGE 4:** Detailed Project Report (DPR)
- STAGE 5:** Technical Schedules
- STAGE 6:** LA & Clearances II Report



2.7 Structure of the Report

Final Detailed Project Report (FDPR) consists of the following volumes:-

Volume – I: Main Report

- Chapter -1 : Executive Summary
- Chapter -2 : Introduction
- Chapter -3 : Project Description
- Chapter -4 : Engineering Surveys, Investigation and Analysis
- Chapter -5 : Social Analysis
- Chapter -6 : Traffic Surveys & Analysis
- Chapter -7 : Indicative Design Standards
- Chapter- 8: Cost Estimates
- Chapter -9 : Environmental Aspects
- Chapter -10 : Road Safety Audit
- Chapter -11 : Economic and Financial Analysis
- Chapter -12 : Conclusions & Recommendations

Volume – IA: Appendix to Main Report

Volume – II: Design Report

Volume – III: Materials Report

Volume – IV: Environmental Assessment Report including Environmental Management Plan (EMP) and Resettlement Action Plan (RAP)

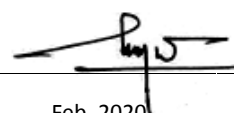
Volume – V: Technical Specifications

Volume – VI: Rate Analysis

Volume – VII: Cost Estimates

Volume – VIII: Bill of Quantities

Volume – IX: Drawing Volume



CHAPTER-3 PROJECT DESCRIPTION

3.1 EXISTING SCENARIO

3.1.1 START AND END POINT OF THE PROJECT ROAD

The name of the road as per offer and agreement is Maram - Peren section of NH-129A in the state of Manipur. The existing road starts near Ziumi Village and passes through Ziumi center Village, Tamphung Village and ends at Dzuko bridge near Peren town. The project road lies under Senapati district in the state of Manipur. The length of the road as per topography survey comes out as 32.967 km.

Packaging details are summarized in below table 3.1.

Table 3.1: Package Details

Existing Chainage (Km)		Existing Length (KM)	Design Chainage (Km)		Design Length (KM)	Package No	State
From	To		From	To			
74+800	87+496	12.696	75+000	87+350	12.350	PKG-IIIA	Manipur
87+496	109+767	20.271	87+350	109+494	22.144	PKG-IIIB	
Total existing length		32.967	Total design length		34.494		

3.1.2 SETTLEMENT

The existing road passes through village / localities namely Ziumi village and Tamphung Village. Details are given in Table-3.2:

TABLE- 3.2: DETAILS OF SETTLEMENT/HABITATIONAL AREA

Sl. No.	Chainage		Name of Village
	From	To	
1	75+000	87+350	Ziumi
2	87+350	109+494	Tamphung

The highlighted habitations shown in Table: 3.2 represent the major habitations along the project road.

3.1.3 LAND USE PATTERN

The project is located in the moderately high rainfall area. Project road passes through forest area. However, the stretch does not pass through any wildlife sanctuary or eco sensitive zone.

3.1.4 RIGHT OF WAY (ROW)

The existing ROW is found average 10 m (varies from 7.0 m to 16.4 m) along the project road. However, the existing ROW is not sufficient to accommodate proposed 2 laning proposal and hence additional land is to be acquired to implement the proposal. Details of Existing ROW are given below in Table-3.3:

TABLE- 3.3: DETAILS OF EXISTING RIGHT OF WAY (EROW)

Ext. Chainage	OFFSET DISTANCE FROM EXISTING CETRE LINE		Total EROW
	EROW(Left)	EROW(Right)	
Package-III			
74900	5.70	5.00	10.70
75000	4.80	5.00	9.80
75100	5.40	4.90	10.30
75200	5.10	4.30	9.40
75300	5.20	5.20	10.40
75400	5.20	4.70	9.90
75500	4.90	4.00	8.90
75600	4.90	4.70	9.60
75700	5.30	4.80	10.10
75800	5.50	5.10	10.60
75900	5.60	4.60	10.20
76000	4.00	5.60	9.60
76100	4.00	5.50	9.50
76200	3.60	5.80	9.40
76300	4.30	3.90	8.20
76400	4.90	2.40	7.30
76500	3.90	4.80	8.70
76600	4.70	4.70	9.40
76700	4.20	5.50	9.70
76800	5.30	3.90	9.20
76900	4.10	4.20	8.30
77000	4.80	4.00	8.80
77100	4.80	4.50	9.30
77200	4.00	4.00	8.00
77300	4.30	4.60	8.90
77400	3.80	5.20	9.00
77500	4.30	4.80	9.10
77600	4.30	4.40	8.70
77700	4.80	3.50	8.30
77800	4.20	4.10	8.30
77900	4.60	4.30	8.90
78000	3.80	4.00	7.80
78100	3.90	3.90	7.80
78200	4.50	4.00	8.50
78300	4.30	3.80	8.10
78400	5.60	4.00	9.60
78500	4.40	4.00	8.40

Ext. Chainage	OFFSET DISTANCE FROM EXISTING CETRE LINE		Total EROW
	EROW(Left)	EROW(Right)	
78600	4.80	4.40	9.20
78700	4.40	4.90	9.30
78800	4.90	4.30	9.20
78900	4.10	3.70	7.80
79000	5.70	4.40	10.10
79100	4.80	4.10	8.90
79200	3.80	4.60	8.40
79300	4.40	4.30	8.70
79400	4.60	3.90	8.50
79500	4.30	4.30	8.60
79600	4.30	4.50	8.80
79700	3.20	4.40	7.60
79800	4.70	4.70	9.40
79900	4.50	4.20	8.70
80000	4.00	4.00	8.00
80100	5.00	4.00	9.00
80200	4.80	4.30	9.10
80300	4.70	3.80	8.50
80400	4.10	4.00	8.10
80500	5.20	4.30	9.50
80600	5.20	3.90	9.10
80700	6.30	4.30	10.60
80800	5.80	4.90	10.70
80900	5.30	4.10	9.40
81000	5.50	4.40	9.90
81100	5.20	5.10	10.30
81200	5.00	4.80	9.80
81300	5.20	4.30	9.50
81400	5.30	5.10	10.40
81500	5.90	4.50	10.40
81600	4.80	4.10	8.90
81700	4.30	4.30	8.60
81800	5.40	3.90	9.30
81900	4.70	4.00	8.70
82000	6.00	5.10	11.10
82100	5.10	4.90	10.00
82200	4.40	3.90	8.30
82300	6.30	3.90	10.20
82400	4.00	3.90	7.90

Ext. Chainage	OFFSET DISTANCE FROM EXISTING CETRE LINE		Total EROW
	EROW(Left)	EROW(Right)	
82500	4.30	4.30	8.60
82600	5.30	4.70	10.00
82700	5.50	4.70	10.20
82800	4.60	5.20	9.80
82900	5.30	4.20	9.50
83000	5.20	4.40	9.60
83100	5.30	4.80	10.10
83300	5.30	4.70	10.00
83400	5.40	4.80	10.20
83500	5.20	5.30	10.50
83600	5.20	5.10	10.30
83700	6.60	5.50	12.10
83900	6.10	4.70	10.80
84000	4.90	4.40	9.30
84100	5.20	4.70	9.90
84200	5.30	4.30	9.60
84300	5.60	5.50	11.10
84400	4.80	5.50	10.30
84500	4.90	4.20	9.10
84600	4.80	4.50	9.30
84700	4.70	5.30	10.00
84800	5.30	4.60	9.90
84900	5.30	5.10	10.40
85000	4.80	4.90	9.70
85100	4.20	4.30	8.50
85200	3.40	4.30	7.70
85300	5.30	4.30	9.60
85400	3.60	4.20	7.80
85500	3.70	4.80	8.50
85600	4.70	4.40	9.10
85700	3.90	4.70	8.60
85800	5.20	4.70	9.90
85900	5.30	4.50	9.80
86000	5.10	4.40	9.50
86100	5.40	3.90	9.30
86200	3.80	4.60	8.40
86300	4.90	4.10	9.00
86400	5.10	4.40	9.50
86500	4.60	4.80	9.40

Ext. Chainage	OFFSET DISTANCE FROM EXISTING CETRE LINE		Total EROW
	EROW(Left)	EROW(Right)	
86600	4.60	4.80	9.40
86700	6.00	4.40	10.40
86800	5.00	5.10	10.10
86900	5.00	4.90	9.90
87000	4.60	4.90	9.50
87100	4.90	4.90	9.80
87200	4.90	4.50	9.40
87300	4.60	4.10	8.70
87400	5.20	4.70	9.90
87500	5.10	5.80	10.90
87600	4.70	4.60	9.30
87700	4.70	3.80	8.50
87800	6.10	4.70	10.80
87900	4.80	3.00	7.80
88000	5.00	4.20	9.20
88100	4.30	3.80	8.10
88200	4.30	4.20	8.50
88300	3.40	3.80	7.20
88400	3.90	4.40	8.30
88500	5.60	4.20	9.80
88600	4.10	3.80	7.90
88700	4.10	4.00	8.10
88800	4.20	3.60	7.80
88900	4.10	4.40	8.50
89000	4.20	4.40	8.60
89100	4.70	4.60	9.30
89200	4.20	3.80	8.00
89300	4.00	3.90	7.90
89400	4.70	4.60	9.30
89500	4.80	3.90	8.70
89600	4.60	4.80	9.40
89700	5.20	4.70	9.90
89800	4.80	5.50	10.30
89900	4.50	4.40	8.90
90000	4.10	3.90	8.00
90100	4.30	4.50	8.80
90200	5.60	3.60	9.20
90300	4.10	3.50	7.60
90400	4.40	4.80	9.20



Ext. Chainage	OFFSET DISTANCE FROM EXISTING CETRE LINE		Total EROW
	EROW(Left)	EROW(Right)	
90500	4.60	4.90	9.50
90600	3.80	4.20	8.00
90700	5.30	4.70	10.00
90800	5.70	4.80	10.50
90900	4.90	5.30	10.20
91000	5.20	6.10	11.30
91100	4.50	5.00	9.50
91200	5.50	4.80	10.30
91300	5.20	4.40	9.60
91400	4.70	5.20	9.90
91500	6.20	5.80	12.00
91600	5.00	5.50	10.50
91700	4.80	4.60	9.40
91800	5.10	8.40	13.50
91900	4.90	4.40	9.30
92000	4.90	4.70	9.60
92100	5.50	4.50	10.00
92200	5.80	4.30	10.10
92300	5.90	4.90	10.80
92400	4.90	4.90	9.80
92500	6.10	5.30	11.40
92600	5.00	5.50	10.50
92700	7.90	5.30	13.20
92800	6.10	5.40	11.50
92900	5.50	5.00	10.50
93000	7.90	4.80	12.70
93100	5.30	3.80	9.10
93200	4.90	4.20	9.10
93300	4.90	4.40	9.30
93400	6.50	4.40	10.90
93500	4.20	4.20	8.40
93600	4.00	3.50	7.50
93700	5.30	4.40	9.70
93800	5.10	4.30	9.40
93900	5.60	4.20	9.80
94000	4.40	4.60	9.00
94100	5.30	4.80	10.10
94200	5.40	4.60	10.00
94300	5.50	4.50	10.00



Ext. Chainage	OFFSET DISTANCE FROM EXISTING CETRE LINE		Total EROW
	EROW(Left)	EROW(Right)	
94400	4.70	4.30	9.00
94500	4.60	4.60	9.20
94600	5.00	4.30	9.30
94700	6.10	4.70	10.80
94800	4.60	4.90	9.50
94900	4.80	4.90	9.70
95000	6.00	4.60	10.60
95100	4.60	3.80	8.40
95200	5.40	4.60	10.00
95300	4.40	4.90	9.30
95400	6.20	4.90	11.10
95600	5.00	4.70	9.70
95700	5.50	4.20	9.70
95800	4.20	4.20	8.40
95900	4.90	4.00	8.90
96000	4.70	4.60	9.30
96100	5.00	4.90	9.90
96200	4.70	4.40	9.10
96300	4.10	4.30	8.40
96400	4.80	4.80	9.60
96500	4.80	4.20	9.00
96600	4.70	4.70	9.40
96700	4.30	4.30	8.60
96800	4.30	4.70	9.00
96900	4.60	5.00	9.60
97000	4.70	4.10	8.80
97100	4.40	4.40	8.80
97200	5.60	4.30	9.90
97300	4.70	5.00	9.70
97400	4.90	4.80	9.70
97500	5.00	5.40	10.40
97600	5.80	3.40	9.20
97700	4.60	4.60	9.20
97800	5.40	4.20	9.60
97900	4.90	5.10	10.00
98000	5.90	4.10	10.00
98100	5.10	4.60	9.70
98200	5.50	4.40	9.90
98300	5.10	4.00	9.10



Ext. Chainage	OFFSET DISTANCE FROM EXISTING CETRE LINE		Total EROW
	EROW(Left)	EROW(Right)	
98400	5.30	4.30	9.60
98500	5.70	4.90	10.60
98600	5.30	4.90	10.20
98700	5.20	4.60	9.80
98800	6.10	4.50	10.60
98900	4.40	5.10	9.50
99000	6.10	3.90	10.00
99100	4.70	4.90	9.60
99200	5.00	4.50	9.50
99300	5.50	4.30	9.80
99400	4.60	3.50	8.10
99500	5.00	4.80	9.80
99600	6.30	4.40	10.70
99700	4.70	4.50	9.20
99800	4.60	4.30	8.90
99900	4.80	4.20	9.00
100000	5.50	4.20	9.70
100100	3.80	4.60	8.40
100200	5.10	4.20	9.30
100300	4.30	5.20	9.50
100400	4.00	4.20	8.20
100500	5.00	5.30	10.30
100600	4.90	5.30	10.20
100700	5.60	4.40	10.00
100800	4.00	4.50	8.50
100900	5.60	5.00	10.60
101000	5.70	4.60	10.30
101100	5.20	4.60	9.80
101200	5.50	4.30	9.80
101300	4.90	4.90	9.80
101400	5.20	5.20	10.40
101500	4.50	4.80	9.30
101600	4.10	4.30	8.40
101700	4.60	4.30	8.90
101800	4.70	5.10	9.80
101900	4.60	4.60	9.20
102000	5.90	5.60	11.50
102100	5.60	5.00	10.60
102200	3.80	4.50	8.30



Ext. Chainage	OFFSET DISTANCE FROM EXISTING CETRE LINE		Total EROW
	EROW(Left)	EROW(Right)	
102300	5.20	5.10	10.30
102400	4.00	5.00	9.00
102500	4.60	3.70	8.30
102600	5.00	3.70	8.70
102700	4.30	5.80	10.10
102800	5.10	5.00	10.10
102900	5.20	4.70	9.90
103000	4.20	4.60	8.80
103100	4.10	3.00	7.10
103200	4.30	4.00	8.30
103300	4.40	4.40	8.80
103400	5.20	3.10	8.30
103500	4.20	4.10	8.30
103600	5.60	4.50	10.10
103700	4.90	4.30	9.20
103800	5.30	5.90	11.20
103900	4.10	4.60	8.70
104100	4.00	3.90	7.90
104200	4.30	3.70	8.00
104300	4.40	3.40	7.80
104400	4.00	4.50	8.50
104500	4.70	4.00	8.70
104600	5.00	3.90	8.90
104700	4.30	3.80	8.10
104800- 108300	Land Slide Zone		
108.300	3.60	7.30	10.90
108.400	3.00	5.80	8.80
108.500	7.80	3.90	11.70
108.600	4.40	4.20	8.60
108.700	2.00	6.70	8.70
108.800	4.20	3.80	8.00
109.000	3.40	3.60	7.00
109.100	5.40	5.00	10.40
109.200	4.30	3.80	8.10
109.300	5.40	3.80	9.20
109.400	5.50	6.40	11.90
109.500	4.70	5.30	10.00
109.600	5.10	5.50	10.60
109.700	6.60	6.20	12.80



3.1.5 EXISTING ALIGNMENT

The horizontal alignment of the existing road has some locations which are sub-standard and has sharp curves including zigzag curve and hair-pin bends. Also, there is no proper transition length for most of the horizontal curves including the zigzag ones require to be providing for super elevation. These deficiencies have been corrected in fixing the horizontal alignment for the entire project road to conform to MoRT&H standards. The vertical alignment of the existing road is also deficient along a few locations of the alignment with proper gradient. The details of existing sharp/blind curves and hair pin bends are given below in **Table-3.4:**

TABLE- 3.4: DETAILS OF EXISTING SHARP/ BLIND CURVES AND HAIR PIN BENDS

Types of Curves	From (km)	To (km)
Sharp Curves/Blind Curves	Package : III	
	74+800	85+000
	89+500	99+250
Hair- Pin Bends	Package : III	
	85+750	88+250
	99+250	105+577

3.1.6 EXISTING PAVEMENT

The existing road is mostly Intermediate/two lane with earthen shoulder. The carriageway width of the existing road varies from 3.5 – 7.0 meter. Width of earthen shoulder varies from 0.50 – 2.5 meter. Hence, total formation width varies from 4.50 – 10.50 meter. Variation of Carriageway width is given below in **Table-3.5:**

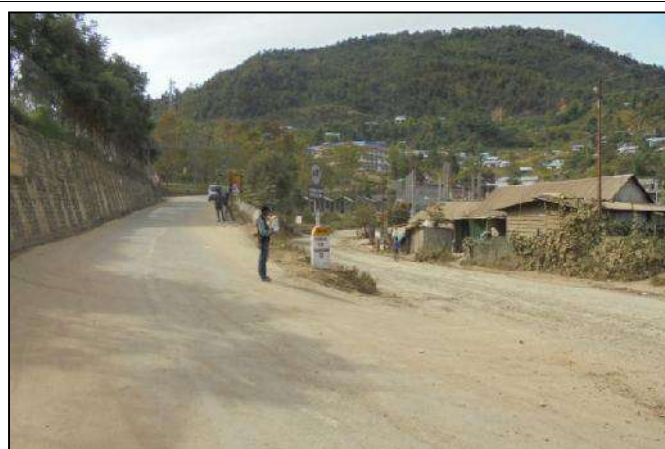
TABLE 3.5: VARIATION OF EXISTING CARRIAGEWAY WIDTH

Ext. Chainage (km)		Length(km)	Average Carriageway Width (m)
From	To		
Package: III			
74.800	84.500	9.700	7.0
84.500	105.930	21.430	3.5-6.0
105.930	107.916	1.986	No existing road
107.916	109.767	1.851	3.5-5.5

The existing pavement condition along the road varies from fair (around 16% of project road) to poor (around 84% of project road). It has been observed that some portion of the stretch the existing pavement is partially damaged with cracks, potholes, raveling and considerable amount of patching and some stretches have been observed as fully exposed. The summary of deflection of existing pavement is given below in **Table-3.6.**

TABLE- 3.6: SUMMARY OF PAVEMENT DEFLECTION

Ext. Chainage (km)		Deflection (mm/km) LHS	Deflection (mm/km) RHS	Maximum deflection (mm/km)
From	To			
0.000	1.000	1.025	0.853	0.939
1.000	2.000	1.004	0.651	0.828
2.000	3.000	0.827	0.468	0.648
3.000	4.000	0.975	0.546	0.760
4.000	5.000	0.464	0.535	0.499
5.000	6.000	0.584	0.483	0.533
6.000	7.000	0.599	0.562	0.580
7.000	8.000	0.585	0.517	0.551
8.000	9.000	0.555	0.473	0.514
9.000	10.000	0.538	0.622	0.580
10.000	11.000	0.597	0.519	0.558
11.000	12.000	1.475	1.929	1.702
12.000	13.000	0.929	0.542	0.735
13.000	14.000	0.738	0.616	0.677
17.000	18.000	0.587	0.665	0.626
18.000	19.000	0.435	0.631	0.533
19.000	20.000	0.659	0.630	0.645
20.000	21.000	0.779	0.584	0.682
21.000	22.000	0.585	0.565	0.575
81.000	82.000	0.826	0.760	0.793
82.000	83.000	0.800	0.678	0.739
83.000	84.000	0.796	0.752	0.774
84.000	85.000	0.755	0.714	0.734



Fair Condition of Pavement



Poor Condition of Pavement

3.1.7 EXISTING JUNCTION

There 6 nos. existing Minor Junction on the project stretch. Details of the Major Junction are given below in **Table-3.7**

TABLE- 3.7: DETAILS OF MAJOR JUNCTION

Sl. No.	Ext. Chainage (km)	Name of Junction	Type of Junction	Leads To
Nil				

3.1.8 EXISTING BRIDGES AND CULVERTS

BRIDGES:

There are 1 nos. of minor bridge (1 no. of RCC T Girder Bridge) and 1 no. of major bridge present in the project stretch. Package wise details are given below in **Table-3.8** (marked one is major bridge):

TABLE- 3.8: DETAILS OF EXISTING BRIDGES ALONG THE PROJECT ROAD

Sl. No.	Chainage (km)	Name of River /Stream	Type of Bridge	Span Arrangement (Expansion joint to Expansion joint) (m)	Clear Roadway between kerbs (m)	Total outer to outer width of Bridge(m)
Package: III (2 Nos.)						
1	75.865	STREAM	RCC T GIRDER	1 X 16.60	7.60	11.90
2	109.735	DZUKO RIVER	COMPOSITE BRIDGE WITH STEEL STRUCTURE	1x 66.48	12.00	12.60



Existing Steel Truss Bridge at Ch-109.735 km

CULVERTS:

There are 402 nos. of existing culverts (including 52 nos. of Slab Culverts, 346 nos. of Pipe Culverts, 1 no. of Arch Culverts and 3 nos. of culvert covered by soil) observed on the project road. Package wise details are given below in **Table-3.9**.

TABLE- 3.9: DETAILS OF EXISTING CULVERTS ALONG THE PROJECT ROAD

Sl. No.	Chainage (km)	Type of Structures (Pipe/ Slab/ Box/ Arch)	Span Arrangement (No. x Length) (m)	Carriageway Width (m)	Width of Culvert (m)
Package-III (142 Nos.)					
1	75.230	Pipe culvert	2×1.0	-	-
2	75.331	Pipe culvert	2×1.0	-	-
3	75.430	Pipe culvert	2×1.2	-	-
4	75.718	Slab culvert	1×4.0	-	-
5	75.932	Pipe culvert	2×1.0	-	-
6	76.378	Pipe culvert	2×1.0	-	-
7	76.460	Slab culvert	1×1.2	-	-
8	76.612	Pipe culvert	1×1.0	-	-
9	76.876	Slab culvert	1×1.2	-	-
10	77.070	Pipe culvert	2×1.0	-	-
11	77.200	Pipe culvert	2×1.0	-	-
12	77.575	Pipe culvert	2×1.0	-	-
13	77.748	Pipe culvert	2×1.0	-	-
14	78.163	Pipe culvert	2×1.0	-	-
15	78.363	Pipe culvert	2×1.0	-	-
16	78.642	Pipe culvert	2×1.0	-	-
17	78.942	Pipe culvert	2×1.0	-	-
18	79.130	Pipe culvert	2×1.0	-	-
19	79.324	Pipe culvert	2×0.9	-	-
20	79.503	Pipe culvert	2×0.9	-	-
21	79.706	Pipe culvert	2×1.0	-	-
22	79.844	Pipe culvert	2×1.0	-	-
23	80.037	Pipe culvert	2×0.9	-	-
24	80.460	Pipe culvert	2×0.9	-	-
25	80.728	Pipe culvert	2×1.0	-	-
26	81.180	Pipe culvert	2×1.0	-	-
27	81.405	Pipe culvert	2×1.0	-	-
28	81.635	Pipe culvert	2×1.0	-	-
29	81.913	Pipe culvert	2×0.9	-	-
30	82.010	Pipe culvert	2×0.9	-	-
31	82.107	Pipe culvert	2X1.0	-	-
32	82.633	Pipe culvert	1X1.2	-	-
33	82.792	Pipe culvert	1X1.0	-	-
34	82.968	Pipe culvert	2×1.0	-	-
35	83.152	Pipe culvert	2×1.0	-	-
36	83.264	Pipe culvert	2X1.0	-	-
37	83.606	Pipe culvert	2X1.2	-	-
38	83.769	Pipe culvert	2×1.0	-	-
39	84.074	Pipe culvert	2X1.0	-	-
40	84.267	Pipe culvert	2X1.0	-	-
41	84.402	Pipe culvert	2X1.0	-	-

Sl. No.	Chainage (km)	Type of Structures (Pipe/ Slab/ Box/ Arch)	Span Arrangement (No. x Length) (m)	Carriageway Width (m)	Width of Culvert (m)
42	84.460	Pipe culvert	1X1.0	-	-
43	84.553	Pipe culvert	1X1.2	-	-
44	84.760	Pipe culvert	2X0.6	-	-
45	85.578	Pipe culvert	2X1.2	-	-
46	85.918	Pipe culvert	2X1.0	-	-
47	86.140	COVERED BY SOIL	-	-	-
48	86.595	Pipe culvert	2X1.0	-	-
49	86.880	COVERED BY SOIL	-	-	-
50	87.281	COVERED BY SOIL	2X1.0	-	-
51	87.887	Pipe culvert	2X1.0	-	-
52	88.202	Pipe culvert	2X1.0	-	-
53	88.400	Pipe culvert	2X1.2	-	-
54	88.628	Pipe culvert	2X1.0	-	-
55	88.932	Pipe culvert	1X1.0	-	-
56	89.368	Pipe culvert	1X1.0	-	-
57	89.989	Pipe culvert	2X1.0	-	-
58	90.105	Pipe culvert	2X1.0	-	-
59	90.110	Pipe culvert	1X1.2	-	-
60	90.176	Slab culvert	1X1.0	-	-
61	90.238	Pipe culvert	1X1.2	-	-
62	90.440	Pipe culvert	2X1.0	-	-
63	90.750	ARCH CULVERT	1X1.0	-	-
64	91.014	Pipe culvert	2X1.0	-	-
65	91.263	Pipe culvert	2X1.0	-	-
66	91.442	Slab culvert	1X1.5	-	-
67	91.927	Slab culvert	1X1.5	-	-
68	91.775	Slab culvert	1X1.5	-	-
69	91.925	Slab culvert	1X1.5	-	-
70	92.052	Slab culvert	1X1.5	-	-
71	92.283	Slab culvert	1X1.5	-	-
72	92.644	Slab culvert	1X2.0	-	-
73	92.837	Slab culvert	1X1.5	-	-
74	93.060	Slab culvert	1X1.5	-	-
75	93.187	Slab culvert	1X2.0	-	-
76	93.610	Slab culvert	1X1.5	-	-
77	93.747	Slab culvert	1X1.5	-	-
78	93.910	Slab culvert	1X1.5	-	-
79	94.125	Slab culvert	1X1.5	-	-
80	94.270	Slab culvert	1x1.5	-	-
81	94.378	Slab culvert	1x1.5	-	-
82	94.628	Slab culvert	1x1.5	-	-
83	94.737	Slab culvert	1x1.5	-	-
84	94.960	Slab culvert	1x3.0	-	-

Sl. No.	Chainage (km)	Type of Structures (Pipe/ Slab/ Box/ Arch)	Span Arrangement (No. x Length) (m)	Carriageway Width (m)	Width of Culvert (m)
85	95.062	Slab culvert	1x3.0	-	-
86	95.148	Slab culvert	1X1.5	-	-
87	95.310	Slab culvert	1X1.5	-	-
88	95.436	Slab culvert	1x3.0	-	-
89	95.627	Slab culvert	1X4	-	-
90	95.763	Pipe culvert	2X1.0	-	-
91	95.842	Pipe culvert	2X1.0	-	-
92	95.898	Pipe culvert	2X1.0	-	-
93	96.166	Pipe culvert	2X1.0	-	-
94	96.290	Slab culvert	1X2.5	-	-
95	96.433	Pipe culvert	2X1.0	-	-
96	96.560	Pipe culvert	2X1.0	-	-
97	96.835	Pipe culvert	2X1.0	-	-
98	97.098	Pipe culvert	2X1.0	-	-
99	97.602	Pipe culvert	2X1.0	-	-
100	97.707	Pipe culvert	2X1.0	-	-
101	97.850	Slab culvert	1X2.0	-	-
102	97.892	Pipe culvert	2X1.0	-	-
103	98.065	Pipe culvert	2X1.0	-	-
104	98.272	Pipe culvert	2X1.0	-	-
105	98.428	Pipe culvert	2X1.0	-	-
106	99.518	Pipe culvert	2X1.0	-	-
107	98.540	Slab culvert	1X5.8	-	-
108	98.654	Pipe culvert	2X1.0	-	-
109	98.910	Pipe culvert	2X1.0	-	-
110	98.966	Pipe culvert	2X1.0	-	-
111	99.066	Pipe culvert	2X1.0	-	-
112	99.288	Pipe culvert	2X1.0	-	-
113	99.518	Pipe culvert	2X1.0	-	-
114	99.625	Pipe culvert	2X1.0	-	-
115	99.730	Pipe culvert	2X1.0	-	-
116	99.855	Pipe culvert	2X1.0	-	-
117	100.014	Pipe culvert	2X1.0	-	-
118	100.109	Pipe culvert	2X1.0	-	-
119	100.328	Pipe culvert	2X1.0	-	-
120	100.400	Pipe culvert	2X1.0	-	-
121	100.571	Pipe culvert	2X1.0	-	-
122	100.740	Pipe culvert	2X1.0	-	-
123	100.793	Pipe culvert	2X1.0	-	-
124	100.952	Pipe culvert	2X1.0	-	-
125	101.334	Pipe culvert	2X1.0	-	-
126	101.548	Pipe culvert	2X1.0	-	-
127	101.705	Pipe culvert	2X1.0	-	-

Sl. No.	Chainage (km)	Type of Structures (Pipe/ Slab/ Box/ Arch)	Span Arrangement (No. x Length) (m)	Carriageway Width (m)	Width of Culvert (m)
128	101.896	Pipe culvert	2X1.0	-	-
129	102.080	Pipe culvert	2X1.0	-	-
130	102.352	Pipe culvert	2X1.0	-	-
131	102.428	Pipe culvert	2X1.0	-	-
132	102.570	Pipe culvert	2X1.0	-	-
133	102.823	Pipe culvert	2X1.0	-	-
134	102.900	Pipe culvert	2X1.0	-	-
135	103.350	Pipe culvert	2X1.0	-	-
136	103.462	Pipe culvert	2X1.0	-	-
137	103.790	Pipe culvert	2X1.0	-	-
138	104.260	Pipe culvert	2X1.0	-	-
139	104.342	Pipe culvert	2X1.0	-	-
140	104.440	Pipe culvert	2X1.0	-	-
141	104.619	Pipe culvert	2X1.0	-	-
142	105.426	Pipe culvert	2X1.0	-	-

3.1.9 FOREST STRETCH

Project road passes through forest area. However, the stretch does not pass through any wildlife sanctuary or eco-sensitive zone.

3.1.10 ROADWAY DRAINAGE

Side drains (Lined & Unlined) are present in the few stretches in the built up area & unlined drain is also present in few stretches in the hill side. So most of the portion of the project road stretch is being affected by rain water and seepage water from hilly portion due to poor condition of existing side drains. Details of existing length of the drain are given below:

Length of Lined Drain = 60 m

Length of Earthen Drain = 12685 m (on hill side)

3.1.11 PHOTOGRAPH OF EXISTING ROAD

Photograph of existing road corridor is presented below:

EXISTING ROAD PHOTOGRAPH



RCC T-Girder Bridge (Ch-76.081 km)



Hard Rock Zone (Ch-78.000 km)



Gravel Road (Ch-100.000 km)



Dzuku Bridge (Ch-106.090 km)

3.1.12 PHOTOGRAPH OF FIELD WORK

Photograph of site visit along with road and structure inventory conducted at various locations on the project stretch is presented below:



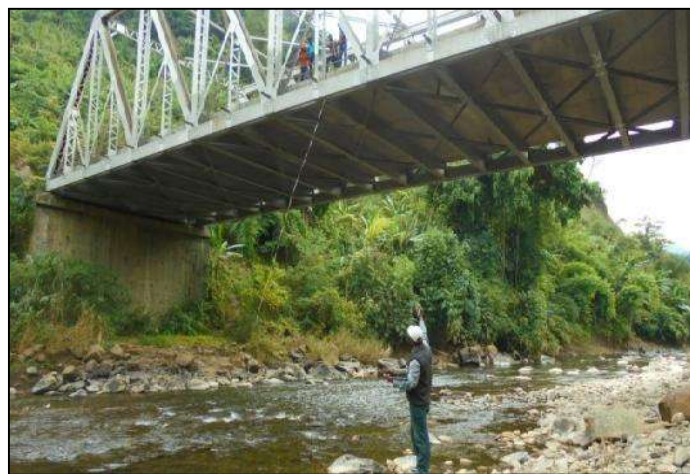
Culvert Inventory



Road Inventory by Odometer



Inventory through Sinking Zone



Dzuko Bridge Inventory



Topographic Survey



Trial Pit

3.2 DEVELOPMENT PROPOSAL

3.2.1 GEOMETRICS DESIGN

HORIZONTAL ALIGNMENT

Horizontal alignment of proposed 2 lane road has been designed as per the design speed mentioned in IRC: SP 73-2015 for mountainous terrain (i. e. Ruling = 60 Kmph & Limiting = 40 Kmph). However, design speed has been reduced up to 20 Kmph in case of hair pin bends as per guideline of Hill Road Manual.

Details of Horizontal Alignment Report indicating important features like curve radius, length, direction of curve, design speed, super elevation, extra widening etc. are presented below in **Table 3.10** along with Vertical report given in **Table 3.11**

TABLE- 3.10: HORIZONTAL ALIGNMENT REPORT

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
Package: III															
						Transition	74955.729	74980.729		25					
685	588056.431	2822142.034	30	50	15.99	Arc	74980.729	75023.786		43.058	80	Left	7	40	0.9
						Transition	75023.786	75048.786		25					
						Straight	75048.786	75111.196	62.410						
						Transition	75111.196	75151.196		40					
686	587944.047	2822028.539	25	49	18.49	Arc	75151.196	75173.730		22.534	50	Right	7	40	1.2
						Transition	75173.730	75213.730		40					
						Straight	75213.730	75222.727	8.997						
						Transition	75222.727	75247.727		25					
687	587849.979	2822058.414	21	0	14.08	Arc	75247.727	75277.054		29.327	80	Right	7	40	0.9
						Transition	75277.054	75302.054		25					
						Straight	75302.054	75315.039	12.985						
						Transition	75315.039	75345.039		30					
688	587810.156	2822136.613	24	53	11.85	Arc	75345.039	75358.069		13.031	30	Right	7	30	1.5
						Transition	75358.069	75388.069		30					
						Straight	75388.069	75389.486	1.417						
						Transition	75389.486	75419.486		30					
689	587855.349	2822187.802	4	3	48.42	Arc	75419.486	75421.968		2.482	35	Left	7	30	1.5
						Transition	75421.968	75451.968		30					



HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Straight	75451.968	75463.701	11.733						
						Transition	75463.701	75488.701		25					
690	587860.77	2822261.512	7	18	34.27	Arc	75488.701	75501.459		12.758	100	Right	7	40	0.9
						Transition	75501.459	75526.459		25					
						Straight	75526.459	75567.233	40.774						
691	587894.96	2822357.042	11	11	5.09	Arc	75567.233	75625.796		58.563	300	Left	Normal Camber	40	0.6
						Straight	75625.796	75685.041	59.245						
						Transition	75685.041	75700.041		15					
692	587918.142	2822483.914	22	57	52.45	Arc	75700.041	75750.142		50.101	125	Right	5.7	40	0.6
						Transition	75750.142	75765.142		15					
						Straight	75765.142	75916.716	151.574						
						Transition	75916.716	75951.716		35					
693	588059.226	2822665.507	6	29	15.25	Arc	75951.716	75958.510		6.794	60	Left	7	40	1.2
						Transition	75958.510	75993.510		35					
						Straight	75993.510	75998.023	4.514						
						Transition	75998.023	76028.023		30					
694	588057.862	2822737.508	1	12	43.89	Arc	76028.023	76028.658		0.635	30	Left	7	30	1.5
						Transition	76028.658	76058.658		30					
						Straight	76058.658	76068.760	10.102						
						Transition	76068.760	76103.760		35					
695	587997.481	2822787.416	10	58	12.46	Arc	76103.760	76111.419		7.659	40	Right	7	30	1.5
						Transition	76111.419	76146.419		35					
						Straight	76146.419	76196.168	49.750						
						Transition	76196.168	76211.168		15					
696	587995.79	2822904.691	8	20	29.62	Arc	76211.168	76240.286		29.118	200	Right	3.6	40	0.6
						Transition	76240.286	76255.286		15					
						Straight	76255.286	76308.789	53.503						
						Transition	76308.789	76338.789		30					
697	588026.371	2823094.55	93	43	29.98	Arc	76338.789	76461.475		122.686	75	Left	7	40	1.2
						Transition	76461.475	76491.475		30					
						Straight	76491.475	76555.901	64.426						
						Transition	76555.901	76595.901		40					
698	587800.008	2823076.082	31	55	23.61	Arc	76595.901	76623.759		27.858	50	Right	7	40	1.2
						Transition	76623.759	76663.759		40					
						Straight	76663.759	76682.256	18.497						

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HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	76682.256	76697.256		15					
699	587745.63	2823168.419	11	41	59.05	Arc	76697.256	76738.096		40.84	200	Left	3.6	40	0.6
						Transition	76738.096	76753.096		15					
						Straight	76753.096	76834.218	81.122						
						Transition	76834.218	76874.218		40					
700	587646.972	2823300.662	21	27	56.15	Arc	76874.218	76892.951		18.732	50	Right	7	40	1.2
						Transition	76892.951	76932.951		40					
						Straight	76932.951	76956.507	23.556						
						Transition	76956.507	76986.507		30					
701	587688.154	2823405.099	7	44	47.34	Arc	76986.507	77006.787		20.28	150	Left	7	50	0.6
						Transition	77006.787	77036.787		30					
						Straight	77036.787	77065.718	28.931						
						Transition	77065.718	77080.718		15					
702	587702.993	2823494.051	3	31	19.2	Arc	77080.718	77093.013		12.294	200	Right	3.6	40	0.6
						Transition	77093.013	77108.013		15					
						Straight	77108.013	77125.079	17.066						
						Transition	77125.079	77160.079		35					
703	587718.963	2823574.606	17	42	43.59	Arc	77160.079	78.627		18.548	60	Left	7	40	1.2
						Transition	78.627	77213.627		35					
						Straight	77213.627	77259.271	45.645						
						Transition	77259.271	77289.271		30					
704	587647.387	2823682.379	7	41	51.24	Arc	77289.271	77309.424		20.152	150	Left	7	50	0.6
						Transition	77309.424	77339.424		30					
						Straight	77339.424	77449.940	110.516						
						Transition	77449.940	77479.940		30					
705	587490.646	2823793.774	9	2	15.41	Arc	77479.940	77503.600		23.66	150	Left	7	50	0.6
						Transition	77503.600	77533.600		30					
						Straight	77533.600	77574.737	41.137						
						Transition	77574.737	77614.737		40					
706	587370.226	2823835.815	12	12	10.16	Arc	77614.737	77625.386		10.649	50	Right	7	40	1.2
						Transition	77625.386	77665.386		40					
						Straight	77665.386	77681.638	16.252						
						Transition	77681.638	77716.638		35					
707	587330.306	2823926.455	6	11	33.6	Arc	77716.638	77723.123		6.485	60	Left	7	40	1.2
						Transition	77723.123	77758.123		35					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Straight	77758.123	77773.550	15.427						
						Transition	77773.550	77803.550		30					
708	587259.967	2823981.835	9	27	55.87	Arc	77803.550	77815.941		12.39	75	Right	7	40	1.2
						Transition	77815.941	77845.941		30					
						Straight	77845.941	77871.745	25.804						
						Transition	77871.745	77886.745		15					
709	587217.476	2824066.946	6	58	37.24	Arc	77886.745	77923.277		36.532	300	Left	3.7	50	0.6
						Transition	77923.277	77938.277		15					
						Straight	77938.277	78000.441	62.164						
						Transition	78000.441	78020.441		20					
710	587132.658	2824186.594	34	49	14.35	Arc	78020.441	78081.214		60.774	100	Left	7	40	0.9
						Transition	78081.214	78101.214		20					
						Straight	78101.214	78193.134	91.920						
						Transition	78193.134	78223.134		30					
711	586959.546	2824227.72	22	19	30.42	Arc	78223.134	78234.824		11.689	30	Right	7	30	1.5
						Transition	78234.824	78264.824		30					
						Straight	78264.824	78286.829	22.005						
						Transition	78286.829	78306.829		20					
712	586948.33	2824311.593	14	39	3.17	Arc	78306.829	78322.172		15.342	60	Left	6.7	30	1.2
						Transition	78322.172	78342.172		20					
						Straight	78342.172	78391.610	49.439						
						Transition	78391.610	78411.610		20					
713	586893.43	2824397.835	5	59	5.53	Arc	78411.610	78422.056		10.446	100	Right	7	40	0.9
						Transition	78422.056	78442.056		20					
						Straight	78442.056	78524.511	82.455						
						Transition	78524.511	78564.511		40					
714	586837.962	2824543.901	21	53	33.47	Arc	78564.511	78583.616		19.105	50	Left	7	40	1.2
						Transition	78583.616	78623.616		40					
						Straight	78623.616	78667.321	43.705						
						Transition	78667.321	78687.321		20					
715	586711.748	2824562.308	17	36	21.4	Arc	78687.321	78718.049		30.728	100	Left	7	40	0.9
						Transition	78718.049	78738.049		20					
						Straight	78738.049	78819.024	80.974						
						Transition	78819.024	78859.024		40					
716	586558.495	2824506.098	17	41	53.25	Arc	78859.024	78874.468		15.445	50	Right	7	40	1.2

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	78874.468	78914.468		40					
						Straight	78914.468	78959.887	45.419						
						Transition	78959.887	78979.887		20					
717	586431.127	2824594.623	46	21	57.17	Arc	78979.887	79060.810		80.924	100	Left	7	40	0.9
						Transition	79060.810	79080.810		20					
						Straight	79080.810	79094.596	13.786						
						Start	79094.596	79144.396	49.800						
						Transition	79144.396	79179.396		35					
718	586273.502	2824543.102	43	16	11.83	Arc	79179.396	79189.708		10.312	60	Left	7	40	1.2
						Transition	79189.708	79224.708		35					
						Straight	79224.708	79245.039	20.331						
719	586232.475	2824478.034	6	24	14.91	Arc	79245.039	79278.571		33.532	300	Right	Normal Camber	40	0.6
						Straight	79278.571	79316.694	38.122						
						Transition	79316.694	79356.694		40					
720	586144.513	2824385.32	115	38	38.45	Arc	79356.694	79417.612		60.918	50	Right	7	40	1.2
						Transition	79417.612	79457.612		40					
						Straight	79457.612	79461.777	4.165						
						Transition	79461.777	79501.777		40					
721	586021.106	2824509.353	144	28	2.43	Arc	79501.777	79587.849		86.072	50	Left	7	40	1.2
						Transition	79587.849	79627.849		40					
						Straight	79627.849	79686.548	58.699						
						Transition	79686.548	79706.548		20					
722	585971.409	2824328.618	26	49	31.89	Arc	79706.548	79733.367		26.819	100	Right	7	40	0.9
						Transition	79733.367	79753.367		20					
						Straight	79753.367	79821.977	68.611						
						Transition	79821.977	79846.977		25					
723	585902.891	2824215.576	25	23	22.67	Arc	79846.977	79857.428		10.451	80	Left	7	40	0.9
						Transition	79857.428	79882.428		25					
						Straight	79882.428	79991.520	109.092						
						Transition	79991.520	80006.520		15					
724	585880.188	2824058.114	9	27	53.1	Arc	80006.520	80016.299		9.779	150	Left	4.7	40	0.6
						Transition	80016.299	80031.299		15					
						Straight	80031.299	80069.579	38.280						
						Transition	80069.579	80089.579		20					
725	585881.079	2823973.157	19	16	44.68	Arc	80089.579	80103.228		13.648	100	Right	7	40	0.9

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	80103.228	80123.228		20					
						Straight	80123.228	80138.608	15.380						
						Transition	80138.608	80168.608		30					
726	585850.471	2823900.492	87	23	26.18	Arc	80168.608	80184.365		15.758	30	Right	7	30	1.5
						Transition	80184.365	80214.365		30					
						Straight	80214.365	80278.585	64.220						
						Transition	80278.585	80303.585		25					
727	585722.149	2823923.317	24	16	18.33	Arc	80303.585	80312.475		8.89	80	Left	7	40	0.9
						Transition	80312.475	80337.475		25					
						Straight	80337.475	80390.791	53.316						
						Transition	80390.791	80420.791		30					
728	585605.645	2823896.904	88	29	39.24	Arc	80420.791	80437.126		16.335	30	Left	7	30	1.5
						Transition	80437.126	80467.126		30					
						Straight	80467.126	80500.302	33.176						
						Transition	80500.302	80525.302		25					
729	585613.408	2823794.685	28	52	27.21	Arc	80525.302	80540.618		15.316	80	Left	7	40	0.9
						Transition	80540.618	80565.618		25					
						Straight	80565.618	80645.176	79.558						
						Transition	80645.176	80675.176		30					
730	585700.348	2823666.808	42	13	47.69	Arc	80675.176	80700.455		25.279	75	Right	7	40	0.9
						Transition	80700.455	80730.455		30					
						Straight	80730.455	80759.825	29.370						
						Transition	80759.825	80774.825		15					
731	585696.462	2823569.75	13	32	59.68	Arc	80774.825	80795.298		20.474	150	Left	4.7	40	0.6
						Transition	80795.298	80810.298		15					
						Straight	80810.298	80850.983	40.685						
732	585707.045	2823490.316	5	25	27.36	Arc	80850.983	80879.384		28.401	300	Right	Normal Camber	40	0.6
						Straight	80879.384	80969.489	90.104						
						Transition	80969.489	81009.489		40					
733	585701.148	2823326.377	92	21	27.6	Arc	81009.489	81050.086		40.597	50	Right	7	40	1.2
						Transition	81050.086	81090.086		40					
						Straight	81090.086	81167.530	77.444						
734	585528.178	2823311.671	13	51	20.85	Arc	81167.530	81240.079		72.549	300	Left	Normal Camber	40	0.6
						Straight	81240.079	81345.241	105.162						
735	585384.099	2823275.191	2	40	39.17	Arc	81345.241	81359.260		14.02	300	Right	Normal Camber	40	0.6

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Straight	81359.260	81529.770	170.510						
						Transition	81529.770	81554.770		25					
736	585159.622	2823217.102	110	56	57.67	Arc	81554.770	81607.227		52.457	40	Left	7	30	1.5
						Transition	81607.227	81632.227		25					
						Straight	81632.227	81657.168	24.940						
						Transition	81657.168	81672.168		15					
737	585223.399	2823088.466	49	35	21.02	Arc	81672.168	81765.355		93.187	125	Right	5.7	40	0.6
						Transition	81765.355	81780.355		15					
						Straight	81780.355	81818.374	38.019						
						Transition	81818.374	81843.374		25					
738	585191.789	2822961.231	48	49	44.62	Arc	81843.374	81852.463		9.089	40	Left	7	30	1.5
						Transition	81852.463	81877.463		25					
						Straight	81877.463	81889.701	12.238						
						Transition	81889.701	81909.701		20					
739	585218.516	2822888.583	138	21	4.12	Arc	81909.701	81937.994		28.294	20	Right	7	20	1.5
						Transition	81937.994	81957.994		20					
						Straight	81957.994	81984.907	26.913						
						Transition	81984.907	82004.907		20					
740	585126.763	2822895.491	111	23	38.98	Arc	82004.907	82023.791		18.884	20	Left	7	20	1.5
						Transition	82023.791	82043.791		20					
						Straight	82043.791	82102.759	58.968						
						Transition	82102.759	82122.759		20					
741	585126.721	2822778.547	21	56	5.61	Arc	82122.759	82141.043		18.284	100	Right	7	40	0.9
						Transition	82141.043	82161.043		20					
						Straight	82161.043	82189.520	28.477						
						Transition	82189.520	82209.520		20					
742	585102.47	2822686.486	31	28	27.52	Arc	82209.520	82244.453		34.933	100	Left	7	40	0.9
						Transition	82244.453	82264.453		20					
						Straight	82264.453	82351.017	86.565						
						Transition	82351.017	82371.017		20					
743	585136.992	2822533.322	26	11	28.94	Arc	82371.017	82396.730		25.713	100	Right	7	40	0.9
						Transition	82396.730	82416.730		20					
						Straight	82416.730	82451.439	34.709						
						Transition	82451.439	82471.439		20					
744	585118.481	2822441.919	18	2	40.37	Arc	82471.439	82482.932		11.494	100	Right	7	40	0.9

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	82482.932	82502.932		20					
						Straight	82502.932	82623.474	120.542						
						Transition	82623.474	82643.474		20					
745	585036.135	2822294.574	14	23	58.92	Arc	82643.474	82648.606		5.132	100	Left	7	40	0.9
						Transition	82648.606	82668.606		20					
						Straight	82668.606	82757.983	89.376						
						Transition	82757.983	82777.983		20					
746	584986.396	2822158.276	131	16	57.33	Arc	82777.983	82803.809		25.826	20	Right	7	20	1.5
						Transition	82803.809	82823.809		20					
						Straight	82823.809	82852.862	29.053						
						Transition	82852.862	82872.862		20					
747	584927.63	2822222.287	54	57	1.67	Arc	82872.862	82881.634		8.772	30	Left	7	25	1.5
						Transition	82881.634	82901.634		20					
						Straight	82901.634	82993.386	91.752						
748	584800.444	2822230.082	13	18	36.24	Arc	82993.386	83016.617		23.23	100	Right	7	20	0.9
						Straight	83016.617	83047.660	31.043						
						Transition	83047.660	83067.660		20					
749	584731.318	2822243.749	68	58	29.57	Arc	83067.660	83083.775		16.115	30	Left	7	25	1.5
						Transition	83083.775	83103.775		20					
						Straight	83103.775	83156.221	52.446						
						Transition	83156.221	83191.221		35					
750	584660.136	2822145.88	45	54	25.99	Arc	83191.221	83204.295		13.074	60	Left	7	40	1.2
						Transition	83204.295	83239.295		35					
						Straight	83239.295	83259.313	20.018						
						Transition	83259.313	83284.313		25					
751	584672.918	2822053.967	27	44	58.52	Arc	83284.313	83298.059		13.746	80	Left	7	40	0.9
						Transition	83298.059	83323.059		25					
						Straight	83323.059	83351.349	28.291						
						Transition	83351.349	83381.349		30					
752	584734.329	2821957.912	62	46	35.49	Arc	83381.349	83428.045		46.696	70	Right	7	40	0.9
						Transition	83428.045	83458.045		30					
						Straight	83458.045	83539.681	81.635						
						Transition	83539.681	83579.681		40					
753	584658.374	2821796.468	55	24	43.91	Arc	83579.681	83588.037		8.356	50	Right	7	40	
						Transition	83588.037	83628.037		40					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Straight	83628.037	83635.128	7.091						
						Transition	83635.128	83675.128		40					
754	584565.539	2821766.052	62	44	27.03	Arc	83675.128	83689.879		14.752	50	Left	7	40	1.2
						Transition	83689.879	83729.879		40					
						Straight	83729.879	83807.335	77.455						
						Transition	83807.335	83822.335		15					
755	584512.921	2821628.264	12	20	0.24	Arc	83822.335	83839.624		17.289	150	Left	4.7	40	0.6
						Transition	83839.624	83854.624		15					
						Straight	83854.624	83993.516	138.892						
						Transition	83993.516	84018.516		25					
756	584480.096	2821428.6	126	3	49.97	Arc	84018.516	84048.522		30.006	25	Right	7	25	1.5
						Transition	84048.522	84073.522		25					
						Straight	84073.522	84119.215	45.693						
						Transition	84119.215	84159.215		40					
757	584351.851	2821506.374	98	57	57.42	Arc	84159.215	84205.579		46.364	50	Left	7	40	1.2
						Transition	84205.579	84245.579		40					
						Straight	84245.579	84252.392	6.812						
						Transition	84252.392	84267.392		15					
758	584273.49	2821407.139	43	47	52.54	Arc	84267.392	84347.944		80.552	125	Left	5.7	40	0.6
						Transition	84347.944	84362.944		15					
						Straight	84362.944	84387.138	24.195						
						Transition	84387.138	84412.138		25					
759	584294.795	2821296.099	28	25	59.83	Arc	84412.138	84426.839		14.7	80	Left	7	40	0.9
						Transition	84426.839	84451.839		25					
						Straight	84451.839	84488.422	36.583						
						Transition	84488.422	84528.422		40					
760	584359.338	2821201.857	59	43	46.77	Arc	84528.422	84540.545		12.124	50	Right	7	40	1.2
						Transition	84540.545	84580.545		40					
						Straight	84580.545	84640.950	60.405						
						Transition	84640.950	84670.950		30					
761	584313.359	2821058.762	11	22	53.47	Arc	84670.950	84700.544		29.593	300	Right	Normal Camber	50	0.6
						Transition	84700.544	84730.544		30					
						Straight	84730.544	84914.461	183.917						
762	584148.595	2820788.962	16	34	52.28	Arc	84914.461	85088.099		173.638	600	Left	Normal Camber	40	NA
						Straight	85088.099	85206.545	118.446						

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	85206.545	85221.545		15					
763	584089.414	2820571.209	11	15	46.62	Arc	85221.545	85231.117		9.572	125	Right	5.7	40	0.6
						Transition	85231.117	85246.117		15					
						Straight	85246.117	85255.214	9.097						
						Transition	85255.214	85270.214		15					
764	584063.148	2820514.076	20	10	38.9	Arc	85270.214	85308.038		37.824	150	Left	4.7	40	0.6
						Transition	85308.038	85323.038		15					
						Straight	85323.038	85409.009	85.971						
						Transition	85409.009	85449.009		40					
765	584051.244	2820351.614	54	28	56.06	Arc	85449.009	85456.554		7.545	50	Left	7	40	1.2
						Transition	85456.554	85496.554		40					
						Straight	85496.554	85585.175	88.620						
766	584163.554	2820242.667	9	28	25.61	Arc	85585.175	85634.779		49.605	300	Right	Normal Camber	40	0.6
						Straight	85634.779	85651.153	16.374						
						Transition	85651.153	85681.153		30					
767	584205.42	2820176.63	87	52	9.36	Arc	85681.153	85697.161		16.008	30	Right	7	30	1.5
						Transition	85697.161	85727.161		30					
						Straight	85727.161	85749.827	22.665						
						Transition	85749.827	85779.827		30					
768	584136.128	2820114.552	77	18	6.64	Arc	85779.827	85790.302		10.475	30	Right	7	30	1.5
						Transition	85790.302	85820.302		30					
						Straight	85820.302	85856.993	36.691						
						Transition	85856.993	85876.993		20					
769	584044.267	2820168.233	48	2	55.75	Arc	85876.993	85907.309		30.317	60	Left	7	30	1.2
						Transition	85907.309	85927.309		20					
						Straight	85927.309	85943.465	16.156						
						Transition	85943.465	85963.465		20					
770	583949.725	2820149.081	39	46	57.37	Arc	85963.465	86012.899		49.434	100	Left	7	40	0.9
						Transition	86012.899	86032.899		20					
						Straight	86032.899	86105.664	72.765						
						Transition	86105.664	86125.664		20					
771	583852.66	2820035.034	25	2	6.79	Arc	86125.664	86149.358		23.695	100	Right	7	40	0.9
						Transition	86149.358	86169.358		20					
						Straight	86169.358	86219.374	50.015						
						Transition	86219.374	86234.374		15					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
772	583760.271	2819986.207	11	33	46.17	Arc	86234.374	86249.645		15.271	150	Left	4.7	40	0.6
						Transition	86249.645	86264.645		15					
						Straight	86264.645	86356.644	91.999						
773	583659.311	2819907.974	4	59	55.41	Arc	86356.644	86382.817		26.173	300	Right	Normal Camber	40	0.6
						Straight	86382.817	86469.598	86.781						
						Transition	86469.598	86489.598		20					
774	583548.322	2819833.281	27	22	31.05	Arc	86489.598	86517.377		27.779	100	Left	7	40	0.9
						Transition	86517.377	86537.377		20					
						Straight	86537.377	86627.029	89.652						
						Transition	86627.029	86647.029		20					
775	583473.253	2819702.274	20	2	35.31	Arc	86647.029	86662.011		14.982	100	Left	7	40	0.9
						Transition	86662.011	86682.011		20					
						Straight	86682.011	86695.069	13.059						
						Transition	86695.069	86730.069		35					
776	583454.707	2819626.118	39	19	55.36	Arc	86730.069	86736.258		6.188	60	Right	7	40	1.2
						Transition	86736.258	86771.258		35					
						Straight	86771.258	86846.264	75.006						
777	583358.874	2819536.716	6	59	12.99	Arc	86846.264	86882.848		36.584	300	Left	Normal Camber	40	0.6
						Straight	86882.848	87045.625	162.777						
778	583216.77	2819378.173	12	6	26.65	Arc	87045.625	87109.019		63.394	300	Left	Normal Camber	40	0.6
						Straight	87109.019	87257.860	148.841						
						Transition	87257.860	87277.860		20					
779	583116.966	2819201.912	13	39	58.4	Arc	87277.860	87281.712		3.852	100	Left	7	40	0.9
						Transition	87281.712	87301.712		20					
						Straight	87301.712	87313.696	11.984						
						Transition	87313.696	87338.696		25					
780	583082.691	2819133.823	131	43	8.41	Arc	87338.696	87371.169		32.473	25	Right	7	25	1.5
						Transition	87371.169	87396.169		25					
						Straight	87396.169	87430.953	34.783						
						Transition	87430.953	87465.953		35					
781	583013.826	2819228.238	45	27	34.95	Arc	87465.953	87478.558		12.605	60	Right	7	40	1.2
						Transition	87478.558	87513.558		35					
						Straight	87513.558	87646.457	132.900						
						Transition	87646.457	87666.457		20					
782	583054.239	2819430.565	25	50	49.06	Arc	87666.457	87691.569		25.111	100	Left	7	40	0.9



HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	87691.569	87711.569		20					
						Straight	87711.569	87820.446	108.878						
						Transition	87820.446	87855.446		35					
783	583021.72	2819612.391	50	6	6.57	Arc	87855.446	87872.913		17.467	60	Right	7	40	1.2
						Transition	87872.913	87907.913		35					
						Straight	87907.913	88052.403	144.490						
						Transition	88052.403	88097.403		45					
784	583163.219	2819799.851	28	41	9.39	Arc	88097.403	88102.469		5.066	100	Right	7	50	0.9
						Transition	88102.469	88147.469		45					
						Straight	88147.469	88165.554	18.085						
						Transition	88165.554	88195.554		30					
785	583268.697	2819858.949	64	57	11.9	Arc	88195.554	88244.909		49.355	70	Left	7	40	0.9
						Transition	88244.909	88274.909		30					
						Straight	88274.909	88316.411	41.502						
						Transition	88316.411	88336.411		20					
786	583280.338	2819981.747	18	57	10.9	Arc	88336.411	88349.490		13.079	100	Right	7	40	0.9
						Transition	88349.490	88369.490		20					
						Straight	88369.490	88473.791	104.301						
						Transition	88473.791	88503.791		30					
787	583334.925	2820150.292	51	28	2.87	Arc	88503.791	88536.670		32.879	70	Left	7	40	0.9
						Transition	88536.670	88566.670		30					
						Straight	88566.670	88607.906	41.236						
						Transition	88607.906	88647.906		40					
788	583277.267	2820272.859	65	13	23.03	Arc	88647.906	88664.823		16.918	50	Right	7	40	1.2
						Transition	88664.823	88704.823		40					
						Straight	88704.823	88726.087	21.263						
						Transition	88726.087	88751.087		25					
789	583330.888	2820375.261	42	57	51.19	Arc	88751.087	88793.575		42.488	90	Left	7	40	0.9
						Transition	88793.575	88818.575		25					
						Straight	88818.575	88988.927	170.352						
						Transition	88988.927	89023.927		35					
790	583289.58	2820629.479	45	32	59.85	Arc	89023.927	89036.626		12.7	60	Left	7	40	1.2
						Transition	89036.626	89071.626		35					
						Straight	89071.626	89079.583	7.956						
						Transition	89079.583	89099.583		20					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
791	583225.05	2820684.601	29	29	57.76	Arc	89099.583	89131.069		31.486	100	Right	7	40	0.9
						Transition	89131.069	89151.069		20					
						Straight	89151.069	89156.472	5.403						
						Transition	89156.472	89176.472		20					
792	583192.233	2820744.209	32	9	24.48	Arc	89176.472	89190.147		13.675	60	Left	7	30	1.2
						Transition	89190.147	89210.147		20					
						Straight	89210.147	89226.201	16.055						
						Transition	89226.201	89251.201		25					
793	583128.471	2820796.607	77	23	45.61	Arc	89251.201	89280.234		29.033	40	Right	7	30	1.5
						Transition	89280.234	89305.234		25					
						Straight	89305.234	89348.519	43.285						
						Transition	89348.519	89383.519		35					
794	583166.509	2820909.554	37	16	48.53	Arc	89383.519	89387.559		4.04	60	Right	7	40	1.2
						Transition	89387.559	89422.559		35					
						Straight	89422.559	89581.623	159.064						
						Transition	89581.623	89596.623		15					
795	583380.63	2821053.106	30	46	31.38	Arc	89596.623	89689.049		92.426	200	Left	3.6	30	0.6
						Transition	89689.049	89704.049		15					
						Straight	89704.049	89774.748	70.699						
						Transition	89774.748	89789.748		15					
796	583458.971	2821207.955	25	17	23.76	Arc	89789.748	89840.957		51.209	150	Left	4.7	40	0.6
						Transition	89840.957	89855.957		15					
						Straight	89855.957	89933.816	77.858						
						Transition	89933.816	89953.816		20					
797	583466.174	2821359.149	25	58	12.91	Arc	89953.816	89979.142		25.327	100	Right	7	40	0.9
						Transition	89979.142	89999.142		20					
						Straight	89999.142	90045.087	45.945						
						Transition	90045.087	90070.087		25					
798	583510.886	2821460.173	56	24	58.35	Arc	90070.087	90084.473		14.386	40	Left	7	30	1.5
						Transition	90084.473	90109.473		25					
						Straight	90109.473	90123.349	13.876						
						Transition	90123.349	90143.349		20					
799	583483.986	2821528.319	67	6	4.89	Arc	90143.349	90158.483		15.134	30	Right	7	25	1.5
						Transition	90158.483	90178.483		20					
						Straight	90178.483	90197.891	19.408						



HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	90197.891	90227.891		30					
800	583523.606	2821596.97	69	7	3.94	Arc	90227.891	90234.081		6.19	30	Left	7	30	1.5
						Transition	90234.081	90264.081		30					
						Straight	90264.081	90302.854	38.773						
						Transition	90302.854	90332.854		30					
801	583481.358	2821696.808	88	19	2.88	Arc	90332.854	90349.097		16.243	30	Right	7	30	1.5
						Transition	90349.097	90379.097		30					
						Straight	90379.097	90497.716	118.619						
						Transition	90497.716	90517.716		20					
802	583636.348	2821809.759	30	3	13.25	Arc	90517.716	90550.170		32.454	100	Left	7	40	0.9
						Transition	90550.170	90570.170		20					
						Straight	90570.170	90656.818	86.648						
803	583735.704	2821997.955	28	48	20.06	Arc	90656.818	90832.781		175.963	350	Left	Normal Camber	40	--NA--
						Straight	90832.781	91016.212	183.431						
						Transition	91016.212	91031.212		15					
804	583726.786	2822297.046	10	32	50.78	Arc	91031.212	91053.029		21.818	200	Left	3.6	40	0.6
						Transition	91053.029	91068.029		15					
						Straight	91068.029	91226.408	158.379						
						Transition	91226.408	91246.408		20					
805	583675.765	2822527.829	23	58	14.99	Arc	91246.408	91310.082		63.674	200	Left	3.6	40	0.6
						Transition	91310.082	91330.082		20					
						Straight	91330.082	91379.366	49.284						
						Transition	91379.366	91419.366		40					
806	583597.34	2822651.389	59	2	15.74	Arc	91419.366	91430.886		11.52	50	Right	7	40	1.2
						Transition	91430.886	91470.886		40					
						Straight	91470.886	91486.911	16.025						
						Transition	91486.911	91521.911		35					
807	583625.624	2822754.175	53	40	23.21	Arc	91521.911	91543.117		21.206	60	Left	7	40	1.2
						Transition	91543.117	91578.117		35					
						Straight	91578.117	91687.484	109.367						
808	583508.468	2822963.759	27	30	47.31	Arc	91687.484	91855.552		168.068	350	Left	Normal Camber	40	--NA--
						Straight	91855.552	91973.988	118.436						
						Transition	91973.988	92003.988		30					
809	583299.21	2823088.263	40	19	40.85	Arc	92003.988	92023.258		19.27	70	Left	7	40	0.9
						Transition	92023.258	92053.258		30					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Straight	92053.258	92135.785	82.527						
						Transition	92135.785	92150.785		15					
810	583156.74	2823070.281	13	1	17.47	Arc	92150.785	92164.194		13.409	125	Left	5.7	40	0.6
						Transition	92164.194	92179.194		15					
						Straight	92179.194	92188.455	9.261						
						Transition	92188.455	92213.455		25					
811	583097.786	2823050.154	27	3	51.89	Arc	92213.455	92226.244		12.789	80	Right	7	40	0.9
						Transition	92226.244	92251.244		25					
						Straight	92251.244	92289.357	38.113						
						Transition	92289.357	92304.357		15					
812	582996.262	2823056.421	18	53	23.33	Arc	92304.357	92338.810		34.453	150	Left	4.7	40	0.6
						Transition	92338.810	92353.810		15					
						Straight	92353.810	92473.978	120.168						
						Transition	92473.978	92488.978		15					
813	582826.786	2823017.668	10	37	21.71	Arc	92488.978	92501.788		12.81	150	Right	4.7	40	0.6
						Transition	92501.788	92516.788		15					
						Straight	92516.788	92581.010	64.222						
						Transition	92581.010	92596.010		15					
814	582718.045	2823011.087	12	5	7.8	Arc	92596.010	92612.650		16.64	150	Left	4.7	40	0.6
						Transition	92612.650	92627.650		15					
						Straight	92627.650	92669.902	42.252						
						Transition	92669.902	92709.902		40					
815	582603.294	2822991.514	72	41	26.33	Arc	92709.902	92733.337		23.435	50	Right	7	40	1.2
						Transition	92733.337	92773.337		40					
						Straight	92773.337	92790.039	16.702						
816	582554.229	2823050.79	3	31	48.26	Arc	92790.039	92808.522		18.483	300	Left	Normal Camber	40	0.6
						Straight	92808.522	92842.047	33.525						
						Transition	92842.047	92872.047		30					
817	582494.722	2823114.869	98	13	23.49	Arc	92872.047	92902.049		30.001	35	Left	7	30	1.5
						Transition	92902.049	92932.049		30					
						Straight	92932.049	92937.567	5.519						
818	582423.351	2823061.15	25	56	4.31	Arc	92937.567	93014.517		76.949	170	Left	4.2	30	0.6
						Straight	93014.517	93047.050	32.533						
						Transition	93047.050	93067.050		20					
819	582372.314	2822962.075	153	0	53.25	Arc	93067.050	93100.462		33.412	20	Right	7	20	1.5

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	93100.462	93120.462		20					
						Straight	93120.462	93149.969	29.506						
						Transition	93149.969	93164.969		15					
820	582337.607	2823110.896	42	8	4.4	Arc	93164.969	93297.046		132.077	200	Left	3.6	40	0.6
						Transition	93297.046	93312.046		15					
						Straight	93312.046	93321.865	9.819						
						Transition	93321.865	93336.865		15					
821	582250.062	2823191.874	16	50	50.02	Arc	93336.865	93358.620		21.755	125	Right	5.7	40	0.6
						Transition	93358.620	93373.620		15					
						Straight	93373.620	93378.962	5.342						
						Transition	93378.962	93398.962		20					
822	582179.441	2823280.789	111	29	45.53	Arc	93398.962	93495.720		96.758	60	Left	7	30	1.2
						Transition	93495.720	93515.720		20					
						Straight	93515.720	93526.642	10.922						
						Transition	93526.642	93546.642		20					
823	582098.977	2823194.607	33	41	0.77	Arc	93546.642	93556.036		9.394	50	Right	7	30	1.2
						Transition	93556.036	93576.036		20					
						Straight	93576.036	93585.014	8.977						
						Transition	93585.014	93600.014		15					
824	582039.952	2823169.083	26	28	26.83	Arc	93600.014	93631.220		31.206	100	Left	7	30	0.9
						Transition	93631.220	93646.220		15					
						Straight	93646.220	93683.191	36.971						
						Transition	93683.191	93703.191		20					
825	581970.44	2823102.631	42	34	1.28	Arc	93703.191	93720.338		17.147	50	Right	7	30	1.2
						Transition	93720.338	93740.338		20					
						Straight	93740.338	93807.196	66.858						
						Transition	93807.196	93832.196		25					
826	581848.288	2823094.64	43	0	2.92	Arc	93832.196	93837.216		5.02	40	Right	7	30	1.5
						Transition	93837.216	93862.216		25					
						Straight	93862.216	93879.252	17.036						
						Transition	93879.252	93904.252		25					
827	581786.754	2823135.186	48	56	36.09	Arc	93904.252	93913.421		9.169	40	Left	7	30	1.5
						Transition	93913.421	93938.421		25					
						Straight	93938.421	93942.137	3.716						
						Transition	93942.137	93972.137		30					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
828	581723.279	2823133.62	60	19	43.46	Arc	93972.137	93973.725		1.588	30	Right	7	30	1.5
						Transition	93973.725	94003.725		30					
						Straight	94003.725	94004.375	0.650						
						Transition	94004.375	94024.375		20					
829	581656.819	2823193.134	90	31	14.83	Arc	94024.375	94091.269		66.894	55	Left	7	30	1.2
						Transition	94091.269	94111.269		20					
						Straight	94111.269	94186.979	75.710						
						Transition	94186.979	94201.979		15					
830	581531.915	2823097.979	12	15	37.51	Arc	94201.979	94219.077		17.098	150	Left	4.7	40	0.6
						Transition	94219.077	94234.077		15					
						Straight	94234.077	94247.445	13.368						
						Transition	94247.445	94282.445		35					
831	581476.317	2823037.681	53	21	0.89	Arc	94282.445	94303.313		20.868	60	Right	7	40	1.2
						Transition	94303.313	94338.313		35					
						Straight	94338.313	94474.271	135.957						
						Transition	94474.271	94494.271		20					
832	581262.424	2823037.236	26	28	24.42	Arc	94494.271	94520.476		26.205	100	Right	7	40	0.9
						Transition	94520.476	94540.476		20					
						Straight	94540.476	94555.285	14.809						
						Transition	94555.285	94575.285		20					
833	581190.252	2823070.581	24	40	43.76	Arc	94575.285	94598.357		23.073	100	Left	7	40	0.9
						Transition	94598.357	94618.357		20					
						Straight	94618.357	94677.579	59.221						
						Transition	94677.579	94697.579		20					
834	581036.475	2823075.098	58	17	59.35	Arc	94697.579	94779.331		81.752	100	Left	7	40	0.9
						Transition	94779.331	94799.331		20					
						Straight	94799.331	94910.216	110.885						
						Transition	94910.216	94940.216		30					
835	580902.725	2822899.271	48	42	26.86	Arc	94940.216	94973.974		33.758	75	Right	7	40	0.9
						Transition	94973.974	95003.974		30					
						Straight	95003.974	95025.073	21.099						
						Transition	95025.073	95055.073		30					
836	580785.74	2822873.628	55	31	20.88	Arc	95055.073	95097.751		42.679	75	Left	7	40	0.9
						Transition	95097.751	95127.751		30					
						Straight	95127.751	95201.386	73.635						

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	95201.386	95231.386		30					
837	580693.366	2822724.653	53	17	58.85	Arc	95231.386	95271.156		39.769	75	Right	7	40	0.9
						Transition	95271.156	95301.156		30					
						Straight	95301.156	95319.899	18.744						
						Transition	95319.899	95359.899		40					
838	580579.938	2822691.36	68	37	26.17	Arc	95359.899	95379.785		19.886	50	Left	7	40	1.2
						Transition	95379.785	95419.785		40					
						Straight	95419.785	95441.869	22.084						
						Transition	95441.869	95481.869		40					
839	580553.208	2822580.441	55	42	42.16	Arc	95481.869	95490.486		8.618	50	Left	7	40	1.2
						Transition	95490.486	95530.486		40					
						Straight	95530.486	95577.895	47.409						
						Transition	95577.895	95607.895		30					
840	580663.12	2822431.001	107	57	25.54	Arc	95607.895	95713.558		105.663	72	Right	7	40	0.9
						Transition	95713.558	95743.558		30					
						Straight	95743.558	95803.380	59.822						
						Transition	95803.380	95823.380		20					
841	580506.801	2822342.216	30	54	23.6	Arc	95823.380	95835.745		12.365	60	Right	7	30	1.2
						Transition	95835.745	95855.745		20					
						Straight	95855.745	95864.394	8.649						
						Transition	95864.394	95889.394		25					
842	580439.958	2822341.719	56	40	37.02	Arc	95889.394	95903.962		14.568	40	Left	7	30	1.5
						Transition	95903.962	95928.962		25					
						Straight	95928.962	95954.524	25.562						
						Transition	95954.524	95969.524		15					
843	580387.926	2822283.544	16	44	4.15	Arc	95969.524	95980.811		11.286	90	Left	7	30	0.9
						Transition	95980.811	95995.811		15					
						Straight	95995.811	96019.738	23.927						
						Transition	96019.738	96034.738		15					
844	580364.274	2822225.898	14	43	59.5	Arc	96034.738	96040.309		5.571	80	Left	7	30	0.9
						Transition	96040.309	96055.309		15					
						Straight	96055.309	96062.318	7.009						
						Transition	96062.318	96082.318		20					
845	580351.063	2822177.687	90	31	52.62	Arc	96082.318	96093.920		11.601	20	Right	7	20	1.5
						Transition	96093.920	96113.920		20					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Straight	96113.920	96126.472	12.553						
						Transition	96126.472	96146.472		20					
846	580278.601	2822170.609	134	22	8.91	Arc	96146.472	96173.376		26.904	20	Left	7	20	1.5
						Transition	96173.376	96193.376		20					
						Straight	96193.376	96228.603	35.226						
						Transition	96228.603	96248.603		20					
847	580320.737	2822082.431	104	59	13.84	Arc	96248.603	96265.250		16.647	20	Right	7	20	1.5
						Transition	96265.250	96285.250		20					
						Straight	96285.250	96326.363	41.113						
						Transition	96326.363	96361.363		35					
848	580184.314	2822037.484	103	33	4.94	Arc	96361.363	96434.802		73.439	60	Right	7	40	1.2
						Transition	96434.802	96469.802		35					
						Straight	96469.802	96503.080	33.278						
						Transition	96503.080	96518.080		15					
849	580151.77	2822165.472	14	8	46.88	Arc	96518.080	96533.942		15.863	125	Right	5.7	40	0.6
						Transition	96533.942	96548.942		15					
						Straight	96548.942	96598.305	49.363						
						Transition	96598.305	96613.305		15					
850	580161.621	2822258.316	7	46	58.53	Arc	96613.305	96625.473		12.168	200	Right	3.6	40	0.6
						Transition	96625.473	96640.473		15					
						Straight	96640.473	96667.381	26.908						
						Transition	96667.381	96707.381		40					
851	580176.246	2822351.363	61	48	19.47	Arc	96707.381	96721.317		13.935	50	Left	7	40	1.2
						Transition	96721.317	96761.317		40					
						Straight	96761.317	96825.408	64.091						
						Transition	96825.408	96845.408		20					
852	580068.641	2822464.32	40	25	47.24	Arc	96845.408	96895.971		50.563	100	Right	7	40	0.9
						Transition	96895.971	96915.971		20					
						Straight	96915.971	96973.407	57.436						
						Transition	96973.407	96993.407		20					
853	580048.236	2822589.598	15	46	53.57	Arc	96993.407	97000.951		7.544	100	Left	7	40	0.9
						Transition	97000.951	97020.951		20					
						Straight	97020.951	97031.437	10.486						
						Transition	97031.437	97056.437		25					
854	580026.322	2822648.353	22	57	0.76	Arc	97056.437	97063.482		7.045	80	Right	7	40	0.9

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	97063.482	97088.482		25					
						Straight	97088.482	97124.592	36.110						
						Transition	97124.592	97139.592		15					
855	580023.697	2822732.245	10	53	25.6	Arc	97139.592	97148.351		8.759	125	Left	5.7	40	0.6
						Transition	97148.351	97163.351		15					
						Straight	97163.351	97.681	14.330						
						Transition	97.681	97202.681		25					
856	580014.228	2822792.117	20	42	59.96	Arc	97202.681	97206.607		3.926	80	Right	7	40	0.9
						Transition	97206.607	97231.607		25					
						Straight	97231.607	97238.619	7.012						
						Transition	97238.619	97278.619		40					
857	580017.273	2822876.081	70	24	3.28	Arc	97278.619	97300.055		21.436	50	Left	7	40	1.2
						Transition	97300.055	97340.055		40					
						Straight	97340.055	97359.414	19.358						
						Transition	97359.414	97374.414		15					
858	579944.186	2822928.704	12	8	42.22	Arc	97374.414	97385.910		11.496	125	Right	5.7	40	0.6
						Transition	97385.910	97400.910		15					
						Straight	97400.910	97418.687	17.777						
						Transition	97418.687	97458.687		40					
859	579864.48	2822981.616	86	7	53.49	Arc	97458.687	97493.851		35.164	50	Left	7	40	1.2
						Transition	97493.851	97533.851		40					
						Straight	97533.851	97541.831	7.980						
						Transition	97541.831	97566.831		25					
860	579780.707	2822920.893	36	41	43.1	Arc	97566.831	97593.067		26.236	80	Right	7	40	0.9
						Transition	97593.067	97618.067		25					
						Straight	97618.067	97624.781	6.714						
						Transition	97624.781	97649.781		25					
861	579700.442	2822902.93	35	37	27.29	Arc	97649.781	97674.522		24.741	80	Left	7	40	0.9
						Transition	97674.522	97699.522		25					
						Straight	97699.522	97742.175	42.653						
862	579627.812	2822838.154	6	37	17.78	Arc	97742.175	97776.846		34.671	300	Right	Normal Camber	40	0.6
						Straight	97776.846	97898.415	121.570						
						Transition	97898.415	97913.415		15					
863	579488.471	2822731.431	22	7	52.74	Arc	97913.415	97956.355		42.94	150	Left	4.7	40	0.6
						Transition	97956.355	97971.355		15					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Straight	97971.355	98011.706	40.351						
						Transition	98011.706	98041.706		30					
864	579427.622	2822642.859	61	50	39.49	Arc	98041.706	98044.088		2.382	30	Right	7	30	1.5
						Transition	98044.088	98074.088		30					
						Straight	98074.088	98097.000	23.629						
						Transition	98097.000	98122.000		25					
865	579345.642	2822637.689	44	41	24.14	Arc	98122.000	98128.917		6.2	40	Left	7	30	1.5
						Transition	98128.917	98153.917		25					
						Straight	98153.917	98203.135	49.218						
						Transition	98203.135	98223.135		20					
866	579265.168	2822567.817	22	32	5.03	Arc	98223.135	98242.465		19.331	100	Left	7	40	0.9
						Transition	98242.465	98262.465		20					
						Straight	98262.465	98301.619	39.154						
						Transition	98301.619	98341.619		40					
867	579198.855	2822461.108	85	43	20.7	Arc	98341.619	98376.426		34.807	50	Right	7	40	1.2
						Transition	98376.426	98416.426		40					
						Straight	98416.426	98463.605	47.179						
						Transition	98463.605	98503.605		40					
868	579057.821	2822496.203	49	43	37.82	Arc	98503.605	98507.000		3.395	50	Left	7	40	1.2
						Transition	98507.000	98547.000		40					
						Straight	98547.000	98662.138	115.138						
						Transition	98662.138	98682.138		20					
869	578891.213	2822410.324	24	28	13.34	Arc	98682.138	98704.847		22.709	100	Left	7	40	0.9
						Transition	98704.847	98724.847		20					
						Straight	98724.847	98909.451	184.605						
870	578751.375	2822227.74	5	21	38.03	Arc	98909.451	98937.519		28.068	300	Left	Normal Camber	40	0.6
						Straight	98937.519	98978.057	40.538						
						Transition	98978.057	99003.057		25					
871	578705.554	2822157.216	24	30	20.72	Arc	99003.057	99012.273		9.216	80	Right	7	40	0.9
						Transition	99012.273	99037.273		25					
						Straight	99037.273	99118.414	81.141						
						Transition	99118.414	99138.414		20					
872	578590.268	2822079.278	21	16	18.17	Arc	99138.414	99155.540		17.126	100	Right	7	40	0.9
						Transition	99155.540	99175.540		20					
						Straight	99175.540	99236.600	61.060						

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HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	99236.600	99256.600		20					
873	578456.546	2822044.243	43	30	44.48	Arc	99256.600	99312.544		55.943	100	Left	7	40	0.9
						Transition	99312.544	99332.544		20					
						Straight	99332.544	99350.555	18.012						
						Transition	99350.555	99370.555		20					
874	578402.738	2821972.281	15	7	47.12	Arc	99370.555	99376.962		6.406	100	Right	7	40	0.9
						Transition	99376.962	99396.962		20					
						Straight	99396.962	99446.045	49.083						
						Transition	99446.045	99461.045		15					
875	578329.729	2821906.523	14	7	20.72	Arc	99461.045	99483.017		21.972	150	Left	4.7	40	0.6
						Transition	99483.017	99498.017		15					
						Straight	99498.017	99532.479	34.461						
876	578282.619	2821840.416	7	54	10.72	Arc	99532.479	99573.858		41.38	300	Right	Normal Camber	40	0.6
						Straight	99573.858	99677.372	103.513						
						Transition	99677.372	99.372		40					
877	578149.877	2821716.01	88	15	28.32	Arc	99.372	99754.391		37.02	50	Right	7	40	1.2
						Transition	99754.391	99794.391		40					
						Straight	99794.391	99864.238	69.847						
						Transition	99864.238	99894.238		30					
878	577979.06	2821832.253	89	24	35.36	Arc	99894.238	99981.275		87.037	75	Left	7	40	0.9
						Transition	99981.275	100011.275		30					
						Straight	100011.275	100153.020	141.745						
						Transition	100153.020	100178.020		25					
879	577796.83	2821650.055	35	53	5.52	Arc	100178.020	100203.125		25.105	80	Right	7	40	0.9
						Transition	100203.125	100228.125		25					
						Straight	100228.125	100270.208	42.083						
880	577684.299	2821621.855	13	51	4.46	Arc	100270.208	100342.733		72.525	300	Left	Normal Camber	40	0.6
						Straight	100342.733	100452.764	110.031						
881	577545.906	2821553.441	3	1	12.86	Arc	100452.764	100468.578		15.814	300	Left	Normal Camber	40	0.6
						Straight	100468.578	100626.624	158.046						
882	577372.373	2821455.958	12	35	10.75	Arc	100626.624	100692.525		65.902	300	Left	Normal Camber	40	0.6
						Straight	100692.525	100732.157	39.632						
						Transition	100732.157	100747.157		15					
883	577302.442	2821393.911	10	8	43.67	Arc	100747.157	100758.718		11.561	150	Right	4.7	40	0.6
						Transition	100758.718	100773.718		15					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Straight	100773.718	100789.230	15.512						
884	577236.015	2821352.144	16	0	24.61	Arc	100789.230	100873.041		83.812	300	Left	Normal Camber	40	0.6
						Straight	100873.041	100919.308	46.267						
						Transition	100919.308	100939.308		20					
885	577165.767	2821253.454	170	43	16.96	Arc	100939.308	100964.003		24.695	15	Left	7	20	1.5
						Transition	100964.003	100984.003		20					
						Straight	100984.003	101025.495	41.492						
						Transition	101025.495	101045.495		20					
886	577256.44	2821303.317	43	9	44.03	Arc	101045.495	101063.161		17.666	50	Right	7	30	1.2
						Transition	101063.161	101083.161		20					
						Straight	101083.161	101122.198	39.037						
						Transition	101122.198	101137.198		15					
887	577345.562	2821300.378	22	44	54.01	Arc	101137.198	101149.990		12.792	70	Left	7	30	0.9
						Transition	101149.990	101164.990		15					
						Straight	101164.990	101185.777	20.787						
						Transition	101185.777	101215.777		30					
888	577420.294	2821320.068	33	9	16.85	Arc	101215.777	101226.283		10.506	70	Right	7	40	0.9
						Transition	101226.283	101256.283		30					
						Straight	101256.283	101282.585	26.302						
						Transition	101282.585	101302.585		20					
889	577521.234	2821302.023	69	10	46.86	Arc	101302.585	101342.956		40.371	50	Left	7	30	1.2
						Transition	101342.956	101362.956		20					
						Straight	101362.956	101374.243	11.287						
						Transition	101374.243	101399.243		25					
890	577581.485	2821367.333	54	47	21.85	Arc	101399.243	101422.056		22.813	50	Right	7	30	1.2
						Transition	101422.056	101447.056		25					
						Straight	101447.056	101477.596	30.540						
						Transition	101477.596	101497.596		20					
891	577688.067	2821356.496	156	20	18.81	Arc	101497.596	101532.168		34.572	20	Right	7	20	1.5
						Transition	101532.168	101552.168		20					
						Straight	101552.168	101597.209	45.040						
						Transition	101597.209	101617.209		20					
892	577594.069	2821293.446	98	8	24.82	Arc	101617.209	101631.466		14.257	20	Left	7	20	1.5
						Transition	101631.466	101651.466		20					
						Straight	101651.466	101666.375	14.909						



HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	101666.375	101681.375		15					
893	577618.968	2821237.112	18	9	15.28	Arc	101681.375	101691.724		10.348	80	Right	7	30	0.9
						Transition	101691.724	101706.724		15					
						Straight	101706.724	101757.324	50.601						
						Transition	101757.324	101772.324		15					
894	577638.591	2821143.767	49	8	43.43	Arc	101772.324	101791.634		19.31	40	Right	7	20	1.5
						Transition	101791.634	101806.634		15					
						Straight	101806.634	101863.187	56.553						
						Transition	101863.187	101878.187		15					
895	577568.026	2821050.793	76	45	50.3	Arc	101878.187	101916.779		38.591	40	Right	7	20	1.5
						Transition	101916.779	101931.779		15					
						Straight	101931.779	101960.076	28.298						
						Transition	101960.076	101975.076		15					
896	577487.068	2821076.807	51	50	6.75	Arc	101975.076	101987.217		12.141	30	Left	7	20	1.5
						Transition	101987.217	102002.217		15					
						Straight	102002.217	102014.553	12.336						
						Transition	102014.553	102029.553		15					
897	577435.959	2821055.245	55	55	44.43	Arc	102029.553	102043.837		14.284	30	Right	7	20	1.5
						Transition	102043.837	102058.837		15					
						Straight	102058.837	102081.057	22.220						
						Transition	102081.057	102096.057		15					
898	577377.079	2821076.968	87	9	30.96	Arc	102096.057	102103.875		7.818	15	Left	7	20	1.5
						Transition	102103.875	102118.875		15					
						Straight	102118.875	102121.855	2.980						
						Transition	102121.855	102136.855		15					
899	577353.62	2821048.271	37	10	39.25	Arc	102136.855	102138.076		1.222	25	Right	7	20	1.5
						Transition	102138.076	102153.076		15					
						Straight	102153.076	102181.240	28.164						
900	577307.451	2821026.915	10	19	35.23	Arc	102181.240	102195.658		14.418	80	Left	7	20	0.9
						Straight	102195.658	102200.802	5.144						
						Transition	102200.802	102220.802		20					
901	577276.276	2821008.934	31	24	19.97	Arc	102220.802	102228.209		7.407	50	Right	7	30	1.2
						Transition	102228.209	102248.209		20					
						Straight	102248.209	102275.136	26.927						
						Transition	102275.136	102290.136		15					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
902	577207.953	2821004.046	12	0	29.45	Arc	102290.136	102296.094		5.958	100	Left	7	30	0.9
						Transition	102296.094	102311.094		15					
						Straight	102311.094	102332.011	20.917						
						Transition	102332.011	102357.011		25					
903	577133.808	2820978.907	77	10	53.01	Arc	102357.011	102385.894		28.883	40	Left	7	30	1.5
						Transition	102385.894	102410.894		25					
						Straight	102410.894	102433.439	22.545						
						Transition	102433.439	102448.439		15					
904	577128.866	2820898.489	15	59	42.33	Arc	102448.439	102455.772		7.333	80	Left	7	30	0.9
						Transition	102455.772	102470.772		15					
						Straight	102470.772	102493.861	23.089						
						Transition	102493.861	102508.861		15					
905	577143.572	2820842.272	34	15	24.6	Arc	102508.861	102511.798		2.937	30	Right	7	20	1.5
						Transition	102511.798	102526.798		15					
						Straight	102526.798	102568.424	41.626						
						Transition	102568.424	102583.424		15					
906	577120.217	2820769.068	44	12	58.51	Arc	102583.424	102591.575		8.152	30	Right	7	20	1.5
						Transition	102591.575	102606.575		15					
						Straight	102606.575	102622.890	16.315						
						Transition	102622.890	102637.890		15					
907	577074.471	2820738.848	46	21	8.25	Arc	102637.890	102647.160		9.27	30	Left	7	20	1.5
						Transition	102647.160	102662.160		15					
						Straight	102662.160	102663.895	1.735						
						Transition	102663.895	102678.895		15					
908	577068.129	2820692.198	136	31	54.21	Arc	102678.895	102699.639		20.744	15	Left	7	20	1.5
						Transition	102699.639	102714.639		15					
						Straight	102714.639	102755.788	41.149						
						Transition	102755.788	102770.788		15					
909	577144.483	2820731.769	45	5	52.47	Arc	102770.788	102779.401		8.613	30	Left	7	20	1.5
						Transition	102779.401	102794.401		15					
						Straight	102794.401	102836.864	42.464						
						Transition	102836.864	102854.864		18					
910	577182.182	2820818.235	176	23	55.31	Arc	102854.864	102879.967		25.102	14	Right	7	20	1.5
						Transition	102879.967	102897.967		18					
						Straight	102897.967	102939.586	41.619						



HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	102939.586	102954.586		15					
911	578.599	2820726.411	41	28	50.21	Arc	102954.586	102961.305		6.719	30	Right	7	20	1.5
						Transition	102961.305	102976.305		15					
						Straight	102976.305	103045.108	68.803						
						Transition	103045.108	103060.108		15					
912	577099.082	2820661.225	19	12	15.32	Arc	103060.108	103061.867		1.759	50	Right	7	20	1.2
						Transition	103061.867	103076.867		15					
						Straight	103076.867	103101.005	24.138						
						Transition	103101.005	103121.005		20					
913	577040.806	2820637.65	29	42	40.1	Arc	103121.005	103126.932		5.928	50	Left	7	30	1.2
						Transition	103126.932	103146.932		20					
						Straight	103146.932	103235.334	88.402						
						Transition	103235.334	103250.334		15					
914	576955.959	2820543.02	9	34	33.86	Arc	103250.334	103252.048		1.713	100	Right	7	30	0.9
						Transition	103252.048	103267.048		15					
						Straight	103267.048	103272.624	5.576						
						Transition	103272.624	103287.624		15					
915	576925.238	2820515.863	17	18	48.78	Arc	103287.624	103296.799		9.174	80	Left	7	30	0.9
						Transition	103296.799	103311.799		15					
						Straight	103311.799	103363.787	51.989						
						Transition	103363.787	103383.787		20					
916	576871.088	2820438.037	30	37	14.82	Arc	103383.787	103390.509		6.722	50	Right	7	30	1.2
						Transition	103390.509	103410.509		20					
						Straight	103410.509	103423.032	12.523						
						Transition	103423.032	103448.032		25					
917	576816.667	2820404.967	44	38	43.92	Arc	103448.032	103454.201		6.168	40	Left	7	30	1.5
						Transition	103454.201	103479.201		25					
						Straight	103479.201	103501.261	22.061						
						Transition	103501.261	103516.261		15					
918	576790.663	2820343.616	21	15	14.21	Arc	103516.261	103519.809		3.548	50	Right	7	20	1.2
						Transition	103519.809	103534.809		15					
						Straight	103534.809	103573.608	38.800						
						Transition	103573.608	103588.608		15					
919	576739.097	2820256.095	176	5	17.71	Arc	103588.608	103625.855		37.246	17	Left	7	20	1.5
						Transition	103625.855	103640.855		15					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Straight	103640.855	103731.192	90.337						
						Transition	103731.192	103751.192		20					
920	576861.69	2820357.321	15	4	58.16	Arc	103751.192	103757.516		6.324	100	Right	7	40	0.9
						Transition	103757.516	103777.516		20					
						Straight	103777.516	103828.086	50.570						
						Transition	103828.086	103853.086		25					
921	576946.908	2820412.301	35	16	18.4	Arc	103853.086	103858.867		5.78	50	Left	7	30	1.2
						Transition	103858.867	103883.867		25					
						Straight	103883.867	103933.335	49.468						
922	576986.333	2820493.87	15	18	27.61	Arc	103933.335	103960.052		26	100	Right	7	20	0.9
						Straight	103960.052	103971.928	11.877						
						Transition	103971.928	103991.928		20					
923	577048.386	2820539.037	175	42	5.75	Arc	103991.928	104033.260		41.331	20	Right	7	20	1.5
						Transition	104033.260	104053.260		20					
						Straight	104053.260	104141.870	88.610						
924	576967.351	2820389.76	8	54	55.65	Arc	104141.870	104204.111		62.242	400	Left	Normal Camber	40	--NA--
						Straight	104204.111	104361.974	157.863						
						Transition	104361.974	104401.974		40					
925	576857.112	2820182.728	60	42	39.36	Arc	104401.974	104414.954		12.98	50	Right	7	40	1.2
						Transition	104414.954	104454.954		40					
						Straight	104454.954	104485.761	30.807						
						Transition	104485.761	104500.761		15					
926	576748.948	2820167.787	19	9	48.11	Arc	104500.761	104535.931		35.17	150	Left	4.7	40	0.6
						Transition	104535.931	104550.931		15					
						Straight	104550.931	104629.898	78.967						
						Transition	104629.898	104664.898		35					
927	576585.053	2820113.741	81	49	41.71	Arc	104664.898	104715.588		50.69	60	Right	7	40	1.2
						Transition	104715.588	104750.588		35					
						Straight	104750.588	104815.816	65.228						
						Transition	104815.816	104830.816		15					
928	576459.565	2820311.287	48	49	3.74	Arc	104830.816	105007.523		176.707	225	Right	3.2	40	0.6
						Transition	105007.523	105022.523		15					
						Straight	105022.523	105051.998	29.475						
						Transition	105051.998	105086.998		35					
929	576507.961	2820496.715	69	52	35.38	Arc	105086.998	105125.172		38.174	60	Left	7	40	1.2

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	105125.172	105160.172		35					
						Straight	105160.172	105229.589	69.417						
930	576408.256	2820587.431	4	22	14.61	Arc	105229.589	105252.474		22.885	300	Right	Normal Camber	40	0.6
						Straight	105252.474	105373.552	121.077						
						Transition	105373.552	105388.552		15					
931	576261.654	2820728.217	54	59	24.65	Arc	105388.552	105493.522		104.97	125	Right	5.7	40	0.6
						Transition	105493.522	105508.522		15					
						Straight	105508.522	105543.371	34.850						
						Transition	105543.371	105558.371		15					
932	576275.163	2820857.676	9	46	5.1	Arc	105558.371	105577.468		19.097	200	Left	3.6	40	0.6
						Transition	105577.468	105592.468		15					
						Straight	105592.468	105742.577	150.109						
						Transition	105742.577	105762.577		20					
933	576267.162	2821054.394	28	17	37.27	Arc	105762.577	105767.268		4.691	50	Left	7	30	1.2
						Transition	105767.268	105787.268		20					
						Straight	105787.268	105792.059	4.791						
						Transition	105792.059	105812.059		20					
934	576244.067	2821102.81	38	5	26.14	Arc	105812.059	105825.300		13.24	50	Right	7	30	1.2
						Transition	105825.300	105845.300		20					
						Straight	105845.300	105855.784	10.484						
935	576248.162	2821152.052	8	21	1.72	Arc	105855.784	105880.560		24.776	170	Left	4.2	30	0.6
						Straight	105880.560	105896.890	16.330						
						Transition	105896.890	105911.890		15					
936	576247.023	2821197.104	15	36	4.19	Arc	105911.890	105914.589		2.699	65	Left	7	20	0.9
						Transition	105914.589	105929.589		15					
						Straight	105929.589	105935.248	5.659						
						Transition	105935.248	105950.248		15					
937	576237.921	2821233.551	14	15	13.01	Arc	105950.248	105951.419		1.17	65	Right	7	20	0.9
						Transition	105951.419	105966.419		15					
						Straight	105966.419	105984.144	17.726						
						Transition	105984.144	105999.144		15					
938	576235.092	2821283.974	11	7	57.11	Arc	105999.144	106003.574		4.43	100	Left	7	30	0.9
						Transition	106003.574	106018.574		15					
						Straight	106018.574	106072.591	54.016						
						Transition	106072.591	106087.591		15					



HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
939	576217.791	2821369.433	39	32	48.15	Arc	106087.591	106089.846		2.256	25	Right	7	20	1.5
						Transition	106089.846	106104.846		15					
						Straight	106104.846	106109.490	4.643						
						Transition	106109.490	106124.490		15					
940	576230.986	2821404.533	43	12	17.31	Arc	106124.490	106128.341		3.852	25	Left	7	20	1.5
						Transition	106128.341	106143.341		15					
						Straight	106143.341	106147.414	4.073						
						Transition	106147.414	106162.414		15					
941	576223.51	2821440.626	24	22	45.05	Arc	106162.414	106164.434		2.02	40	Right	7	20	1.5
						Transition	106164.434	106179.434		15					
						Straight	106179.434	106247.955	68.521						
						Transition	106247.955	106267.955		20					
942	576239.561	2821549.269	35	34	20.73	Arc	106267.955	106278.998		11.043	50	Right	7	30	1.2
						Transition	106278.998	106298.998		20					
						Straight	106298.998	106461.257	162.259						
						Transition	106461.257	106476.257		15					
943	576378.65	2821701.626	16	1	15.32	Arc	106476.257	106483.626		7.369	80	Left	7	30	0.9
						Transition	106483.626	106498.626		15					
						Straight	106498.626	106511.067	12.440						
						Transition	106511.067	106526.067		15					
944	576401.389	2821741.859	21	52	47.06	Arc	106526.067	106526.342		0.275	40	Right	7	25	1.5
						Transition	106526.342	106541.342		15					
						Straight	106541.342	106542.715	1.373						
						Transition	106542.715	106557.715		15					
945	576423.205	2821764.468	43	14	29.13	Arc	106557.715	106557.809		0.094	20	Left	7	20	1.5
						Transition	106557.809	106572.809		15					
						Straight	106572.809	106624.543	51.735						
						Transition	106624.543	106639.543		15					
946	576434.734	2821850.315	14	21	21.92	Arc	106639.543	106649.600		10.056	100	Right	7	40	0.9
						Transition	106649.600	106664.600		15					
						Straight	106664.600	106693.150	28.550						
						Transition	106693.150	106718.150		25					
947	576462.187	2821918.883	37	21	35.82	Arc	106718.150	106719.232		1.082	40	Right	7	30	1.5
						Transition	106719.232	106744.232		25					
						Straight	106744.232	106749.638	5.406						

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HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	106749.638	106769.638		20					
948	576505.682	2821952.249	32	15	18.94	Arc	106769.638	106777.786		8.148	50	Left	7	30	1.2
						Transition	106777.786	106797.786		20					
						Straight	106797.786	106826.633	28.847						
						Transition	106826.633	106841.633		15					
949	576535.591	2822013.527	30	39	1.33	Arc	106841.633	106842.682		1.048	30	Left	7	25	1.5
						Transition	106842.682	106857.682		15					
						Straight	106857.682	106868.764	11.082						
950	576533.43	2822051.862	16	53	8.93	Arc	106868.764	106892.341		23.577	80	Right	7	30	0.9
						Straight	106892.341	106905.220	12.879						
						Transition	106905.220	106925.220		20					
951	576546.046	2822095.15	61	44	49.82	Arc	106925.220	106926.773		1.554	20	Right	7	20	1.5
						Transition	106926.773	106946.773		20					
						Straight	106946.773	106950.585	3.811						
						Transition	106950.585	106965.585		15					
952	576583.385	2822108.626	31	31	11.8	Arc	106965.585	106967.089		1.504	30	Right	7	20	1.5
						Transition	106967.089	106982.089		15					
						Straight	106982.089	106983.223	1.135						
						Transition	106983.223	106998.223		15					
953	576615.965	2822103.844	50	4	57.71	Arc	106998.223	107000.706		2.482	20	Left	7	20	1.5
						Transition	107000.706	107015.706		15					
						Straight	107015.706	107024.826	9.121						
						Transition	107024.826	107039.826		15					
954	576649.773	2822127.113	39	40	49.74	Arc	107039.826	107042.140		2.314	25	Left	7	20	1.5
						Transition	107042.140	107057.140		15					
						Straight	107057.140	107063.969	6.829						
955	576659.003	2822154.261	8	18	56.05	Arc	107063.969	107075.580		11.611	80	Left	7	30	0.9
						Straight	107075.580	107085.987	10.408						
956	576662.725	2822185.492	21	33	18.53	Arc	107085.987	107116.084		30.097	80	Right	7	30	0.9
						Straight	107116.084	107213.157	97.073						
957	576724.03	2822299.102	6	24	28.77	Arc	107213.157	107246.709		33.552	300	Left	Normal Camber	40	0.6
						Straight	107246.709	107276.248	29.538						
						Transition	107276.248	107296.248		20					
958	576754.983	2822370.952	25	5	55.32	Arc	107296.248	107320.053		23.805	100	Right	7	40	0.9
						Transition	107320.053	107340.053		20					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Straight	107340.053	107393.990	53.937						
						Transition	107393.990	107413.990		20					
959	576841.039	2822448.93	46	50	43.18	Arc	107413.990	107434.870		20.88	50	Right	7	30	1.2
						Transition	107434.870	107454.870		20					
						Straight	107454.870	107484.393	29.523						
						Transition	107484.393	107499.393		15					
960	576917.257	2822448.778	33	50	52.59	Arc	107499.393	107502.115		2.723	30	Left	7	25	1.5
						Transition	107502.115	107517.115		15					
						Straight	107517.115	107536.707	19.592						
961	576957.117	2822469.929	13	13	54.46	Arc	107536.707	107555.182		18.475	80	Right	7	30	0.9
						Straight	107555.182	107562.209	7.027						
						Transition	107562.209	107577.209		15					
962	576989.579	2822480.939	24	5	57.77	Arc	107577.209	107583.239		6.031	50	Left	7	30	1.2
						Transition	107583.239	107598.239		15					
						Straight	107598.239	107654.928	56.688						
						Transition	107654.928	107669.928		15					
963	577061.286	2822542.733	20	33	24.87	Arc	107669.928	107680.043		10.115	70	Left	7	30	0.9
						Transition	107680.043	107695.043		15					
						Straight	107695.043	107718.557	23.514						
						Transition	107718.557	107733.557		15					
964	577089.976	2822595.732	26	41	5	Arc	107733.557	107737.186		3.629	40	Left	7	25	1.5
						Transition	107737.186	107752.186		15					
						Straight	107752.186	107757.462	5.275						
965	577092.27	2822625.959	11	49	10.59	Arc	107757.462	107773.965		16.503	80	Right	7	30	0.9
						Straight	107773.965	107816.558	42.593						
						Transition	107816.558	107831.558		15					
966	577106.639	2822695.869	50	14	2.94	Arc	107831.558	107842.860		11.303	30	Left	7	20	1.5
						Transition	107842.860	107857.860		15					
						Straight	107857.860	107877.272	19.412						
967	577082.474	2822733.019	5	0	48.63	Arc	107877.272	107886.023		8.75	100	Left	7	30	0.9
						Straight	107886.023	107903.237	17.214						
968	577058.986	2822759.569	19	39	10.63	Arc	107903.237	107930.678		27.441	80	Right	7	30	0.9
						Straight	107930.678	107954.540	23.862						
						Transition	107954.540	107979.540		25					
969	577032.901	2822817.124	37	46	22.93	Arc	107979.540	107980.911		1.371	40	Left	7	30	1.5

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	107980.911	108005.911		25					
						Straight	108005.911	108042.758	36.847						
						Transition	108042.758	108057.758		15					
970	576964.87	2822859.4	14	48	31.28	Arc	108057.758	108063.435		5.677	80	Left	7	30	0.9
						Transition	108063.435	108078.435		15					
						Straight	108078.435	108129.985	51.550						
						Transition	108129.985	108144.985		15					
971	576882.076	2822884.646	27	57	9.66	Arc	108144.985	108149.500		4.515	40	Right	7	25	1.5
						Transition	108149.500	108164.500		15					
						Straight	108164.500	108169.465	4.966						
						Transition	108169.465	108184.465		15					
972	576853.143	2822912.321	30	5	27.38	Arc	108184.465	108190.473		6.007	40	Right	7	25	1.5
						Transition	108190.473	108205.473		15					
						Straight	108205.473	108233.869	28.397						
973	576836.433	2822963.858	4	29	58.18	Arc	108233.869	108249.576		15.706	200	Right	3.6	30	0.6
						Straight	108249.576	108362.655	113.080						
						Transition	108362.655	108382.655		20					
974	576808.702	2823105.641	31	19	5.19	Arc	108382.655	108389.985		7.33	50	Right	7	30	1.2
						Transition	108389.985	108409.985		20					
						Straight	108409.985	108422.100	12.114						
						Transition	108422.100	108437.100		15					
975	576824.052	2823157.774	15	59	26.36	Arc	108437.100	108444.427		7.327	80	Left	7	30	0.9
						Transition	108444.427	108459.427		15					
						Straight	108459.427	108483.730	24.304						
						Transition	108483.730	108498.730		15					
976	576831.12	2823220.197	47	44	19.97	Arc	108498.730	108508.726		9.996	30	Right	7	20	1.5
						Transition	108508.726	108523.726		15					
						Straight	108523.726	108537.293	13.566						
						Transition	108537.293	108552.293		15					
977	576868.321	2823255.155	29	1	42.65	Arc	108552.293	108557.559		5.266	40	Left	7	20	1.5
						Transition	108557.559	108572.559		15					
						Straight	108572.559	108592.050	19.492						
978	576886.52	2823296.067	4	25	24.93	Arc	108592.050	108607.491		15.441	200	Right	3.6	30	0.6
						Straight	108607.491	108622.574	15.082						
						Transition	108622.574	108637.574		15					

HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
979	576904.45	2823333.788	16	26	26.46	Arc	108637.574	108645.529		7.956	80	Left	7	30	0.9
						Transition	108645.529	108660.529		15					
						Straight	108660.529	108684.108	23.579						
						Transition	108684.108	108704.108		20					
980	576914.872	2823399.218	31	46	19.49	Arc	108704.108	108711.835		7.726	50	Left	7	30	1.2
						Transition	108711.835	108731.835		20					
						Straight	108731.835	108734.115	2.280						
981	576901.39	2823438.902	10	39	46.87	Arc	108734.115	108765.753		31.638	170	Left	4.2	40	0.6
						Straight	108765.753	108777.582	11.829						
						Transition	108777.582	108797.582		20					
982	576875.774	2823483.272	31	16	11.77	Arc	108797.582	108804.870		7.288	50	Right	7	30	1.2
						Transition	108804.870	108824.870		20					
						Straight	108824.870	108872.098	47.227						
						Transition	108872.098	108887.098		15					
983	576872.832	2823570.214	14	22	19.18	Arc	108887.098	108889.657		2.559	70	Right	7	40	0.9
						Transition	108889.657	108904.657		15					
						Straight	108904.657	108952.016	47.359						
						Transition	108952.016	108967.016		15					
984	576892.191	2823651.499	14	16	52.62	Arc	108967.016	108976.941		9.926	100	Right	7	40	0.9
						Transition	108976.941	108991.941		15					
						Straight	108991.941	109009.808	17.867						
985	576915.963	2823698.533	8	30	44.32	Arc	109009.808	109039.521		29.714	200	Right	3.6	30	0.6
						Straight	109039.521	109111.422	71.900						
						Transition	109111.422	109131.422		20					
986	576983.986	2823787.596	35	21	5.47	Arc	109131.422	109142.272		10.85	50	Right	7	30	1.2
						Transition	109142.272	109162.272		20					
						Straight	109162.272	109212.960	50.688						
						Transition	109212.960	109227.960		15					
987	577071.478	2823821.52	39	58	47.2	Arc	109227.960	109233.893		5.933	30	Left	7	20	1.5
						Transition	109233.893	109248.893		15					
						Straight	109248.893	109252.781	3.888						
						Transition	109252.781	109270.781		18					
988	577091.466	2823878.699	168	10	29.59	Arc	109270.781	109302.679		31.898	17	Left	7	20	1.5
						Transition	109302.679	109320.679		18					
						Straight	109320.679	109366.988	46.308						

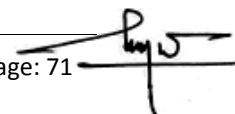


HIP/ CURVE NO.	HIP		DEFLECTION ANGLE			ELEMENT	START	END	LENGTH (m)	CHORD LENGTH (m)	RADIUS (m)	HAND OF ARC	SUPERELEVATION (%)	DESIGN SPEED	EXTRA WIDENING
	EASTING	NORTHING	DEG	MIN	SEC		CHAINAGE (m)	CHAINAGE (m)							
						Transition	109366.988	109381.988		15					
989	577000.662	2823809.299	60	45	37.74	Arc	109381.988	109409.407		27.419	40	Right	7	20	1.5
						Transition	109409.407	109424.407		15					
						Straight	109424.407	109493.805	69.398						

TABLE 3.11: VERTICAL CURVE REPORT

CURVE NO.	IP		TYPE OF CURVE	CURVE LENGTH	M VALUE	START		END		GRADIENT	
	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT
Package III											
269	75506.686	1591.28	Sag	100	1.75	75456.686	1594.78	75556.686	1594.78	-7	7
270	75958	1622.872	Hog	60	-0.525	75928	1620.772	75988	1622.872	7	0
271	76036	1622.872	Sag	60	0.525	76006	1622.872	76066	1624.972	0	7
272	76186.398	1633.4	Hog	100	-1.18	76136.398	1629.9	76236.398	1632.181	7	-2.438
273	77478.893	1601.892	Hog	100	-0.183	77428.893	1603.111	77528.893	1599.94	-2.438	-3.904
274	78165.27	1575.097	Sag	100	0.395	78115.27	1577.049	78215.27	1574.725	-3.904	-0.743
275	78523.534	1572.436	Hog	100	-0.647	78473.534	1572.808	78573.534	1569.478	-0.743	-5.917
276	78930.77	1548.339	Sag	100	0.43	78880.77	1551.298	78980.77	1547.1	-5.917	-2.479
277	79044.439	1545.521	Hog	60	-0.339	79014.439	1546.265	79074.439	1543.421	-2.479	-7
278	80480.799	1444.850	Sag	72	0.220	80444.799	1447.370	80516.799	1443.211	-7.000	-4.554
279	80684.639	1435.567	Sag	80	0.321	80644.639	1437.389	80724.639	1435.028	-4.554	-1.348

CURVE NO.	IP		TYPE OF CURVE	CURVE LENGTH	M VALUE	START		END		GRADIENT	
	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT
280	81043.803	1430.724	Hog	80	-0.564	81003.803	1431.263	81083.803	1427.928	-1.348	-6.991
281	81376.249	1407.484	Sag	90	0.246	81331.249	1410.630	81421.249	1405.323	-6.991	-4.802
282	81781.354	1388.031	Sag	80	0.372	81741.354	1389.952	81821.354	1387.598	-4.802	-1.083
283	82022.781	1385.417	Hog	80	-0.337	81982.781	1385.850	82062.781	1383.637	-1.083	-4.449
284	82647.647	1357.615	Sag	150	0.989	82572.647	1360.952	82722.647	1358.232	-4.449	0.823
285	83323.991	1363.180	Hog	80	-0.264	83283.991	1362.851	83363.991	1362.454	0.823	-1.815
286	83658.254	1357.112	Hog	200	-1.296	83558.254	1358.928	83758.254	1350.112	-1.815	-7.000
287	83919.075	1338.855	Sag	100	0.529	83869.075	1342.355	83969.075	1337.470	-7.000	-2.770
288	84219.782	1330.526	Hog	100	-0.529	84169.782	1331.911	84269.782	1327.026	-2.770	-7.000
289	85154.789	1265.075	Sag	80	0.526	85114.789	1267.875	85194.789	1264.381	-7.000	-1.736
290	85333.640	1261.971	Hog	140	-0.921	85263.640	1263.186	85403.640	1257.071	-1.736	-7.000
291	85776.420	1230.977	Sag	52	0.393	85750.420	1232.797	85802.420	1230.729	-7.000	-0.951
292	86169.391	1227.239	Hog	70	-0.294	86134.391	1227.572	86204.391	1225.732	-0.951	-4.306
293	86499.589	1213.020	Sag	115	0.518	86442.089	1215.496	86557.089	1212.617	-4.306	-0.701
294	86711.704	1211.534	Sag	56	0.174	86683.704	1211.730	86739.704	1212.034	-0.701	1.789

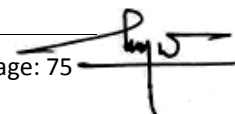



CURVE NO.	IP		TYPE OF CURVE	CURVE LENGTH	M VALUE	START		END		GRADIENT	
	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT
295	86947.115	1215.744	Hog	130	-0.466	86882.115	1214.582	87012.115	1215.042	1.789	-1.081
296	87149.794	1213.554	Sag	60	0.374	87119.794	1213.878	87179.794	1214.723	-1.081	3.900
297	87370.521	1222.161	Hog	112	-0.807	87314.521	1219.977	87426.521	1221.118	3.900	-1.863
298	87558.136	1218.666	Sag	80	0.514	87518.136	1219.412	87598.136	1219.979	-1.863	3.281
299	87808.839	1226.891	Sag	50	0.087	87783.839	1226.071	87833.839	1228.060	3.281	4.676
300	88351.834	1252.284	Hog	75	-0.515	88314.334	1250.530	88389.334	1251.980	4.676	-0.812
301	88772.271	1248.871	Sag	132	0.838	88706.271	1249.407	88838.271	1251.689	-0.812	4.270
302	89408.808	1276.051	Hog	92	-0.581	89362.808	1274.087	89454.808	1275.689	4.270	-0.785
303	89984.271	1271.531	Sag	150	1.022	89909.271	1272.120	90059.271	1275.029	-0.785	4.664
304	90155.026	1279.495	Hog	78	-0.479	90116.026	1.676	90194.026	1279.396	4.664	-0.253
305	90683.385	1278.156	Hog	50	-0.191	90658.385	1278.220	90708.385	1.331	-0.253	-3.301
306	91062.154	1265.651	Sag	100	0.376	91012.154	1267.302	91112.154	1265.504	-3.301	-0.296
307	91281.833	1265.002	Sag	84	0.216	91239.833	1265.126	91323.833	1265.740	-0.296	1.758
308	91726.340	1272.817	Hog	106	-0.826	91673.340	1271.886	91779.340	1270.443	1.758	-4.479
309	92299.748	1247.133	Sag	50	0.214	92274.748	1248.253	92324.748	1246.870	-4.479	-1.051
310	92716.082	1242.756	Hog	100	-0.298	92666.082	1243.282	92766.082	1241.039	-1.051	3.435

CURVE NO.	IP		TYPE OF CURVE	CURVE LENGTH	M VALUE	START		END		GRADIENT	
	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT
311	93107.373	1229.314	Sag	50	0.091	93082.373	1230.172	93132.373	1228.817	-3.435	-1.986
312	93693.424	1217.675	Sag	60	0.092	93663.424	1218.271	93723.424	1217.446	-1.986	-0.764
313	94107.312	1214.512	Hog	60	-0.009	94077.312	1214.741	94137.312	1214.245	-0.764	-0.891
314	94971.400	1206.816	Hog	60	-0.191	94941.400	1207.083	95001.400	1205.784	-0.891	-3.439
315	95461.906	1189.946	Hog	29.196	-0.034	95447.307	1190.448	95476.504	1189.309	-3.439	-4.364
316	96347.123	1148.676	Sag	60	0.317	96317.123	1150.231	96377.123	1148.386	-5.184	-0.964
317	96879.858	1143.539	Hog	210	-1.584	96774.858	1144.552	96984.858	1136.189	-0.964	-7.000
318	97699.561	1086.160	Sag	91	0.114	97654.061	1089.345	97745.061	1083.430	-7.000	-6.000
319	97799.561	1080.160	Hog	60	-0.075	97769.561	1081.960	97829.561	1078.060	-6.000	-7.000
320	98515.857	1030.019	Sag	52	0.065	98489.857	1031.839	98541.857	1028.459	-7.000	-6.000
321	98615.857	1024.019	Hog	60	-0.075	98585.857	1025.819	98645.857	1021.919	-6.000	-7.000
322	99560.006	957.929	Sag	60	0.342	99530.006	960.029	99590.006	957.196	-7.000	-2.444
323	100061.017	945.685	Hog	60	-0.342	100031.017	946.418	100091.017	943.585	-2.444	-7.000
324	100268.276	931.177	Sag	60	0.105	100238.276	933.000	100298.276	929.498	-7.000	-5.596
325	100523.492	916.896	Hog	60	-0.105	100493.492	918.574	100553.492	914.796	-5.596	-7.000

CURVE NO.	IP		TYPE OF CURVE	CURVE LENGTH	M VALUE	START		END		GRADIENT	
	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT
326	101953.300	816.809	Sag	60	0.401	101923.300	818.909	101983.300	816.314	-7.000	-1.651
327	102554.448	806.887	Hog	60	-0.401	102524.448	807.382	102584.448	804.787	-1.651	-7.000
328	103760.425	722.468	Sag	60	0.138	103730.425	724.568	103790.425	720.919	-7.000	-5.163
329	104337.714	692.662	Hog	100	-0.230	104287.714	695.243	104387.714	689.162	-5.163	-7.000
330	104720.837	665.843	Sag	100	0.379	104670.837	669.343	104770.837	663.861	-7.000	-3.965
331	105360.395	640.486	Sag	100	1.186	105310.395	642.468	105410.395	643.248	-3.965	5.524
332	105689.330	658.658	Hog	80	-0.312	105649.330	656.448	105729.330	659.621	5.524	2.409
333	105938.762	664.666	Sag	80	0.459	105898.762	663.702	105978.762	667.466	2.409	7.000
334	106276.793	688.328	Hog	100	-0.518	106226.793	684.828	106326.793	689.757	7.000	2.859
335	106625.717	698.303	Hog	100	-0.032	106575.717	696.874	106675.717	699.603	2.859	2.601
336	107025.088	708.690	Sag	100	0.550	106975.088	707.389	107075.088	712.190	2.601	7.000
337	107480.696	740.582	Hog	120	-2.100	107420.696	736.382	107540.696	736.382	7.000	-7.000
338	107762.842	720.832	Sag	100	0.779	107712.842	724.332	107812.842	720.449	-7.000	-0.766
339	108402.244	715.934	Sag	80	0.255	108362.244	716.241	108442.244	716.648	-0.766	1.785
340	108608.594	719.617	Hog	80	-0.561	108568.594	718.903	108648.594	718.086	1.785	-3.829
341	108872.417	709.516	Sag	80	0.438	108832.417	711.047	108912.417	709.736	-3.829	-0.551

CURVE NO.	IP		TYPE OF CURVE	CURVE LENGTH	M VALUE	START		END		GRADIENT	
	CHAINAGE	LEVEL				CHAINAGE	LEVEL	CHAINAGE	LEVEL	IN	OUT
342	109118.447	710.871	Hog	150	-0.579	109043.447	710.458	109193.447	708.968	0.551	-2.537
343	109366.886	704.567	Sag	80	0.254	109326.886	705.582	109406.886	704.567	-2.537	0.000




3.2.2 PROPOSED CROSS SECTION DETAILS

Cross-section of the improved facility should be adequate to cater to the traffic expected over the design period and offer safe and convenient traffic operation at speeds consistent with the terrain conditions and functional classification of this road.

The cross-sectional parameters (land /shoulder width etc.) shall be as per standards specified in IRC SP: 73-2015. Following typical cross-sections have been envisaged for the subject road. Package wise TCS length is presented in **Table- 3.12** and **Table- 3.13**:

TABLE 3.12: PROPOSED CROSS-SECTION DETAILS

TCS TYPE	DESCRIPTION	Package wise Length(M)	
		Pkg. IIIA	Pkg. IIIB
TCS-1	Typical Cross Section of Two lane Carriageway in Built up area with both side footpath cum RCC Rectangular Drain (Reconstruction of Existing Pavement)	0	0
TCS-2	Typical Cross Section of Two Lane Carriageway in Rural Area with RR Masonry Trapezoidal Drain on Hill Side and Earthen Shoulder on valley side (Reconstruction of Existing Pavement)	5550	5200
TCS-3	Typical Cross Section of Two lane Carriageway in Rural area with breast wall on hill side and earthen shoulder on valley side (Reconstruction of Existing Pavement)	400	300
TCS-4	Typical Cross Section of Two lane Carriageway at reconstruction stretch in rural area with one side retaining wall and other side RR masonry Trapezoidal drain(Reconstruction of Existing Pavement)	2400	4075
TCS-5	Typical Cross Section of Two lane Carriageway in Rural area with one side retaining wall and other side breast wall (Reconstruction of Existing Pavement)	700	150
TCS-6	Typical Cross Section of Two lane Carriageway due to presence of hill in Rural area with both side RR Masonry Trapezoidal Drain(Reconstruction of Existing Pavement)	2675	5450
TCS-7	Typical Cross Section of Two lane Carriageway in Rural area with one side RR Masonry Trapezoidal Drain and earthen shoulder on valley side (New construction)	0	1750
TCS-8	Typical Cross Section of Two lane Carriageway at realignment stretch due to presence of hill in Rural area with both side RR Masonry Trapezoidal Drain(New construction)	0	1050
TCS-9	Typical Cross Section of Two lane Carriageway in rural area with one side retaining wall and other side RR Masonry Trapezoidal Drain(New construction)	0	2469
TCS-10	Typical Cross Section of Two lane Carriageway in Built up area with both side footpath and open RR masonry trapezoidal drain(Reconstruction of Existing Pavement)	375	0
TCS-11	Typical Cross Section of Two lane Carriageway in rural area with one side breast wall and other side RR masonry trapezoidal drain(Reconstruction of Existing Pavement)	250	500



TCS TYPE	DESCRIPTION	Package wise Length(M)	
		Pkg. IIIA	Pkg. IIIB
TCS-12	Typical Cross Section of Two lane Carriageway in rural area with both side breast wall (Reconstruction of Existing Pavement)	0	0
TCS-13	Typical Cross Section of Two lane Carriageway in rural area with one side retaining wall (New Construction)	0	150
TCS-14	Typical Cross Section of Two lane Carriageway in rural area with both side retaining wall (New Construction)	0	0
TCS-15	Typical Cross Section of reconstruction of Two lane Carriageway in rural area with composite RE wall (New Construction)	0	0
TCS-16	Typical Cross Section of reconstruction of Two lane Carriageway paved shoulder in rural area on both side composite RE wall	0	0
TCS-17	Typical Cross Section of Two lane Carriageway in rural area with breast wall on hill side and earthen shoulder on valley side (New Construction)	0	350
TCS-18	Typical Cross Section of Two lane Carriageway in rural area with one side retaining wall and other side breast wall (New Construction)	0	450
TCS-19	Typical Cross Section of Two lane Carriageway in rural area with one side breast wall and other side RR masonry trapezoidal drain (New Construction)	0	250
Total length =		12350	22144

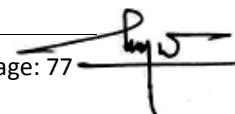



TABLE 3.13: CHAINAGEWISE CROSS-SECTION DETAILS

Chainage (Km)		Net Length (m)	TCS No.
From	To		
75000	75375	375	TCS-10
75375	76175	800	TCS-2
76175	76225	50	TCS-4
76225	76325	100	TCS-2
76325	76375	50	TCS-4
76375	76525	150	TCS-2
76525	76625	100	TCS-4
76625	76825	200	TCS-2
76825	76975	150	TCS-6
76975	77025	50	TCS-4
77025	77125	100	TCS-2
77125	77325	200	TCS-4
77325	77375	50	TCS-6
77375	77425	50	TCS-4
77425	77475	50	TCS-6
77475	77625	150	TCS-4
77625	77675	50	TCS-2
77675	77775	100	TCS-4
77775	77875	100	TCS-2
77875	78025	150	TCS-4
78025	78125	100	TCS-2
78125	78325	200	TCS-4
78325	78425	100	TCS-2
78425	78475	50	TCS-4
78475	78575	100	TCS-2
78575	78775	200	TCS-4
78775	78825	50	TCS-2
78825	78925	100	TCS-4
78925	79025	100	TCS-2
79025	79075	50	TCS-6
79075	79175	100	TCS-11
79175	79275	100	TCS-3
79275	80175	900	TCS-6
80175	80325	150	TCS-2
80325	80425	100	TCS-6
80425	80675	250	TCS-2
80675	80725	50	TCS-4
80725	80775	50	TCS-6
80775	80975	200	TCS-2
80975	81025	50	TCS-4
81025	81075	50	TCS-2
81075	81175	100	TCS-11
81175	81275	100	TCS-3
81275	81375	100	TCS-4

Chainage (Km)		Net Length (m)	TCS No.
From	To		
81375	81425	50	TCS-2
81425	81475	50	TCS-6
81475	81525	50	TCS-4
81525	81575	50	TCS-6
81575	81625	50	TCS-4
81625	81725	100	TCS-2
81725	81775	50	TCS-6
81775	81975	200	TCS-2
81975	82025	50	TCS-6
82025	82125	100	TCS-2
82125	82175	50	TCS-3
82175	82225	50	TCS-5
82225	82275	50	TCS-11
82275	82325	50	TCS-3
82325	82475	150	TCS-2
82475	82875	400	TCS-4
82875	83075	200	TCS-6
83075	83575	500	TCS-2
83575	83675	100	TCS-6
83675	83725	50	TCS-2
83725	83775	50	TCS-4
83775	83875	100	TCS-2
83875	83975	100	TCS-3
83975	84525	550	TCS-6
84525	84725	200	TCS-2
84725	84825	100	TCS-6
84825	84975	150	TCS-2
84975	85325	350	TCS-5
85325	85425	100	TCS-6
85425	85575	150	TCS-2
85575	85625	50	TCS-4
85625	85975	350	TCS-2
85975	86125	150	TCS-5
86125	86725	600	TCS-2
86725	86875	150	TCS-5
86875	86925	50	TCS-2
86925	86975	50	TCS-4
86975	87025	50	TCS-6
87025	87175	150	TCS-2
87175	87225	50	TCS-4
87225	87275	50	TCS-2
87275	87325	50	TCS-4
87325	87350	25	TCS-6
Total Length of PKG- IIIA =		12350	
87350	87825	475	TCS-4

Chainage (Km)		Net Length (m)	TCS No.
From	To		
87825	88025	200	TCS-2
88025	88075	50	TCS-4
88075	88125	50	TCS-2
88125	88175	50	TCS-4
88175	88225	50	TCS-6
88225	88275	50	TCS-2
88275	88475	200	TCS-4
88475	88525	50	TCS-2
88525	88625	100	TCS-4
88625	88875	250	TCS-2
88875	89025	150	TCS-6
89025	89125	100	TCS-4
89125	89225	100	TCS-2
89225	89475	250	TCS-6
89475	89525	50	TCS-2
89525	89575	50	TCS-4
89575	89825	250	TCS-2
89825	89875	50	TCS-4
89875	89975	100	TCS-2
89975	90025	50	TCS-6
90025	90075	50	TCS-4
90075	90225	150	TCS-2
90225	90325	100	TCS-6
90325	90375	50	TCS-2
90375	90575	200	TCS-4
90575	90675	100	TCS-6
90675	90725	50	TCS-4
90725	91175	450	TCS-2
91175	91225	50	TCS-4
91225	91325	100	TCS-6
91325	91425	100	TCS-4
91425	91475	50	TCS-6
91475	91525	50	TCS-11
91525	91675	150	TCS-6
91675	91825	150	TCS-2
91825	92125	300	TCS-6
92125	92175	50	TCS-2
92175	92725	550	TCS-6
92725	92775	50	TCS-4
92775	92875	100	TCS-3
92875	92975	100	TCS-2
92975	93075	100	TCS-6
93075	93175	100	TCS-2
93175	93225	50	TCS-4
93225	93325	100	TCS-6

Chainage (Km)		Net Length (m)	TCS No.
From	To		
93325	93375	50	TCS-2
93375	93575	200	TCS-6
93575	93775	200	TCS-2
93775	93825	50	TCS-4
93825	93875	50	TCS-6
93875	93975	100	TCS-4
93975	94125	150	TCS-2
94125	94225	100	TCS-11
94225	94325	100	TCS-4
94325	94375	50	TCS-6
94375	94525	150	TCS-4
94525	94575	50	TCS-2
94575	94625	50	TCS-4
94625	94975	350	TCS-2
94975	95225	250	TCS-6
95225	95275	50	TCS-4
95275	95325	50	TCS-6
95325	95475	150	TCS-2
95475	95525	50	TCS-4
95525	95675	150	TCS-2
95675	95925	250	TCS-4
95925	96025	100	TCS-6
96025	96075	50	TCS-4
96075	96275	200	TCS-6
96275	96375	100	TCS-2
96375	96575	200	TCS-4
96575	98125	1550	TCS-6
98125	98475	350	TCS-11
98475	98825	350	TCS-6
98825	98875	50	TCS-4
98875	98925	50	TCS-2
98925	99375	450	TCS-4
99375	99425	50	TCS-2
99425	99475	50	TCS-4
99475	99525	50	TCS-13
99525	99625	100	TCS-2
99625	99675	50	TCS-4
99675	99825	150	TCS-2
99825	99875	50	TCS-4
99875	100525	650	TCS-2
100525	100575	50	TCS-4
100575	100725	150	TCS-6
100725	100925	200	TCS-2
100925	101125	200	TCS-6
101125	101375	250	TCS-2

Chainage (Km)		Net Length (m)	TCS No.
From	To		
101375	101625	250	TCS-6
101625	101925	300	TCS-2
101925	102025	100	TCS-9
102025	102175	150	TCS-7
102175	102575	400	TCS-9
102575	102675	100	TCS-8
102675	102775	100	TCS-9
102775	102825	50	TCS-13
102825	102875	50	TCS-7
102875	102925	50	TCS-13
102925	102975	50	TCS-7
102975	103075	100	TCS-9
103075	103475	400	TCS-7
103475	103825	350	TCS-8
103825	103925	100	TCS-7
103925	104025	100	TCS-8
104025	104425	400	TCS-7
104425	104525	100	TCS-8
104525	104825	300	TCS-4
104825	104925	100	TCS-3
104925	105075	150	TCS-5
105075	105175	100	TCS-2
105175	105275	100	TCS-3
105275	105675	400	TCS-4
105675	105875	200	TCS-7
105875	106175	300	TCS-18
106175	106475	300	TCS-17
106475	106625	150	TCS-8
106625	106975	350	TCS-9
106975	107025	50	TCS-8
107025	107125	100	TCS-7
107125	107175	50	TCS-9
107175	107225	50	TCS-7
107225	107275	50	TCS-19
107275	107375	100	TCS-8
107375	107525	150	TCS-19
107525	107625	100	TCS-7
107625	107675	50	TCS-19
107675	107725	50	TCS-7
107725	107875	150	TCS-18
107875	107925	50	TCS-17
107925	107975	50	TCS-7
107975	109175	1200	TCS-9
109175	109275	100	TCS-8
109275	109325	50	TCS-7

Chainage (Km)		Net Length (m)	TCS No.
From	To		
109325	109494	169	TCS-9
Total Length of PKG- IIB =		22144	

3.2.3 PAVEMENT DETAILS

2 lane roads will be developed in place of existing Intermediate/two lane road. Considering Design traffic of 20 msa and Design CBR of 10% following pavement thickness has been adopted over existing and New/Widening portion.

TABLE 3.14: PAVEMENT THICKNESS AS PER CONVENTIONAL METHOD

Design CBR (%)	Design Traffic (MSA)	GSB (mm)	WMM (mm)	DBM (mm)	BC (mm)	Total Thickness (mm)	Sub-grade in New /Widening portion
10%	20	200	250	70	40	560	500

Pavement Thickness as per IRC:37-2018

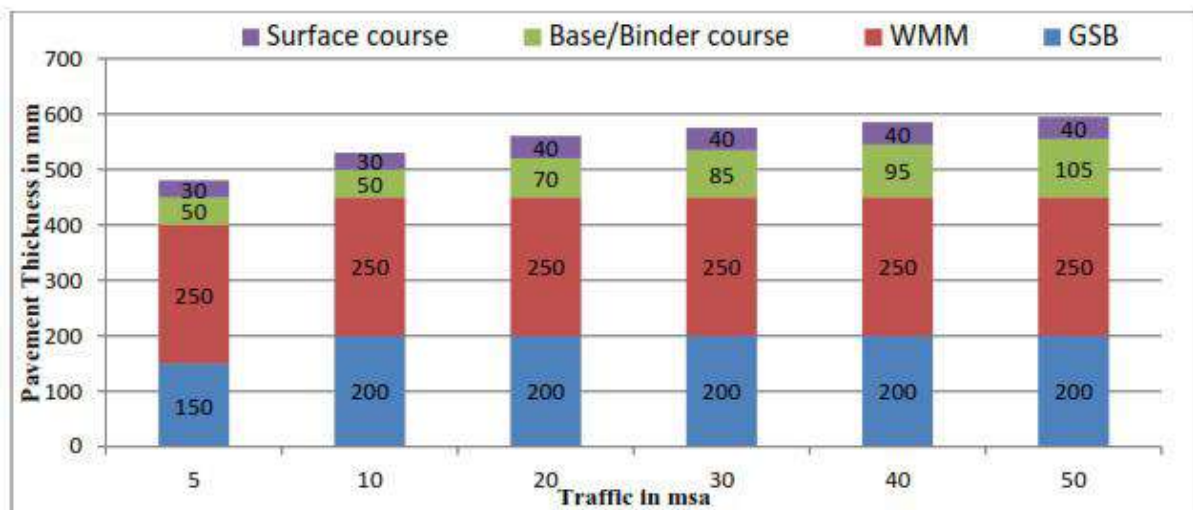


Figure 12.6 Catalogue for pavement with bituminous surface course with granular base and sub-base - Effective CBR 10% (Plate-6)

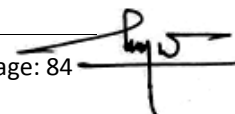
3.2.4 MUCK DISPOSAL

The muck from hill cutting and construction activities will be safely disposed at suitable locations. Principle adopted for selecting muck dumping areas was to avoid sensitive areas like dense vegetation, natural water courses and areas prone to landslides. During the selection of the dumping sites preference was given on the following aspects.

- The muck does not fall/ flow into stream/river.
- Dumping sites should be at least 30 m (horizontal) away from the High Flood Level of the River/ stream.
- The sites are free from active landslides or creeps.
- The sites should not fall within pristine forest nor are these habitats of threatened species of flora and fauna.
- The sites are located close to its source in order to avoid long distance haulage.

Requirement of total muck disposal area has given below:

Muck Disposal Estimate (Maram-Peren Road Stretch)											
PKG No.	Chainage(M)		Quantity of Muck/Debris generated in Cum	Quantity of Muck with 30% swell factor in Cum	Total Quantity of Muck/Debris including swell factor in Cum	Estimated Quantity of Muck/Debris proposed to be utilized for Filling in cum	Estimated quantity of muck/debris proposed to be dumped in cum.	Estimated quantity of muck/debris dumped in other location in Cum	Avg. Dumping Height in M.	Avg. Dumping Area (Sqm.)	Avg. Dumping Area (Ha.)
	From	To									
PKG-III	75,000	109,494	4,228,021.00	1,268,406.30	5,496,427.30	241,979.00	5,254,448.30	5,254,448.30	15.00	350,296.55	35.03




3.2.5 BRIDGES AND CULVERTS

BRIDGES

Out of 10nos. of existing bridges along the project stretch 1 no. major bridge and 3 nos. minor bridges are retained and 6 nos. minor bridges will be replaced by Box Culverts. The package wise details of the major and minor bridges are given below in **Table -3.15:**

TABLE 3.15: DETAILS OF BRIDGES

Sl. No.	Survey Chainage (km)	Design Chainage (km)	Existing Details		Proposal	
			Type of Structures (Bridge)	Span Arrangement (No. x Span) m	Type of Structures (Bridge)	Span Arrangement [Span (M) X Height (M)]
	Package: III					
1	75.865	76.000	RCC T GIRDER	1x16.60M	Retained	
2	109.735	109.461	STEEL TRUSS	1x66.48M	Retained	

CULVERTS

Package: III

Reconstruction with Box culverts =111 nos.

Additional new Box culverts =33 nos.

Removal of existing culvert=31 nos.

TABLE- 3.16a: DETAILS OF RECONSTRUCTION OF EXISTING CULVERTS

Sl. No.	Survey Chainage (Km)	Design Chainage (km)	Existing Details		Proposal	
			Type of Structure	Span Arrangement (M)	Type of Structure	Span Arrangement [Span (M) X Height (M)]
Package-III						
1	75.230	75.390	Pipe culvert	2×1.0	BOX	2.0 X 3.0
2	75.331	75.507	Pipe culvert	2×1.0	BOX	3.0 X 4.0
3	75.718	75.860	Slab culvert	1×4.0	BOX	5.0 X 3.0
4	76.378	76.483	Pipe culvert	2×1.0	BOX	2.0 X 3.0
5	76.460	76.565	Slab culvert	1×1.2	BOX	2.0 X 3.0
6	76.612	76.711	Pipe culvert	1×1.0	BOX	3.0 X 4.0
7	77.070	77.165	Pipe culvert	2×1.0	BOX	2.0 X 3.0
8	77.200	77.292	Pipe culvert	2×1.0	BOX	3.0 X 4.0
9	77.575	77.650	Pipe culvert	2×1.0	BOX	2.0 X 2.0
10	77.748	77.820	Pipe culvert	2×1.0	BOX	2.0 X 2.0
11	78.163	78.230	Pipe culvert	2×1.0	BOX	2.0 X 3.0
12	78.363	78.434	Pipe culvert	2×1.0	BOX	2.0 X 2.0
13	78.642	78.708	Pipe culvert	2×1.0	BOX	2.0 X 2.0
14	78.942	79.005	Pipe culvert	2×1.0	BOX	2.0 X 3.0
15	79.130	79.180	Pipe culvert	2×1.0	BOX	2.0 X 2.0
16	80.460	80.435	Pipe culvert	2×0.9	BOX	2.0 X 2.0
17	80.728	80.695	Pipe culvert	2×1.0	BOX	2.0 X 3.0

Sl. No.	Survey Chainage (Km)	Design Chainage (km)	Existing Details		Proposal	
			Type of Structure	Span Arrangement (M)	Type of Structure	Span Arrangement [Span (M) X Height (M)]
Package-III						
18	81.180	81.142	Pipe culvert	2×1.0	BOX	2.0 X 2.0
19	81.405	81.367	Pipe culvert	2×1.0	BOX	2.0 X 3.0
20	81.635	81.592	Pipe culvert	2×1.0	BOX	3.0 X 4.0
21	81.913	81.868	Pipe culvert	2×0.9	BOX	2.0 X 3.0
22	82.010	81.952	Pipe culvert	2×0.9	BOX	2.0 X 3.0
23	82.107	82.050	Pipe culvert	2X1.0	BOX	2.0 X 2.0
24	82.633	82.568	Pipe culvert	1X1.2	BOX	2.0 X 2.0
25	82.792	82.725	Pipe culvert	1X1.0	BOX	2.0 X 3.0
26	82.968	82.900	Pipe culvert	2×1.0	BOX	2.0 X 2.0
27	83.152	83.075	Pipe culvert	2×1.0	BOX	2.0 X 3.0
28	83.264	83.180	Pipe culvert	2X1.0	BOX	2.0 X 3.0
29	83.606	83.525	Pipe culvert	2X1.2	BOX	2.0 X 3.0
30	83.769	83.666	Pipe culvert	2×1.0	BOX	2.0 X 3.0
31	84.074	83.975	Pipe culvert	2X1.0	BOX	2.0 X 2.0
32	84.553	84.435	Pipe culvert	1X1.2	BOX	2.0 X 2.0
33	84.760	84.640	Pipe culvert	2X0.6	BOX	2.0 X 3.0
34	85.578	85.455	Pipe culvert	2X1.2	BOX	2.0 X 3.0
35	85.918	85.785	Pipe culvert	2X1.0	BOX	2.0 X 2.0
36	86.140	86.005	COVERED BY	-	BOX	2.0 X 3.0
37	86.595	86.450	Pipe culvert	2X1.0	BOX	2.0 X 3.0
38	86.880	86.735	COVERED BY	-	BOX	2.0 X 3.0
39	87.281	87.135	COVERED BY	2X1.0	BOX	2.0 X 3.0
40	87.887	87.740	Pipe culvert	2X1.0	BOX	2.0 X 3.0
41	88.202	88.042	Pipe culvert	2X1.0	BOX	2.0 X 2.0
42	88.400	88.240	Pipe culvert	2X1.2	BOX	2.0 X 3.0
43	88.628	88.462	Pipe culvert	2X1.0	BOX	2.0 X 3.0
44	88.932	88.763	Pipe culvert	1X1.0	BOX	3.0 X 4.0
45	89.368	89.194	Pipe culvert	1X1.0	BOX	2.0 X 3.0
46	89.989	89.800	Pipe culvert	2X1.0	BOX	3.0 X 4.0
47	90.105	89.920	Pipe culvert	2X1.0	BOX	2.0 X 3.0
48	90.176	89.980	Slab culvert	1X1.0	BOX	2.0 X 2.0
49	90.238	90.032	Pipe culvert	1X1.2	BOX	2.0 X 3.0
50	90.440	90.227	Pipe culvert	2X1.0	BOX	2.0 X 2.0
51	90.750	90.532	ARCH	1X1.0	BOX	3.0 X 4.0
52	91.014	90.793	Pipe culvert	2X1.0	BOX	2.0 X 2.0
53	91.263	91.041	Pipe culvert	2X1.0	BOX	2.0 X 2.0
54	91.442	91.220	Slab culvert	1X1.5	BOX	2.0 X 3.0
55	91.927	91.405	Slab culvert	1X1.5	BOX	2.0 X 3.0
56	91.925	91.670	Slab culvert	1X1.5	BOX	2.0 X 3.0
57	92.052	91.796	Slab culvert	1X1.5	BOX	2.0 X 3.0
58	92.283	92.015	Slab culvert	1X1.5	BOX	3.0 X 4.0

Sl. No.	Survey Chainage (Km)	Design Chainage (km)	Existing Details		Proposal	
			Type of Structure	Span Arrangement (M)	Type of Structure	Span Arrangement [Span (M) X Height (M)]
Package-III						
59	92.644	92.360	Slab culvert	1X2.0	BOX	3.0 X 4.0
60	92.837	92.540	Slab culvert	1X1.5	BOX	2.0 X 3.0
61	93.060	92.751	Slab culvert	1X1.5	BOX	2.0 X 3.0
62	93.187	92.875	Slab culvert	1X2.0	BOX	2.0 X 2.0
63	93.610	93.290	Slab culvert	1X1.5	BOX	2.0 X 3.0
64	93.747	93.425	Slab culvert	1X1.5	BOX	2.0 X 2.0
65	93.910	93.585	Slab culvert	1X1.5	BOX	2.0 X 3.0
66	94.125	93.795	Slab culvert	1X1.5	BOX	2.0 X 3.0
67	94.270	93.930	Slab culvert	1x1.5	BOX	2.0 X 2.0
68	94.378	94.032	Slab culvert	1x1.5	BOX	2.0 X 3.0
69	94.628	94.281	Slab culvert	1x1.5	BOX	2.0 X 3.0
70	94.737	94.375	Slab culvert	1x1.5	BOX	2.0 X 2.0
71	94.960	94.590	Slab culvert	1x3.0	BOX	2.0 X 3.0
72	95.062	94.688	Slab culvert	1x3.0	BOX	2.0 X 2.0
73	95.148	94.770	Slab culvert	1X1.5	BOX	2.0 X 3.0
74	95.310	94.930	Slab culvert	1X1.5	BOX	2.0 X 3.0
75	95.436	95.070	Slab culvert	1x3.0	BOX	3.0 X 4.0
76	95.627	95.235	Slab culvert	1X4	BOX	5.0 X 3.0
77	95.763	95.367	Pipe culvert	2X1.0	BOX	2.0 X 2.0
78	95.842	95.445	Pipe culvert	2X1.0	BOX	2.0 X 3.0
79	95.898	95.503	Pipe culvert	2X1.0	BOX	2.0 X 3.0
80	96.166	95.770	Pipe culvert	2X1.0	BOX	2.0 X 2.0
81	96.290	95.890	Slab culvert	1X2.5	BOX	3.0 X 4.0
82	96.433	96.030	Pipe culvert	2X1.0	BOX	2.0 X 2.0
83	96.560	96.157	Pipe culvert	2X1.0	BOX	2.0 X 2.0
84	96.835	96.431	Pipe culvert	2X1.0	BOX	3.0 X 4.0
85	99.288	98.854	Pipe culvert	2X1.0	BOX	5.0 X 3.0
86	99.518	99.080	Pipe culvert	2X1.0	BOX	4.0 X 5.0
87	99.625	99.181	Pipe culvert	2X1.0	BOX	2.0 X 3.0
88	99.730	99.285	Pipe culvert	2X1.0	BOX	2.0 X 3.0
89	99.855	99.407	Pipe culvert	2X1.0	BOX	2.0 X 3.0
90	100.014	99.565	Pipe culvert	2X1.0	BOX	2.0 X 2.0
91	100.109	99.660	Pipe culvert	2X1.0	BOX	2.0 X 3.0
92	100.328	99.870	Pipe culvert	2X1.0	BOX	2.0 X 3.0
93	100.400	99.941	Pipe culvert	2X1.0	BOX	2.0 X 3.0
94	100.571	100.104	Pipe culvert	2X1.0	BOX	2.0 X 3.0
95	100.740	100.267	Pipe culvert	2X1.0	BOX	2.0 X 2.0
96	100.793	100.318	Pipe culvert	2X1.0	BOX	2.0 X 3.0
97	100.952	100.475	Pipe culvert	2X1.0	BOX	2.0 X 3.0
98	101.334	100.855	Pipe culvert	2X1.0	BOX	2.0 X 2.0
99	101.548	101.072	Pipe culvert	2X1.0	BOX	2.0 X 3.0

Sl. No.	Survey Chainage (Km)	Design Chainage (km)	Existing Details		Proposal	
			Type of Structure	Span Arrangement (M)	Type of Structure	Span Arrangement [Span (M) X Height (M)]
Package-III						
100	101.705	101.230	Pipe culvert	2X1.0	BOX	2.0 X 2.0
101	102.352	101.864	Pipe culvert	2X1.0	BOX	2.0 X 3.0
102	102.428	101.935	Pipe culvert	2X1.0	BOX	2.0 X 2.0
103	102.570	102.100	Pipe culvert	2X1.0	BOX	2.0 X 3.0
104	102.823	102.502	Pipe culvert	2X1.0	BOX	2.0 X 3.0
105	102.900	102.900	Pipe culvert	2X1.0	BOX	2.0 X 3.0
106	103.462	103.450	Pipe culvert	2X1.0	BOX	2.0 X 3.0
107	104.260	104.230	Pipe culvert	2X1.0	BOX	2.0 X 2.0
108	104.342	104.310	Pipe culvert	2X1.0	BOX	2.0 X 3.0
109	104.440	104.408	Pipe culvert	2X1.0	BOX	2.0 X 2.0
110	104.619	104.570	Pipe culvert	2X1.0	BOX	2.0 X 3.0
111	105.426	105.360	Pipe culvert	2X1.0	BOX	2.0 X 3.0

TABLE- 3.16b: DETAILS OF ADDITIONAL NEW CULVERT

Sl. No.	Design Chainage (km)	Proposal	
		Type of Structure	Span Arrangement [Span (M) X Height (M)]
Package-III			
1	75.700	BOX	3.0 X 4.0
2	77.502	BOX	2.0 X 2.0
3	78.002	BOX	2.0 X 2.0
4	78.359	BOX	2.0 X 2.0
5	80.812	BOX	2.0 X 2.0
6	81.255	BOX	2.0 X 2.0
7	82.127	BOX	2.0 X 2.0
8	82.199	BOX	2.0 X 2.0
9	82.482	BOX	2.0 X 2.0
10	84.978	BOX	2.0 X 2.0
11	85.217	BOX	2.0 X 2.0
12	86.076	BOX	2.0 X 2.0
13	86.811	BOX	2.0 X 2.0
14	87.517	BOX	2.0 X 2.0
15	87.927	BOX	2.0 X 2.0
16	88.610	BOX	2.0 X 2.0
17	89.524	BOX	2.0 X 2.0
18	89.650	BOX	2.0 X 2.0
19	90.450	BOX	2.0 X 2.0
20	92.971	BOX	2.0 X 2.0

Sl. No.	Design Chainage (km)	Proposal	
		Type of Structure	Span Arrangement [Span (M) X Height (M)]
Package-III			
21	95.689	BOX	2.0 X 2.0
22	99.031	BOX	3.0 X 4.0
23	102.713	BOX	2.0 X 3.0
24	104.968	BOX	3.0 X 4.0
25	105.590	BOX	2.0 X 3.0
26	105.807	BOX	2.0 X 2.0
27	105.978	BOX	2.0 X 2.0
28	106.906	BOX	2.0 X 3.0
29	107.842	BOX	2.0 X 2.0
30	108.399	BOX	2.0 X 3.0
31	108.697	BOX	2.0 X 2.0
32	108.859	BOX	2.0 X 3.0
33	109.325	BOX	2.0 X 3.0

TABLE- 3.16c: DETAILS OF REMOVED CULVERTS

Sl. No.	Survey Chainage (Km)	Existing Details	
		Type of Structure	Span Arrangement (M)
Package-III			
1	75.430	Pipe culvert	2×1.2
2	75.932	Pipe culvert	2×1.0
3	76.876	Slab culvert	1×1.2
4	79.324	Pipe culvert	2×0.9
5	79.503	Pipe culvert	2×0.9
6	79.706	Pipe culvert	2×1.0
7	79.844	Pipe culvert	2×1.0
8	80.037	Pipe culvert	2×0.9
9	84.267	Pipe culvert	2X1.0
10	84.402	Pipe culvert	2X1.0
11	84.460	Pipe culvert	1X1.0
12	90.110	Pipe culvert	1X1.2
13	91.775	Slab culvert	1X1.5
14	97.098	Pipe culvert	2X1.0
15	97.602	Pipe culvert	2X1.0
16	97.707	Pipe culvert	2X1.0
17	97.850	Slab culvert	1X2.0
18	97.892	Pipe culvert	2X1.0
19	98.065	Pipe culvert	2X1.0

Sl. No.	Survey Chainage (Km)	Existing Details	
		Type of Structure	Span Arrangement (M)
Package-III			
20	98.272	Pipe culvert	2X1.0
21	98.428	Pipe culvert	2X1.0
22	99.518	Pipe culvert	2X1.0
23	98.540	Slab culvert	1X5.8
24	98.654	Pipe culvert	2X1.0
25	98.910	Pipe culvert	2X1.0
26	98.966	Pipe culvert	2X1.0
27	99.066	Pipe culvert	2X1.0
28	101.896	Pipe culvert	2X1.0
29	102.080	Pipe culvert	2X1.0
30	103.350	Pipe culvert	2X1.0
31	103.790	Pipe culvert	2X1.0

3.2.6 JUNCTION IMPROVEMENT

The existing major junction at start location will be improved as 3-legged at grade junction. The remaining minor junctions will be improved at grade as per typical minor junction improvement drawings. The details of major junctions are given in Table-3.17

TABLE- 3.17: DETAILS OF MAJOR JUNCTION

Package: III				
Sl. No.	Design Chainage (Km)	Name of Junction	Type of Junction	Leads To
Nil				

Package: IIIA (6 Nos.)

- 1 No. (3 legged)

Package: IIIB (6 Nos.)

- 4 Nos. (3 legged)
- 1 No. (4 legged)

3.2.7 SERVICE ROADS

No Service Road proposed along the project stretch.

3.2.8 FOOTPATH AND DRAINS

Footpath cum RCC cover drain has been proposed in built up area. In case of semi-Built Up RR masonry open trapezoidal drain is proposed. Details are given bellow in **Table-3.18** to **Table-3.19**.

TABLE- 3.18: LIST OF FOOTPATHS CUM RCC COVER DRAIN

Chainage(m)		Length(m)	Side	Net Length (m)	TCS Type
From	To				
Nil					

TABLE- 3.19: LIST OF RR MASONRY OPEN TRAPEZOIDAL DRAIN

Chainage (Km)		Length of CD	Side	Net Length (m)	TCS No.
From	To				
Package - IIIA					
75000	75375		Both	750	TCS-10
75375	76175	16.76	Single	783	TCS-2
76175	76225		Single	50	TCS-4
76225	76325		Single	100	TCS-2
76325	76375		Single	50	TCS-4
76375	76525	2.7	Single	147	TCS-2
76525	76625	2.7	Single	97	TCS-4
76625	76825	3.96	Single	196	TCS-2
76825	76975		Both	300	TCS-6
76975	77025		Single	50	TCS-4
77025	77125		Single	100	TCS-2
77125	77325	6.66	Single	193	TCS-4
77325	77375		Both	100	TCS-6
77375	77425		Single	50	TCS-4
77425	77475		Both	100	TCS-6
77475	77625	2.6	Single	147	TCS-4
77625	77675	2.6	Single	47	TCS-2
77675	77775		Single	100	TCS-4
77775	77875	2.6	Single	97	TCS-2
77875	78025	2.6	Single	147	TCS-4
78025	78125		Single	100	TCS-2
78125	78325	2.7	Single	197	TCS-4
78325	78425	2.6	Single	97	TCS-2
78425	78475	2.6	Single	47	TCS-4
78475	78575		Single	100	TCS-2
78575	78775	2.6	Single	197	TCS-4
78775	78825		Single	50	TCS-2
78825	78925		Single	100	TCS-4
78925	79025	2.7	Single	97	TCS-2
79025	79075		Both	100	TCS-6
79075	79175		Single	100	TCS-11
79275	80175		Both	1800	TCS-6
80175	80325		Single	150	TCS-2
80325	80425		Both	200	TCS-6
80425	80675	2.6	Single	247	TCS-2
80675	80725	2.7	Single	47	TCS-4
80725	80775		Both	100	TCS-6
80775	80975	2.6	Single	197	TCS-2
80975	81025		Single	50	TCS-4

Chainage (Km)		Length of CD	Side	Net Length (m)	TCS No.
From	To				
81025	81075		Single	50	TCS-2
81075	81175	2.6	Single	97	TCS-11
81275	81375	2.7	Single	97	TCS-4
81375	81425		Single	50	TCS-2
81425	81475		Both	100	TCS-6
81475	81525		Single	50	TCS-4
81525	81575		Both	100	TCS-6
81575	81625	3.96	Single	46	TCS-4
81625	81725		Single	100	TCS-2
81725	81775		Both	100	TCS-6
81775	81975	5.4	Single	195	TCS-2
81975	82025		Both	100	TCS-6
82025	82125	2.6	Single	97	TCS-2
82225	82275		Single	50	TCS-11
82325	82475		Single	150	TCS-2
82475	82875	7.9	Single	392	TCS-4
82875	83075	5.3	Both	389	TCS-6
83075	83575	5.4	Single	495	TCS-2
83575	83675	2.7	Both	195	TCS-6
83675	83725		Single	50	TCS-2
83725	83775		Single	50	TCS-4
83775	83875		Single	100	TCS-2
83975	84525	2.6	Both	1095	TCS-6
84525	84725	2.7	Single	197	TCS-2
84725	84825		Both	200	TCS-6
84825	84975		Single	150	TCS-2
85325	85425		Both	200	TCS-6
85425	85575	2.7	Single	147	TCS-2
85575	85625		Single	50	TCS-4
85625	85975	2.6	Single	347	TCS-2
86125	86725	2.7	Single	597	TCS-2
86875	86925		Single	50	TCS-2
86925	86975		Single	50	TCS-4
86975	87025		Both	100	TCS-6
87025	87175	2.7	Single	147	TCS-2
87175	87225		Single	50	TCS-4
87225	87275		Single	50	TCS-2
87275	87325		Single	50	TCS-4
87325	87350	2.6	Both	45	TCS-6
Total Length of PKG-IIIA =				14165	
Package - IIIB					
87350	87825	2.7	Single	472	TCS-4
87825	88025	2.6	Single	197	TCS-2
88025	88075	2.6	Single	47	TCS-4
88075	88125		Single	50	TCS-2
88125	88175		Single	50	TCS-4

Chainage (Km)		Length of CD	Side	Net Length (m)	TCS No.
From	To				
88175	88225		Both	100	TCS-6
88225	88275	2.7	Single	47	TCS-2
88275	88475	2.7	Single	197	TCS-4
88475	88525		Single	50	TCS-2
88525	88625	2.6	Single	97	TCS-4
88625	88875	3.96	Single	246	TCS-2
88875	89025		Both	300	TCS-6
89025	89125		Single	100	TCS-4
89125	89225	2.7	Single	97	TCS-2
89225	89475		Both	500	TCS-6
89475	89525	2.6	Single	47	TCS-2
89525	89575		Single	50	TCS-4
89575	89825	6.56	Single	243	TCS-2
89825	89875		Single	50	TCS-4
89875	89975	2.7	Single	97	TCS-2
89975	90025	2.6	Both	95	TCS-6
90025	90075	2.7	Single	47	TCS-4
90075	90225		Single	150	TCS-2
90225	90325	2.6	Both	195	TCS-6
90325	90375		Single	50	TCS-2
90375	90575	6.56	Single	193	TCS-4
90575	90675		Both	200	TCS-6
90675	90725		Single	50	TCS-4
90725	91175	5.2	Single	445	TCS-2
91175	91225	2.7	Single	47	TCS-4
91225	91325		Both	200	TCS-6
91325	91425	2.7	Single	97	TCS-4
91425	91475		Both	100	TCS-6
91475	91525		Single	50	TCS-11
91525	91675	2.7	Both	295	TCS-6
91675	91825	2.7	Single	147	TCS-2
91825	92125	3.96	Both	592	TCS-6
92125	92175		Single	50	TCS-2
92175	92725	6.66	Both	1087	TCS-6
92725	92775	2.7	Single	47	TCS-4
92875	92975	2.6	Single	97	TCS-2
92975	93075		Both	200	TCS-6
93075	93175		Single	100	TCS-2
93175	93225		Single	50	TCS-4
93225	93325	2.7	Both	195	TCS-6
93325	93375		Single	50	TCS-2
93375	93575	2.6	Both	395	TCS-6
93575	93775	2.7	Single	197	TCS-2
93775	93825	2.7	Single	47	TCS-4
93825	93875		Both	100	TCS-6
93875	93975	2.6	Single	97	TCS-4

Chainage (Km)		Length of CD	Side	Net Length (m)	TCS No.
From	To				
93975	94125	2.7	Single	147	TCS-2
94125	94225		Single	100	TCS-11
94225	94325	2.7	Single	97	TCS-4
94325	94375	2.6	Both	95	TCS-6
94375	94525		Single	150	TCS-4
94525	94575		Single	50	TCS-2
94575	94625	2.7	Single	47	TCS-4
94625	94975	8	Single	342	TCS-2
94975	95225	3.96	Both	492	TCS-6
95225	95275	6.14	Single	44	TCS-4
95275	95325		Both	100	TCS-6
95325	95475	5.3	Single	145	TCS-2
95475	95525	2.7	Single	47	TCS-4
95525	95675		Single	150	TCS-2
95675	95925	9.16	Single	241	TCS-4
95925	96025		Both	200	TCS-6
96025	96075	2.6	Single	47	TCS-4
96075	96275	2.6	Both	395	TCS-6
96275	96375		Single	100	TCS-2
96375	96575	3.96	Single	196	TCS-4
96575	98125		Both	3100	TCS-6
98125	98475		Single	350	TCS-11
98475	98825		Both	700	TCS-6
98825	98875	6.14	Single	44	TCS-4
98875	98925		Single	50	TCS-2
98925	99375	14.62	Single	435	TCS-4
99375	99425	2.7	Single	47	TCS-2
99425	99475		Single	50	TCS-4
99525	99625	2.6	Single	97	TCS-2
99625	99675	2.7	Single	47	TCS-4
99675	99825		Single	150	TCS-2
99825	99875	2.7	Single	47	TCS-4
99875	100525	13.4	Single	637	TCS-2
100525	100575		Single	50	TCS-4
100575	100725		Both	300	TCS-6
100725	100925	2.6	Single	197	TCS-2
100925	101125	2.7	Both	395	TCS-6
101125	101375	2.6	Single	247	TCS-2
101375	101625		Both	500	TCS-6
101625	101925	2.7	Single	297	TCS-2
101925	102025	2.6	Single	97	TCS-9
102025	102175	2.7	Single	147	TCS-7
102175	102575	2.7	Single	397	TCS-9
102575	102675		Both	200	TCS-8
102675	102775	2.7	Single	97	TCS-9
102825	102875		Single	50	TCS-7

Chainage (Km)		Length of CD	Side	Net Length (m)	TCS No.
From	To				
102925	102975		Single	50	TCS-7
102975	103075		Single	100	TCS-9
103075	103475	2.7	Single	397	TCS-7
103475	103825		Both	700	TCS-8
103825	103925		Single	100	TCS-7
103925	104025		Both	200	TCS-8
104025	104425	7.9	Single	392	TCS-7
104425	104525		Both	200	TCS-8
104525	104825	2.7	Single	297	TCS-4
105075	105175		Single	100	TCS-2
105275	105675	5.4	Single	395	TCS-4
105675	105875	2.6	Single	197	TCS-7
106475	106625		Both	300	TCS-8
106625	106975	2.7	Single	347	TCS-9
106975	107025		Both	100	TCS-8
107025	107125		Single	100	TCS-7
107125	107175		Single	50	TCS-9
107175	107225		Single	50	TCS-7
107225	107275		Single	50	TCS-19
107275	107375		Both	200	TCS-8
107375	107525		Single	150	TCS-19
107525	107625		Single	100	TCS-7
107625	107675		Single	50	TCS-19
107675	107725		Single	50	TCS-7
107925	107975		Single	50	TCS-7
107975	109175	8	Single	1192	TCS-9
109175	109275		Both	200	TCS-8
109275	109325	2.7	Single	47	TCS-7
109325	109494		Single	169	TCS-9
Length of PKG-IIIB =				18496	

Package - IIIA

Length of Side Drain	14165	m
Length of catch water Drain=	1417	m
Length of Outlet=	1417	m
Total Length of Drain=	16998	m

Package - IIIB

Length of Side Drain	26958	m
Length of catch water Drain=	2696	m
Length of Outlet=	2696	m
Total Length of Drain=	32350	m

3.2.9 ROAD MARKINGS/SIGNAGE/ROAD FURNITURE

Retro-reflective signage as per IRC standard mounted on post or overhead gantry, required for safety and traffic control will be provided at suitable locations. Thermoplastic road markings, road studs

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delineators, crash barriers etc. will be provided at required locations to ensure adequate safety of the road users. Package wise details are given below table- **3.21a and 3.21b.**

TABLE- 3.21a: LIST OF ROAD MARKINGS (Package – IIIA)

Sl. No	Type	IRC-67 2012 Specification	Dimension	Chainage / Location	No
1	Right Hand Side Curve	fig 15.02	900 mm Triangular	Right Hand Side Curve: 75.155, 75.253, 75.350, 75.493, 77.085, 80.856, 81.013, 81.350, 81.677, 82.375, 82.476, 82.997, 83.385, 83.586, 84.676, 85.227, 85.590, 85.686, 85.785, 86.130, 86.361, 86.735	44
2	Left Hand Side Curve	fig 15.01	900 mm Triangular	Left Hand Side Curve : 75.420, 75.571, 77.165, 77.294, 79.852, 80.780, 81.172, 81.561, 82.214, 82.647, 83.073, 83.196, 83.288, 83.681, 84.918, 85.274, 85.453, 85.881, 85.967, 86.239, 86.497, 86.651, 86.850, 87.053	48
3	Built-up area	fig 15.35	900 mm Triangular	2 (75.000, 75.380)	4
7	Side road	fig 15.09 & 15.10	900 mm Triangular	75	2
8	Y Intersection	fig 15.11 & 15.12	900 mm Triangular	75	2
8	Pedestrian Crossing		900 mm Triangular	75	2
10	Truck Lay Bye	fig 16.07	>0.9 sqm		
10	Direction Sign	Fig 16.04	<.0.9 sqm	Side road- 75.000	2
11	Direction Sign	Fig 16.06	>0.9 sqm	Built up- 2 (75.000, 75.380)	4
12	Hazard Marker	fig 15.76 & fig 15.77	900x300 mm rectangular	Culvert- 75.39, 75.507, 75.7, 75.86, 76.483, 76.565, 76.711, 77.165, 77.292, 77.502, 77.65, 77.82, 78.002, 78.23, 78.359, 78.434, 78.708, 79.005, 79.18, 80.435, 80.695, 80.812, 81.142, 81.255, 81.367, 81.592, 81.868, 81.952, 82.05, 82.127, 82.199, 82.482, 82.568, 82.725, 82.9, 83.075, 83.18, 83.525, 83.666, 83.975, 84.435, 84.64, 84.978, 85.217, 85.455, 85.785, 86.005, 86.076	192
13	Stop Sign	fig 14.01	900 mm Octagonal	Side Road- 75.000	1
14	Speed limit	fig 14.37	600mm Circular	Built Up area- 2 (75.000, 75.380,) Min Design Speed- 81.910, 82.023, 82.777, 83.016	12
16	Rumble strip	fig 15.50	900 Triangular	Built-up area- 2 (75.000, 75.380)	2
17	Right & Left Hair Pin bend	fig 15.03 & 15.04	900 mm Triangular	82.700, 82.900	2
18	Right & Left Reverse bend	Fig 15.05 & Fig 15.06	900 mm Triangular	79.150, 79.750, 79.950, 80.750, 81.800, 82.150, 83.800, 84.650	8
19	Series of bends	Fig 15.07	900 mm Triangular	75.700, 76.950, 77.450, 79.050	4
20	Convex Mirror for Blind Curve			82.750, 82.830	4
21	Restriction Ends	Fig 14.40	600 mm circular	Built Up area- 2 (75.000, 75.380,) Min Design Speed- 81.910, 82.023, 82.777, 83.016	6
22	Place/ City identification	Fig 16.06	Direction Sign > 0.9 sqm	Built up- 2 (75.000, 75.380)	
23	National	Fig 20.02	450x600 mm	1. Built-up	

Sl. No	Type	IRC-67 2012 Specification	Dimension	Chainage / Location	No
	Highway route marker sign		Rectangular plate	a)75.000 to 75.380= $\{(380/150)+1\} \times 2$ = Approx 6 nos, 2. Junction (one number per junction) ch. 75.000 So, 1 nos. 3. For Through Traffic (Considering one number per 1 km) So, $\{(26.750\text{km}/1)+1\} \times 2=27\text{nos.},$	

TABLE- 3.21b: LIST OF ROAD MARKINGS (Package – IIIB)

SI No	Type	IRC-67 2012 Specification	Dimension	Chainage / Location	No
1	Right Hand Side Curve	fig 15.02	900 mm Triangular	Right Hand Side Curve: 87.470, 87.859, 91.422, 92.218, 92.493, 92.715, 94.497, 96.367, 96.522, 96.618, 96.850, 97.060, 97.207, 97.379, 97.571, 97.746, 99.009, 99.142, 99.375, 99.537, 100.750, 101.687, 101.779, 102.225, 102.514, 102.587, 103.066, 103.255, 103.387, 104.408, 104.671, 104.835, 105.238, 105.394, 105.818, 105.955, 106.093, 106.166, 106.278, 106.375, 106.434, 106.536, 108.240, 108.387, 108.629, 108.667, 108.718, 108.867, 108.982, 109.075, 109.450, 109.494, 109.614, 109.867	108
2	Left Hand Side Curve	fig 15.01	900 mm Triangular	Left Hand Side Curve : 87.673, 89.604, 89.795, 90.661, 91.037, 91.250, 91.525, 91.693, 92.009, 92.155, 92.307, 92.600, 92.797, 92.878, 92.942, 94.580, 96.039, 96.712, 96.998, 97.144, 97.283, 97.462, 97.656, 98.684, 98.915, 99.263, 99.465, 100.278, 100.459, 100.631, 100.793, 101.622, 102.294, 102.361, 102.452, 102.777, 103.128, 103.293, 103.450, 103.857, 104.148, 104.507, 105.095, 105.562, 105.769, 105.861, 105.918, 105.995, 106.128, 106.322, 106.499, 108.218, 108.317, 108.360, 108.464, 108.541, 108.926, 109.038, 109.124, 109.710, 109.758	122
7	Side road	fig 15.09 & 15.10	900 mm Triangular	87.580, 91.900, 96.150, 109.300	8
8	Y Intersection	fig 15.11 & 15.12	900 mm Triangular	87.580, 91.900, 96.15, 109.300	8
7	Cross Road	fig 15.14	900 mm Triangular	109.7	2
8	Pedestrian Crossing		900 mm Triangular	Bus bay- 96.780 Side Road- 87.580, 91.900, 96.150, 109.300,	10
9	Bus Stop	fig 17.35	800x600 rectangular	96+780km	2
10	Direction Sign	Fig 16.04	<.0.9 sqm	Side road- 87.580, 91.900, 96.150, 109.300	18

[Signature]



SI No	Type	IRC-67 2012 Specification	Dimension	Chainage / Location	No
12	Hazard Marker	fig 15.76 & fig 15.77	900x300 mm rectangular	Culvert- 87.517, 87.74, 87.927, 88.042, 88.24, 88.462, 88.61, 88.763, 89.194, 89.524, 89.65, 89.8, 89.92, 89.98, 90.032, 90.227, 90.45, 90.532, 90.793, 91.041, 91.22, 91.405, 91.67, 91.796, 92.015, 92.36, 92.54, 92.751, 92.875, 92.971, 93.29, 93.425, 93.585, 93.795, 93.93, 94.032, 94.281, 94.375, 94.59, 94.688, 94.77, 94.93, 95.07, 95.235, 95.367, 95.445, 95.503, 95.689, 95.77, 95.89, 96.03, 96.157, 96.431, 98.854, 99.031, 99.08, 99.181, 99.285, 99.407, 99.565, 99.66, 99.87, 99.941, 100.104, 100.267, 100.318, 100.475, 100.855, 101.072, 101.23, 101.864, 101.935, 102.1, 102.502, 102.713, 102.9, 103.45, 104.23, 104.31, 104.408, 104.57, 104.968, 105.36, 105.59, 105.807, 105.978, 106.906, 107.842, 108.399, 108.697, 108.859, 109.325)	368
13	Stop Sign	fig 14.01	900 mm Octagonal	Side Road- 87.580, 91.900, 96.150, 109.300, Cross Road- 109.700	5
14	Speed limit	fig 14.37	600mm Circular	Min Design Speed- 93.067, 93.164, 96.082, 96.265, 101.050, 104.003, 105.950, 109.889	16
17	Right & Left Hair Pin bend	fig 15.03 & 15.04	900 mm Triangular	87.450, 92.970, 93.200, 96.070, 96.250, 100.850, 101.060, 101.400, 101.600, 102.600, 102.760, 102.800, 102.950, 103.500, 103.750, 103.900, 104.100, 109.150, 109.400	19
18	Right & Left Reverse bend	Fig 15.05 & Fig 15.06	900 mm Triangular	99.600, 100.200	2
19	Series of bends	Fig 15.07	900 mm Triangular	88.000, 89.450, 89.900, 90.500, 93.300, 94.350, 94.650, 96.000, 97.900, 98.600, 101.850, 101.100, 101.350, 102.200, 106.550, 108.200	16
20	Convex Mirror for Blind Curve			87.300, 87.400, 93.040, 93.140, 96.125, 96.190, 100.920, 100.990, 101.470, 101.550, 102.650, 102.730, 102.830, 102.900, 103.570, 103.640, 103.970, 104.050, 109.250, 109.320	40
21	Restriction Ends	Fig 14.40	600 mm circular	Min Design Speed- 93.067, 93.164, 96.082, 96.265, 101.050, 104.003, 105.950, 109.889	8
23	National Highway route marker sign	Fig 20.02	450x600 mm Rectangular plate	1. Junction (one number per junction) 4 (87.580, 91.900, 96.150, 109.300) So, 4 nos. 2. For Through Traffic (Considering one number per 1 km) So, $\{(26.750\text{km}/1)+1\} \times 2 = 56\text{nos.}$	120

3.2.10 BUS BAY & PASSENGER SHELTER

2 nos. of Bus Bays with passenger shelter are provided at 1 location on both. Package wise details of Bus bay location are given below in Table-3.22:



TABLE- 3.22: LIST OF BUSBAYS WITH PASSENGER SHELTER

Sl. No.	Chainage(km)	Side
Package-III A		
Nil		
Package-III B		
1	96+780	Both

3.2.11 TRUCK LAY BYE

No truck lay bye is proposed on the proposed road.

3.2.12 PROTECTION WORK

For proper protection of proposed road on hill and valley side, Breast Wall, retaining wall and composite RE wall have been proposed from road safety point of view. Package wise details of Breast Wall and Retaining Wall are given in Table- 3.23, Table -3.24 and Table -3.25 respectively.

TABLE- 3.23: DETAILS OF BREAST WALL

Chainage (Km)		Length of CD	Side	Net Length (m)	TCS No.
From	To				
Package - IIIA					
79075	79175		Single	100	TCS-11
79175	79275	2.6	Single	97	TCS-3
81075	81175	2.6	Single	97	TCS-11
81175	81275	2.6	Single	97	TCS-3
82125	82175	2.6	Single	47	TCS-3
82175	82225	2.6	Single	47	TCS-5
82225	82275		Single	50	TCS-11
82275	82325		Single	50	TCS-3
83875	83975	2.6	Single	97	TCS-3
84975	85325	5.2	Single	345	TCS-5
85975	86125	5.3	Single	145	TCS-5
86725	86875	5.3	Single	145	TCS-5
Total Length =				1319	
Package - IIIB					
91475	91525		Single	50	TCS-11
92775	92875	2.6	Single	97	TCS-3
94125	94225		Single	100	TCS-11
98125	98475		Single	350	TCS-11
104825	104925		Single	100	TCS-3
104925	105075	3.96	Single	146	TCS-5
105175	105275		Single	100	TCS-3
105875	106175	2.6	Single	297	TCS-18
106175	106475		Single	300	TCS-17
107225	107275		Single	50	TCS-19
107375	107525		Single	150	TCS-19
107625	107675		Single	50	TCS-19

Chainage (Km)		Length of CD	Side	Net Length (m)	TCS No.
From	To				
107725	107875	2.6	Single	147	TCS-18
107875	107925		Single	50	TCS-17
Total Length =				1988	

TABLE- 3.24: DETAILS OF RETAINING WALL

Chainage		Side	Avg. Height (m)	CD Length (m)	Total Length (m)	Net Length (m)
From	To					
Package - IIIA						
76175	76225	Valley	8		50	50
76325	76375	Valley	2		50	50
76525	76625	Valley	2	2.7	100	97.3
76975	77025	Valley	1.5		50	50
77125	77325	Valley	2	6.66	200	193.34
77375	77425	Valley	1.5		50	50
77475	77625	Valley	1.5	2.6	150	147.4
77675	77775	Valley	1.5		100	100
77875	78025	Valley	3	2.6	150	147.4
78125	78325	Valley	3	2.7	200	197.3
78425	78475	Valley	1.5	2.6	50	47.4
78575	78775	Valley	1.5	2.6	200	197.4
78825	78925	Valley	1.5		100	100
80675	80725	Valley	1.5	2.7	50	47.3
80975	81025	Valley	4		50	50
81275	81375	Valley	4	2.7	100	97.3
81475	81525	Valley	2		50	50
81575	81625	Valley	2	3.96	50	46.04
82175	82225	Valley	2	2.6	50	47.4
82475	82875	Valley	2	7.9	400	392.1
83725	83775	Valley	1.5		50	50
84975	85325	Valley	2	5.2	350	344.8
85575	85625	Valley	2		50	50
85975	86125	Valley	1.5	5.3	150	144.7
86725	86875	Valley	2	5.3	150	144.7
86925	86975	Valley	2		50	50
87175	87225	Valley	1.5		50	50
87275	87325	Valley	2		50	50
Total=				58.12	3100	3042
Package - IIIB						
86725	86875	Valley	2	5.3	150	144.7
86925	86975	Valley	2		50	50
87175	87225	Valley	1.5		50	50
87275	87325	Valley	2		50	50
87525	87825	Valley	1.5	2.7	300	297.3
88025	88075	Valley	1.5	2.6	50	47.4
88125	88175	Valley	2		50	50
88275	88475	Valley	1.5	2.7	200	197.3

Chainage		Side	Avg. Height (m)	CD Length (m)	Total Length (m)	Net Length (m)
From	To					
88525	88625	Valley	2	2.6	100	97.4
89025	89125	Valley	1.5		100	100
89525	89575	Valley	1.5		50	50
89825	89875	Valley	1.5		50	50
90025	90075	Valley	2	2.7	50	47.3
90375	90575	Valley	1.5	6.56	200	193.44
90675	90725	Valley	1.5		50	50
91175	91225	Valley	2	2.7	50	47.3
91325	91425	Valley	1.5	2.7	100	97.3
92725	92775	Valley	1.5	2.7	50	47.3
93175	93225	Valley	1.5		50	50
93775	93825	Valley	1.5	2.7	50	47.3
93875	93975	Valley	2	2.6	100	97.4
94225	94325	Valley	2	2.7	100	97.3
94375	94525	Valley	4		150	150
94575	94625	Valley	2	2.7	50	47.3
95225	95275	Valley	2	6.14	50	43.86
95475	95525	Valley	1.5	2.7	50	47.3
95675	95925	Valley	2	9.16	250	240.84
96025	96075	Valley	2	2.6	50	47.4
96375	96575	Valley	4	3.96	200	196.04
98825	98875	Valley	2	6.14	50	43.86
98925	98975	Valley	3		50	50
98975	99025	Valley	6		50	50
99025	99075	Valley	8	3.96	50	46.04
99075	99125	Valley	8	5.26	50	44.74
99125	99175	Valley	2		50	50
99175	99225	Valley	6	2.7	50	47.3
99225	99375	Valley	2	2.7	150	147.3
99425	99475	Valley	2		50	50
99475	99525	Valley	6		50	50
99625	99675	Valley	1.5	2.7	50	47.3
99825	99875	Valley	2	2.7	50	47.3
100525	100575	Valley	1.5		50	50
101925	102025	Valley	2	2.6	100	97.4
102175	102575	Valley	3	2.7	400	397.3
102675	102775	Valley	3	2.7	100	97.3
102775	102825	Valley	5		50	50
102875	102925	Valley	5	2.7	50	47.3
102975	103075	Valley	4		100	100
104525	104825	Valley	2	2.7	300	297.3
104925	105075	Valley	3	3.96	150	146.04
105275	105675	Valley	2	5.4	400	394.6
106625	106975	Valley	2	2.7	350	347.3
107125	107175	Valley	2		50	50
107975	109175	Valley	2	8	1200	1192

Chainage		Side	Avg. Height (m)	CD Length (m)	Total Length (m)	Net Length (m)
From	To					
109325	109494	Valley	4		169	169
Total=				128	6969	6841

Package - IIIA

Length of 1.5m Retaining Wall =	984 m
Length of 2.0m Retaining Wall =	1516 m
Length of 3.0m Retaining Wall =	345 m
Length of 4.0m Retaining Wall =	147 m
Length of 5.0m Retaining Wall =	0 m
Length of 6.0m Retaining Wall =	0 m
Length of 8.0m Retaining Wall =	50 m

Package - IIIB

Length of 1.5m Retaining Wall =	1422 m
Length of 2.0m Retaining Wall =	377 m
Length of 3.0m Retaining Wall =	691 m
Length of 4.0m Retaining Wall =	615 m
Length of 5.0m Retaining Wall =	97 m
Length of 6.0m Retaining Wall =	147 m
Length of 8.0m Retaining Wall =	91 m

3.2.13 Hydro seeding or roadside vegetation

Hydro seeding or roadside vegetation will be provided through hill cutting portion for better stability and prevention of soil erosion. The details of Hydro seeding in different package wise are given below table:

TABLE- 3.26a: DETAILS OF Hydro seeding or roadside vegetation (Package – IIIA)

Chainage		Net Length (m)	side	Total Length (m)
From	To			
79085	79285	200	Right	200
81060	81285	225	Right	225
82110	82310	200	Right	200
83860	83960	100	Right	100
84985	85335	350	Right	350
85985	86135	150	Right	150
86735	86860	125	Right	125
Total=				1350

Avg Width of Hydro Seeding = 8.00 m
Total Area of Hydro Seeding = 10800 sqm

TABLE- 3.26b: DETAILS OF Hydro seeding or roadside vegetation (Package – IIIB)

Chainage		Net Length (m)	side	Total Length (m)
From	To			
86735	86860	125	Right	125
91460	91535	75	Right	75
92760	92860	100	Right	100
94110	94235	125	Right	125
98110	98460	350	Right	350
104810	104910	100	Right	100
104910	105060	150	Right	150
105160	105285	125	Right	125
Total=				1150

Avg Width of Hydro Seeding = 8.00 m
Total Area of Hydro Seeding = 9200 sqm

CHAPTER - 4

ENGINEERING SURVEYS, INVESTIGATION AND ANALYSIS

4.1 INTRODUCTION

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

Necessary engineering survey and investigations need to be carried out at site to assess the existing characteristics of the road:

- (a) Reconnaissance Survey
- (b) Road Inventory
- (c) Pavement Condition Survey
- (d) Inventory and Condition Survey of Existing Structures
- (e) Topographical Survey
- (f) Traffic Survey
- (g) Benkelman Beam Deflection Test
- (h) Sub-grade Investigation
- (i) Quarry Material Survey
- (j) Sub-Soil Exploration survey (if required) at new bridge location

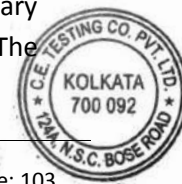
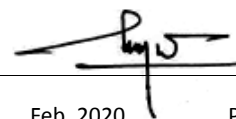
4.2 ENGINEERING SURVEYS AND INVESTIGATIONS

4.2.1 RECONNAISSANCE SURVEY

The consultants made an in-depth study of the available maps of the project area and other relevant information collected. A detailed reconnaissance survey was conducted for the entire stretch of the project road and detail features such as land use, habitation, water routes, river, intersecting roads, utilities such as electrical lines (HT/LT), etc. has been noted. The detailed ground reconnaissance of project influence area was utilized for planning and programming the detailed surveys and investigations.

4.2.2 ROAD INVENTORY

Detailed inventory of the project road stretch has been prepared through visual inspection with sample measurements to assess the existing status. Features like existing kilometrage, terrain, land use, width of carriageway and shoulders, height of embankment, geometric deficiencies, important road junctions, railway level crossings, utilities, other roadside features etc. were recorded. The inventory is essentially included to collect physical information on the road and its environment for enabling preliminary assessment of the project. The existing road is mostly intermediate/two lane with earthen shoulder. The



details of these are provided in **Appendix: 4.1** of Main Report. Brief summary of the Carriageway & Shoulder details are given in **Table- 4.1**.

TABLE- 4.1: BRIEF SUMMARY OF CARRIAGEWAY AND SHOULDER WIDTH

Existing Chainage (km)		Carriageway Width (m)	Shoulder Width (m)
75.000	75.250	7	L.H.S-2M R.H.S-1M
75.250	75.500	7	L.H.S-2M R.H.S-1M
75.500	75.750	7	L.H.S-2M R.H.S-1M
75.750	76.000	7	L.H.S-2M R.H.S-1M
76.000	76.250	7	L.H.S-2M R.H.S-1M
76.250	76.500	7	L.H.S-2M R.H.S-1M
76.500	76.750	7	L.H.S-1.0M R.H.S-0.5M
76.750	77.000	7	L.H.S-1.0M R.H.S-0.5M
77.000	77.250	7	L.H.S-1.0M R.H.S-0.5M
77.250	77.500	7	L.H.S-1.0M R.H.S-0.5M
77.500	77.750	7	L.H.S-1.0M R.H.S-0.5M
77.750	78.000	7	L.H.S-1.0M R.H.S-0.5M
78.000	78.250	7	L.H.S-1.0M R.H.S-0.5M
78.250	78.500	7	L.H.S-1.0M R.H.S-0.5M
78.500	78.750	7	L.H.S-1.0M R.H.S-0.5M
78.750	79.000	7	L.H.S-1.0M R.H.S-0.5M
79.000	79.250	7	L.H.S-1.0M R.H.S-0.5M
79.250	79.500	7	L.H.S-1.0M R.H.S-0.5M
79.500	79.750	7	L.H.S-1.0M R.H.S-0.5M
79.750	80.000	7	L.H.S-1.0M



Existing Chainage (km)		Carriageway Width (m)	Shoulder Width (m)
			R.H.S-0.5M
80.000	80.250	7	L.H.S-1.0M R.H.S-0.5M
80.250	80.500	7	L.H.S-1.0M R.H.S-0.5M
80.500	80.750	7	L.H.S-1.0M R.H.S-0.5M
80.750	81.000	7	L.H.S-1.0M R.H.S-0.5M
81.000	81.250	7	L.H.S-1.0M R.H.S-0.5M
81.250	81.500	7	L.H.S-1.0M R.H.S-0.5M
81.500	81.750	7	L.H.S-1.0M R.H.S-0.5M
81.750	82.000	7	L.H.S-1.0M R.H.S-0.5M
82.000	82.250	7	L.H.S-1.0M R.H.S-0.5M
82.250	82.500	7	L.H.S-1.0M R.H.S-0.5M
82.500	82.750	7	L.H.S-1.0M R.H.S-0.5M
82.750	83.000	7	L.H.S-1.0M R.H.S-0.5M
83.000	83.250	7	L.H.S-1.0M R.H.S-0.5M
83.250	83.500	7	L.H.S-1.0M R.H.S-0.5M
83.500	83.750	7	L.H.S-1.0M R.H.S-0.5M
83.750	84.000	7	L.H.S-1.0M R.H.S-0.5M
84.000	84.250	7	L.H.S-1.0M R.H.S-0.5M
84.250	84.500	7	L.H.S-1.0M R.H.S-0.5M
84.500	84.750	4.5	LHS-2M RHS-2M
84.750	85.000	4.5	LHS-2M RHS-2M
85.000	85.250	4	LHS-2M RHS-3M

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Existing Chainage (km)		Carriageway Width (m)	Shoulder Width (m)
85.250	85.500	4	LHS-2M RHS-3M
85.500	85.750	4	LHS-2M RHS-4M
85.750	86.000	4	LHS-2M RHS-4M
86.000	86.250	4.5	LHS-1.5M RHS-FAILED
86.250	86.500	4.5	LHS-1.5M RHS-FAILED
86.500	86.750	4	LHS-1.5M RHS-FAILED
86.750	87.000	4	LHS-2 RHS-2.5
87.000	87.250	6	LHS-2 RHS-2.5
87.250	87.500	6	LHS-2 RHS-2.5
87.500	87.750	4	LHS-2M RHS-FAILED
87.750	88.000	4.5	LHS-2M RHS-2.5
88.000	88.250	4.5	LHS-2M RHS-2.5
88.250	88.500	5.5	LHS-2M RHS-2.6M
88.500	88.750	5.5	LHS-2M RHS-2.6M
88.750	89.000	5.5	LHS-2M RHS-2.6M
89.000	89.250	4	LHS-2M RHS-2.6M
89.250	89.500	4	LHS-2M RHS-2.6M
89.500	89.750	5	LHS-2M RHS-2.6M
89.750	90.000	5	LHS-2M RHS-2M
90.000	90.250	5	LHS-2M RHS-2M
90.250	90.500	5	LHS-2M RHS-2M
90.500	90.750	5	LHS-2M

Existing Chainage (km)		Carriageway Width (m)	Shoulder Width (m)
			RHS-2M
90.750	91.000	5	LHS-2M RHS-2M
91.000	91.250	5	LHS-2M RHS-2M
91.250	91.500	5	LHS-2M RHS-2M
91.500	91.750	5	LHS-2M RHS-2M
91.750	92.000	5	LHS-2M RHS-2M
92.000	92.250	3.5	LHS-0.5M RHS-1M
92.250	92.500	3.5	LHS-0.5M RHS-1M
92.500	92.750	3.5	LHS-0.5M RHS-0.5M
92.750	93.000	3.5	LHS-0.5M RHS-0.5M
93.000	93.250	3.5	LHS-0.5M RHS-0.5M
93.250	93.500	3.5	LHS-0.5M RHS-0.5M
93.500	93.750	3.5	LHS-0.5M RHS-0.5M
93.750	94.000	3.5	LHS-0.5M RHS-0.5M
94.000	94.250	3.5	LHS-0.5M RHS-0.5M
94.250	94.500	3.5	LHS-0.5M RHS-0.5M
94.500	94.750	3.5	LHS-1M RHS-2M
94.750	95.000	3.5	LHS-1M RHS-2M
95.000	95.250	3.5	LHS-1M RHS-1M
95.250	95.500	3.5	LHS-1M RHS-1M
95.500	95.750	3.5	LHS-1M RHS-1.5M
95.750	96.000	3.5	LHS-1M RHS-1.5M



Existing Chainage (km)		Carriageway Width (m)	Shoulder Width (m)
			LHS-1M RHS-1.5M
96.000	96.250	3.5	LHS-1M RHS-1.5M
96.250	96.500	3.5	LHS-1M RHS-1.5M
96.500	96.750	3.5	LHS-1M RHS-1.5M
96.750	97.000	3.5	LHS-1M RHS-1.5M
97.000	97.250	3.5	LHS-1M RHS-1.5M
97.250	97.500	3.5	LHS-1M RHS-1.5M
97.500	97.750	3.5	LHS-1M RHS-1.5M
97.750	98.000	3.5	LHS-1M RHS-1.5M
98.000	98.250	3.5	LHS-1M RHS-2M
98.250	98.500	3.5	LHS-1M RHS-2M
98.500	98.750	4.5	LHS-0.5M RHS-2M
98.750	99.000	4.5	LHS-0.5M RHS-2M
99.000	99.250	4.5	LHS-0.5M RHS-2M
99.250	99.500	4.5	LHS-0.5M RHS-2M
99.500	99.750	4.5	LHS-0.5M RHS-2M
99.750	100.000	4.5	LHS-0.5M RHS-2M
100.000	100.250	4.5	LHS-0.5M RHS-2M
100.250	100.500	4.5	LHS-0.5M RHS-2M
100.500	100.750	3.5	L.H.S-1M R.H.S-1M
100.750	101.000	3.5	L.H.S-1M R.H.S-1M
101.000	101.250	3.5	L.H.S-1M R.H.S-1M
101.250	101.500	3.5	L.H.S-1M

Existing Chainage (km)		Carriageway Width (m)	Shoulder Width (m)
			R.H.S-1M
101.500	101.750	3.5	L.H.S-1M R.H.S-1M
101.750	102.000	3.5	L.H.S-1M R.H.S-1M
102.000	102.250	3.5	L.H.S-1M R.H.S-1M
102.250	102.500	3.5	L.H.S-1M R.H.S-1M
102.500	102.750	3.5	L.H.S-1M R.H.S-1M
102.750	103.000	3.5	L.H.S-1M R.H.S-1M
103.000	103.250	3.5	L.H.S-1M R.H.S-1M
103.250	103.500	3.5	L.H.S-1M R.H.S-1M
103.500	103.750	3.5	L.H.S-1M R.H.S-1M
103.750	104.000	3.5	L.H.S-1M R.H.S-1M
104.000	104.250	3.5	L.H.S-1M R.H.S-1M
104.250	104.500	3.5	L.H.S-1M R.H.S-1M
104.500	104.750	3.5	L.H.S-1M R.H.S-1M
104.750	105.000	3.5	L.H.S-1M R.H.S-1M
105.000	105.250	3.5	L.H.S-1M R.H.S-1M
105.250	105.500	3.5	L.H.S-1M R.H.S-1M
105.500	105.750	3.5	L.H.S-1M R.H.S-1M
105.750	109.767	3.5	L.H.S-1M R.H.S-1M

4.2.3 PAVEMENT CONDITION SURVEY

Pavement condition survey has been conducted at site through visual inspection. The existing pavement surface is of bituminous type and surface condition along the road varies from fair to poor. Pavement in poor stretches, are partially damaged with cracks, potholes, raveling. Considerable amount of patching



is also provided as damage repair control. Some stretches have been observed where bituminous layer is fully exposed. Detailed field study including pavement condition, shoulder condition, embankment condition, drainage condition etc. were noted and supplemented by sample measurements. The following measurements were involved:

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

The details of the Pavement Conditions are provided in **Appendix: 4.2** of the Main Report. Brief summary of existing pavement surface condition are in **Table- 4.2**.

TABLE- 4.2: BRIEF SUMMARY OF PAVEMENT CONDITION

Fair Condition Stretches	Poor Condition Stretches
Nil	Remaining portion of the project road (i.e. 32.967 km)

4.2.4 INVENTORY AND CONDITION SURVEY OF EXISTING STRUCTURES

Inventory and condition survey of the existing bridges and culverts were carried out to identify their number, type, condition and hydrological aspects. Mainly visual inspection and dimensional measurements were carried out during this survey. The exercise enabled to collect the visible as-built information to the extent possible and condition to assess the individual requirements of the existing structures enroute, like widening, repair and reconstruction. The details of culvert and bridge inventories and condition surveys are provided in **Appendix: 4.3 & 4.4** of Appendix to Main Report respectively. Brief summary of existing structures are in **Table- 4.3**.

TABLE- 4.3: BRIEF SUMMARY OF STRUCTURE DETAILS

Bridges (Total 2 nos.)		
Type	No.	Remarks
RCC T Girder Bridge	1 no. (minor bridge)	Retain: 4 nos. (2 nos. PSC Box Bridge, 1 No. RCC T-Girder Bridge and 1no. Steel Truss Bridge) (Remaining 6 nos. RCC Slab bridges to be replaced by RCC Box culverts)
Steel Truss Bridges	1 no. (major bridge)	
Culverts (Total 144 nos.)		

Type	No.	Remarks
RCC Slab Culverts	31 nos.	Reconstruction: 111 nos. (111 nos. of culvert are in very poor condition and to be replaced by Box Culverts.) additiional 33 nos New Box culverts are required
HP Culvert	107 nos.	
Arch Culvert	1 no.	
Covered By Soil	3 nos.	

4.2.5 TOPOGRAPHIC SURVEY

The specific objective of the topographical survey is to delineate accurately the complete existing natural and man-made features, so as to study and develop the existing road, creating an accurate Digital Terrain Model, which is also a fundamental requirement to design the highway through latest software. The detailed topographical survey for the existing road as well as realignment stretches were completed with fixing BM pillars according to the procedure outlined in the TOR. A list of TBM and GPS pillars established along the project road is given in **Appendix: 4.5** of Main Report. Summary of BM, TBM and GPS pillar list are given in **Table- 4.4**.

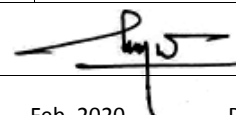
TABLE- 4.4: SUMMARY OF PILLARS DETAILS

❖ BM PILLAR LIST

Pt. No.	Easting (m)	Northing (m)	R.L. (m)
BM-1/1	610180.439	2811105.502	1436.673
BM-1/2	609937.036	2811080.581	1455.871
BM-2/1	609417.100	2810956.223	1481.335
BM-2/2	609247.706	2810916.847	1492.501
BM-2/3	609029.115	2810838.480	1501.950
BM-3/1	608938.027	2811129.490	1515.951
BM-3/2	609074.180	2811316.488	1524.888
BM-3/3	609118.850	2811435.327	1523.117
BM-4/1	608911.133	2811613.245	1525.050
BM-4/2	608736.645	2811577.369	1525.075
BM-4/3	608339.359	2811503.431	1515.122
BM-5/1	608376.340	2811882.594	1504.866
BM-5/2	608319.876	2811998.321	1496.512
BM-5/3	607956.108	2811979.048	1482.238
BM-6/1	607447.623	2812301.853	1459.376
BM-6/2	607333.370	2812544.254	1443.246
BM-7/1	607387.537	2812901.210	1424.727
BM-7/2	607482.983	2813059.616	1408.651
BM-7/3	607578.149	2813267.902	1398.313
BM-8/1	607666.943	2813563.026	1391.604
BM-8/2	607470.717	2813455.890	1414.055
BM-8/3	607212.258	2813384.506	1429.991



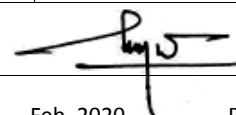
Pt. No.	Easting (m)	Northing (m)	R.L. (m)
BM-9/1	606773.057	2813434.056	1434.038
BM-9/2	606724.358	2813582.847	1434.566
BM-9/3	606588.930	2813441.504	1439.241
BM-10/1	606253.749	2813269.622	1446.836
BM-10/2	606026.605	2812966.713	1449.829
BM-11/1	605618.536	2812711.108	1446.369
BM-11/2	605341.634	2812617.898	1435.849
BM-11/3	605105.587	2812644.001	1443.425
BM-12/1	604849.585	2812957.185	1457.496
BM-12/2	604982.131	2813208.137	1458.240
BM-12/3	605139.737	2813565.378	1453.863
BM-13/1	605267.301	2813882.668	1447.914
BM-13/2	605183.883	2814110.485	1438.027
BM-13/3	605284.396	2814496.875	1412.767
BM-14/1	605338.312	2814667.016	1397.401
BM-14/2	605360.152	2814780.787	1388.822
BM-14/3	605543.160	2814960.618	1371.225
BM-15/1	605424.196	2815236.835	1350.718
BM-15/2	605532.410	2815551.375	1327.457
BM-15/3	605700.938	2815608.687	1316.399
BM-16/1	605479.607	2815652.050	1309.672
BM-16/2	605374.240	2815537.452	1305.620
BM-17/1	605193.122	2815098.096	1332.318
BM-17/2	605024.523	2815013.215	1345.594
BM-17/3	604801.121	2814949.484	1367.093
BM-18/1	604754.463	2814518.477	1394.899
BM-18/2	604572.359	2814353.903	1414.422
BM-18/3	604380.436	2814243.694	1426.165
BM-19/1	603815.713	2814099.300	1463.209
BM-19/2	603764.113	2813879.114	1473.785
BM-20/1	603546.003	2813756.713	1527.926
BM-20/2	603444.900	2814068.012	1545.557
BM-20/3	603396.059	2814232.511	1555.665
BM-21/1	603556.722	2814723.384	1603.580
BM-21/2	603366.066	2814928.341	1615.955
BM-22/1	603157.706	2814955.086	1619.956
BM-22/2	603081.654	2815213.272	1607.857
BM-22/3	603292.944	2815431.304	1597.401
BM-23/1	603158.589	2815664.273	1595.931
BM-23/2	602864.334	2815669.894	1581.924
BM-23/3	602848.064	2815875.030	1572.250
BM-24/1	602683.360	2816202.308	1548.120
BM-24/2	602522.648	2816176.771	1543.635
BM-24/3	602516.646	2815909.520	1539.011




Pt. No.	Easting (m)	Northing (m)	R.L. (m)
BM-25/1	602456.037	2815385.409	1537.168
BM-25/2	602234.210	2815324.626	1526.189
BM-25/3	602049.551	2815358.865	1525.428
BM-26/1	602106.436	2814906.954	1555.309
BM-26/2	602075.173	2814703.509	1569.711
BM-27/1	602179.968	2814503.813	1595.690
BM-27/2	602014.525	2814374.626	1611.166
BM-27/3	601726.689	2814349.860	1632.272
BM-28/1	601400.389	2814211.273	1661.513
BM-28/2	601232.744	2814495.387	1665.189
BM-28/3	600991.301	2814754.379	1669.958
BM-29/1	600754.486	2815024.027	1697.088
BM-29/2	600670.492	2815224.503	1720.299
BM-29/3	600533.549	2815478.912	1743.582
BM-30/1	600368.392	2815660.400	1748.511
BM-30/2	600181.518	2815611.627	1750.874
BM-30/3	600105.424	2815363.278	1759.833
BM-31/1	599616.236	2814990.936	1757.929
BM-32/1	599166.967	2814556.923	1769.209
BM-32/2	598892.758	2814451.566	1766.763
BM-32/3	598658.704	2814632.621	1764.041
BM-33/1	598535.824	2814994.470	1749.281
BM-33/2	598640.643	2815264.291	1734.753
BM-33/3	598658.359	2815620.788	1720.807
BM-34/1	598730.902	2815800.150	1696.970
BM-34/2	598734.997	2816076.994	1688.262
BM-34/3	598923.142	2816245.735	1671.224
BM-35/1	599077.942	2816483.313	1654.282
BM-35/2	599227.697	2816661.276	1644.049
BM-35/3	599073.258	2816762.615	1659.126
BM-36/1	598608.475	2816954.138	1692.275
BM-36/2	598245.966	2817171.450	1723.811
BM-37/1	597886.644	2817513.562	1736.536
BM-37/2	598099.931	2817776.174	1736.484
BM-37/3	598153.543	2817960.336	1735.740
BM-38/1	598320.478	2818205.540	1733.276
BM-38/2	598258.174	2818420.840	1724.851
BM-38/3	598276.579	2818658.408	1705.894
BM-39/1	598223.539	2818951.172	1691.618
BM-39/2	598308.062	2819098.476	1684.296
BM-39/3	598569.104	2819127.919	1676.617
BM-40/1	598712.998	2818934.093	1656.037
BM-40/2	598971.120	2818916.601	1641.441
BM-40/3	599022.295	2818831.251	1634.250



Pt. No.	Easting (m)	Northing (m)	R.L. (m)
BM-41/1	599339.722	2818756.93	1617.283
BM-41/2	599407.957	2818987.302	1609.452
BM-42/1	599323.629	2819457.342	1581.643
BM-42/2	599483.805	2819528.386	1573.615
BM-42/3	599655.974	2819558.658	1568.723
BM-43/1	600138.431	2819396.174	1553.319
BM-43/2	600340.899	2819325.152	1542.396
BM-43/3	600419.139	2819402.609	1541.209
BM-44/1	600245.012	2819987.287	1509.564
BM-44/2	600176.88	2820234.446	1499.411
BM-44/3	600235.777	2820390.556	1490.82
BM-45/1	600531.68	2820712.653	1457.146
BM-45/2	600350.075	2820662.941	1446.533
BM-45/3	600152.377	2820665.854	1435.447
BM-46/1	599474.879	2820478.818	1413.699
BM-46/2	599321.886	2820672.731	1413.948
BM-47/1	599052.399	2820736.714	1423.277
BM-47/2	598782.630	2820704.258	1438.290
BM-47/3	598720.874	2820895.217	1444.111
BM-48/1	598527.591	2821205.446	1456.869
BM-48/2	598378.173	2821340.285	1463.301
BM-48/3	598246.981	2821525.176	1473.988
BM-48/4	598156.560	2821683.584	1486.362
BM-49/1	598427.916	2821748.225	1469.917
BM-49/2	598523.356	2821931.786	1463.300
BM-50/1	598869.732	2822251.375	1470.281
BM-50/2	599112.015	2822365.753	1470.973
BM-50/3	599311.230	2822438.344	1470.649
BM-51/1	599156.272	2822595.735	1455.908
BM-51/2	598877.888	2822661.761	1474.398
BM-51/3	598745.611	2822718.601	1482.745
BM-52/1	598693.297	2822993.042	1484.811
BM-52/2	598705.256	2823370.170	1466.039
BM-52/3	598735.418	2823530.126	1464.301
BM-53/1	598681.234	2823762.442	1476.324
BM-53/2	598540.866	2823610.537	1485.952
BM-53/3	598347.952	2823406.958	1515.578
BM-54/1	598109.697	2823283.568	1528.064
BM-54/2	598183.154	2823051.860	1550.737
BM-54/3	597987.534	2822916.996	1572.669
BM-55/1	597752.338	2822611.916	1609.525
BM-55/2	597543.486	2822698.618	1633.645
BM-55/3	597289.037	2822925.199	1657.187
BM-56/1	596905.997	2823063.375	1690.615




Pt. No.	Easting (m)	Northing (m)	R.L. (m)
BM-56/2	596848.937	2822844.245	1696.874
BM-56/3	596618.524	2822654.635	1687.229
BM-57/1	596435.221	2822594.796	1696.504
BM-57/2	596176.999	2822439.571	1714.802
BM-57/3	596072.612	2822303.327	1714.090
BM-58/1	595883.502	2822472.897	1707.878
BM-58/2	595786.935	2822584.629	1716.310
BM-58/3	595728.000	2822882.601	1711.224
BM-59/1	595829.450	2823187.347	1711.836
BM-59/2	595858.844	2823384.068	1712.036
BM-59/3	595771.888	2823627.312	1707.319
BM60/1	595573.041	2824036.750	1721.724
BM60/2	595562.719	2824194.016	1730.873
BM60/3	595482.056	2824436.109	1729.078
BM-61/1	594911.044	2824866.509	1714.693
BM-61/2	594611.259	2824814.075	1688.092
BM-62/1	594323.277	2824887.592	1689.543
BM-62/2	594079.387	2824899.390	1687.960
BM-62/3	593823.312	2824926.865	1690.499
BM63/1	593595.510	2824649.592	1701.535
BM63/2	593465.624	2824562.628	1715.250
BM-64/1	593305.223	2823936.592	1769.348
BM-64/2	593226.094	2823773.618	1785.509
BM-64/3	593026.282	2823613.807	1806.879
BM-64/4	592978.487	2823471.028	1823.567
BM65/1	592739.085	2823451.085	1846.615
BM65/2	592661.474	2823330.010	1856.718
BM65/3	592577.480	2823082.662	1873.775
BM-66/1	592637.970	2822253.434	1890.107
BM-66/2	592425.492	2822369.571	1886.768
BM-67/1	592039.695	2822411.535	1906.281
BM-67/2	591823.604	2822374.102	1917.403
BM-68/1	591510.333	2822588.313	1928.600
BM-68/2	591303.653	2822667.961	1927.916
BM-68/3	591119.758	2822660.879	1932.062
BM-68/4	590863.117	2822802.035	1953.536
BM-69/1	590689.619	2822945.373	1977.738
BM-69/2	590498.929	2822929.932	1995.371
BM-69/3	590411.438	2823054.947	2008.402
BM-70/1	590032.370	2823127.030	2031.511
BM-70/2	589878.948	2823104.707	2045.031
BM-70/3	589704.750	2823035.947	2048.248
BM-71/1	589567.907	2822689.977	2007.950
BM-71/2	589665.184	2822451.200	1990.407

[Handwritten Signature]



Pt. No.	Easting (m)	Northing (m)	R.L. (m)
BM-71/3	589686.803	2822251.111	1974.543
BM-72/1	589612.551	2821788.101	1930.360
BM-72/2	589581.795	2822101.782	1912.940
BM-72/3	589563.783	2822232.619	1903.483
BM-73/1	589467.040	2821744.255	1860.495
BM-73/2	589363.067	2821545.747	1838.171
BM-73/3	589349.319	2821421.107	1826.204
BM-74/1	589197.859	2821407.865	1797.953
BM-74/2	589081.720	2821540.606	1766.199
BM-74/3	589024.367	2821737.095	1749.963
BM75/1	588845.981	2821305.531	1705.554
BM75/2	588625.379	2821237.578	1675.684
BM75/3	588461.842	2821261.368	1656.397
BM76/1	588264.950	2821323.276	1630.740
BM76/2	588090.475	2821465.121	1616.669
BM76/3	588292.675	2821606.333	1628.040
BM77/1	588324.179	2821939.959	1642.770
BM77/2	588282.100	2822103.028	1644.003
BM77/3	588061.290	2822131.298	1626.323
BM78/1	587842.023	2822180.578	1594.517
BM78/2	587902.465	2822474.953	1595.720
BM78/3	588031.602	2822654.128	1618.448
BM79/1	587991.459	2823068.640	1628.534
BM79/2	587769.053	2823089.392	1620.260
BM79/3	587658.125	2823252.886	1620.381
BM80/1	587585.750	2823701.300	1603.497
BM80/2	587434.002	2823800.795	1598.778
BM80/3	587254.647	2823969.521	1586.946
BM-81/1	586864.402	2824454.489	1573.262
BM-81/2	586633.757	2824518.251	1555.769
BM-81/3	586395.808	2824547.624	1543.813
BM-82/1	586061.268	2824474.363	1519.660
BM-82/2	585978.445	2824297.344	1504.666
BM-83/1	585851.145	2823895.640	1466.476
BM-83/2	585614.396	2823820.676	1441.221
BM-83/3	585701.676	2823694.497	1434.969
BM-84/1	585607.827	2823297.977	1426.382
BM-84/2	585316.191	2823238.166	1404.640
BM-84/3	585182.679	2823172.622	1394.457
BM-85	584916.300	2822223.002	1359.791
BM-85/1	585123.351	2822864.236	1384.789
BM-85/2	585139.367	2822562.211	1370.570
BM-85/3	585059.891	2822324.760	1359.065
BM-86/1	584709.692	2822011.830	1363.168

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Pt. No.	Easting (m)	Northing (m)	R.L. (m)
BM-86/2	584646.499	2821756.042	1357.533
BM-87/1	584439.028	2821424.604	1336.366
BM-87/2	584307.983	2821453.335	1329.548
BM-87/3	584361.977	2821213.116	1309.008
BM-88/1	584181.501	2820829.879	1278.519
BM-88/2	584066.705	2820491.007	1261.784
BM-88/3	584113.774	2820298.434	1248.257
BM-89/1	584035.107	2820160.850	1231.153
BM-89/2	583814.991	2819993.029	1225.491
BM-89/3	583614.983	2819871.240	1215.943
BM-90/1	583323.394	2819487.175	1215.309
BM-90/2	583184.080	2819303.630	1214.064
BM-90/3	583029.128	2819173.094	1221.232
BM-91/1	583107.404	2819745.790	1237.539
BM-91/2	583252.245	2819866.302	1245.833
BM-92/1	583295.199	2820524.547	1257.483
BM-92/2	583220.822	2820677.247	1263.198
BM-92/3	583141.392	2820906.411	1276.422
BM-93/1	583454.472	2821276.969	1271.741
BM-93/2	583502.608	2821477.464	1276.240
BM-93/3	583473.581	2821689.885	1279.429
BM-94/1	583724.901	2822078.871	1273.490
BM-94/2	583718.045	2822315.217	1265.935
BM-94/3	583654.031	2822526.781	1265.386
BM-95/1	583456.585	2822990.027	1267.728
BM-95/2	583093.274	2823032.404	1250.972
BM-95/3	582925.737	2823012.139	1246.854
BM-96/1	582365.860	2822962.004	1230.106
BM-96/2	582241.408	2823192.697	1224.423
BM-97/1	581809.451	2823107.943	1215.693
BM-97/2	581569.969	2823119.174	1215.212
BM-97/3	581261.698	2823025.137	1209.090
BM-98/1	580957.081	2822953.254	1207.216
BM-98/2	580751.350	2822802.874	1201.303
BM-98/3	580572.642	2822658.649	1191.189
BM-98/4	580604.971	2822527.811	1186.280
BM-99/1	580358.459	2822179.05	1163.849
BM-99/2	580220.533	2822037.081	1146.294
BM-100/1	580064.101	2822467.295	1143.935
BM-100/2	580017.655	2822672.729	1130.372
BM-100/3	579960.997	2822910.975	1118.387
BM-101/1	579433.090	2822634.036	1074.228
BM-101/2	579242.402	2822500.603	1054.404
BM-102/1	578850.909	2822349.304	1016.897



Pt. No.	Easting (m)	Northing (m)	R.L. (m)
BM-102/2	578672.520	2822125.284	986.391
BM-102/3	578492.425	2822044.199	977.651
BM-103/1	578121.958	2821719.507	953.832
BM-103/2	577891.572	2821729.240	943.703
BM-103/3	577704.248	2821620.347	928.865
BM-104/1	577330.443	2821405.170	903.181
BM-104/2	577219.060	2821271.016	884.691
BM-104/3	577454.107	2821307.975	863.749
BM-105/1	577629.635	2821231.400	836.883
BM-105/2	577499.103	2821061.876	815.090
BM-105/3	577313.806	2820943.618	792.162
BM-106/1	576855.167	2820401.575	742.472
BM-106/2	576777.503	2820260.650	737.522
BM-106/3	576958.987	2820415.653	716.587
BM-107/1	576904.972	2820236.034	692.302
BM-107/2	576671.889	2820131.754	671.619
BM-111/1	576875.488	2823847.958	706.679
BM-111/2	576789.834	2824027.572	722.125
BM-112/1	576755.154	2823842.326	742.616
BM-112/2	576643.905	2823815.968	772.883
BM-112/3	576559.601	2823902.443	793.547
BM-113/1	576438.758	2823972.095	832.278
BM-113/2	576364.403	2824161.98	855.885
BM-113/3	576245.721	2824183.938	882.85
BM-114/1	575998.651	2824365.215	923.022
BM-114/2	575997.765	2824182.549	938.166
BM-114/3	576033.329	2824059.519	951.932

❖ **TBM PILLAR LIST**

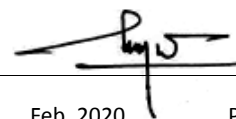
TBM No.	Easting (m)	Northing (m)	R.L. (m)
TBM-J17	602289.654	2814612.357	1584.387
TBM-54	603416.533	2814825.709	1612.149
TBM-J15	601541.411	2814229.256	1658.041
TBM-61	601993.183	2815312.346	1532.598
TBM-60	602499.583	2815653.892	1534.483
TBM-J12	603342.067	2815533.609	1596.109
TBM-56	603289.456	2814936.856	1617.628
TBM-55	603330.396	2814945.483	1617.708
TBM-90	600021.735	2820643.493	1424.487
TBM-A26	576941.035	2823816.188	705.197



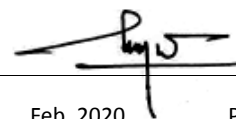
TBM No.	Easting (m)	Northing (m)	R.L. (m)
TBM-A25	576944.308	2823824.122	705.214
TBM-B93	576845.674	2823864.042	710.137
TBM-B94	576837.501	2823855.186	710.189
TBM-D64	576883.137	2823596.217	720.942
TBM-D63	576886.062	2823613.357	720.474
TBM-B92	576463.368	2823945.478	827.730
TBM-D62	576689.869	2823960.278	730.762
TBM-D61	576695.659	2823950.980	730.883
TBM-B91	576443.551	2823967.863	830.760
TBM-B90	576309.008	2824132.989	850.309
TBM-B89	576298.650	2824128.949	850.521
TBM-B88	576239.096	2824179.560	884.205
TBM-B87	576224.578	2824168.815	886.282
TBM-B84	576122.103	2824222.742	906.546
TBM-B83	576129.657	2824229.109	906.602
TBM-A24	576258.790	2820765.708	645.988
TBM-A23	576260.971	2820752.797	645.445
TBM-A22	576500.462	2820459.819	650.753
TBM-A21	576490.843	2820431.145	651.293
TBM-20	577179.234	2821243.298	889.037
TBM-19	577197.049	2821250.131	887.925
TBM-18	577427.599	2821316.489	865.013
TBM-17	577430.745	2821325.754	865.033
TBM-A16	577670.077	2821326.426	848.487
TBM-A15	577656.403	2821317.200	846.649
TBM-A14	577469.099	2821051.210	812.940
TBM-A13	577390.831	2821033.594	805.150
TBM-A12	577212.563	2820776.612	774.491
TBM-A11	577221.496	2820770.234	773.855
TBM-A10	576924.504	2820455.167	745.249
TBM-A9	576917.100	2820461.500	745.199
TBM-A4	576857.780	2820181.873	689.919
TBM-A3	576800.251	2820142.952	686.087
TBM-A2	576484.292	2820243.188	662.070
TBM-A1	576487.838	2820238.017	662.447
TBM-A8	576886.433	2820366.098	723.429
TBM-A7	576875.216	2820370.663	724.293
TBM-A6	576936.246	2820340.251	697.280
TBM-A5	576907.116	2820267.412	693.760
TBM-B82	577982.303	2821813.681	948.964



TBM No.	Easting (m)	Northing (m)	R.L. (m)
TBM-B81	577968.537	2821814.510	948.503
TBM-B80	577691.272	2821616.612	928.419
TBM-B79	577668.804	2821608.084	927.720
TBM-B86	578648.273	2822115.129	984.649
TBM-B85	578637.063	2822109.781	983.710
TBM-D56	579364.618	2822644.969	1067.595
TBM-D55	579360.538	2822634.572	1067.181
TBM-D60	578937.956	2822430.514	1026.650
TBM-D59	578943.837	2822434.180	1026.818
TBM-D58	579028.246	2822480.513	1033.557
TBM-D57	579036.046	2822485.339	1034.213
TBM-B72	580916.504	2822920.019	1206.725
TBM-B71	580920.699	2822907.959	1206.389
TBM-B78	580285.776	2822165.031	1159.399
TBM-B77	580294.065	2822170.628	1160.101
TBM-B76	580444.718	2822348.957	1170.747
TBM-B75	580450.015	2822340.135	1170.416
TBM-B74	580560.534	2822575.716	1188.600
TBM-B73	580568.292	2822560.794	1187.995
TBM-B70	581482.975	2823046.691	1211.696
TBM-B69	581487.096	2823037.429	1211.641
TBM-B68	581758.027	2823130.233	1215.214
TBM-B67	581766.754	2823130.845	1215.271
TBM-B66	582206.452	2823242.754	1224.041
TBM-B65	582239.012	2823194.923	1224.280
TBM-B64	582497.329	2823107.129	1238.418
TBM-B63	582507.665	2823104.851	1239.154
TBM-D54	580166.712	2822063.068	1144.625
TBM-D53	580159.666	2822079.297	1144.498
TBM-D52	580009.423	2822782.872	1127.116
TBM-D51	580019.161	2822778.997	1127.608
TBM-D50	579724.500	2822903.785	1103.660
TBM-D49	579709.144	2822902.405	1102.929
TBM-D46	583588.217	2822676.836	1269.372
TBM-D45	583592.245	2822682.960	1269.740
TBM-D44	583560.865	2822868.328	1272.387
TBM-D43	583559.874	2822873.812	1272.189
TBM-D42	582955.013	2823048.892	1247.234
TBM-D41	582966.454	2823049.218	1247.455
TBM-D48	583630.130	2821810.794	1277.020



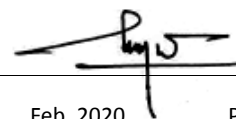

TBM No.	Easting (m)	Northing (m)	R.L. (m)
TBM-D47	583638.727	2821805.971	1277.057
TBM-B62	583516.731	2821736.487	1277.761
TBM-B61	583488.666	2821418.578	1273.290
TBM-B60	583455.199	2821339.536	1271.254
TBM-B59	583447.626	2821197.360	1272.654
TBM-B54	583056.205	2819677.574	1232.138
TBM-B53	583014.104	2819579.519	1226.933
TBM-B58	583121.109	2820813.664	1272.430
TBM-B57	583212.752	2820691.807	1264.536
TBM-B56	583288.211	2820224.645	1249.140
TBM-B55	583302.434	2820199.629	1250.005
TBM-M44	584116.634	2820297.738	1248.477
TBM-M43	584096.493	2820312.103	1250.288
TBM-M50	583191.252	2819316.344	1214.309
TBM-M49	583197.704	2819328.680	1214.262
TBM-M48	583454.605	2819613.797	1212.163
TBM-M47	583463.797	2819628.668	1212.067
TBM-M46	583861.320	2820035.531	1227.392
TBM-M45	583868.440	2820042.021	1227.478
TBM-M42	584362.624	2821183.739	1307.028
TBM-M41	584361.356	2821215.194	1309.569
TBM-M40	584379.236	2821490.192	1334.162
TBM-M39	584380.767	2821499.659	1334.490
TBM-M38	584676.967	2821808.592	1358.529
TBM-M37	584692.026	2821843.136	1359.486
TBM-M36	584728.449	2822255.855	1362.263
TBM-M35	584730.582	2822246.578	1362.063
TBM-B52	585894.350	2823958.054	1472.102
TBM-B51	585908.179	2824123.396	1486.712
TBM-B50	586250.151	2824500.365	1533.743
TBM-B49	586272.663	2824551.622	1537.247
TBM-B48	586707.701	2824564.624	1562.214
TBM-B47	586707.449	2824555.104	1561.924
TBM-B46	586929.250	2824333.209	1574.019
TBM-B45	587004.812	2824206.244	1575.509
TBM-D40	585696.772	2823661.980	1435.030
TBM-D39	585706.025	2823661.680	1434.900
TBM-D38	585603.870	2823296.798	1426.752
TBM-D37	585588.544	2823312.912	1425.532
TBM-D36	585203.893	2822944.521	1386.894



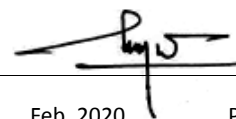

TBM No.	Easting (m)	Northing (m)	R.L. (m)
TBM-D35	585195.282	2822940.361	1386.980
TBM-D34	584990.563	2822160.765	1358.873
TBM-D33	584970.629	2822162.823	1359.145
TBM-B44	587179.208	2824120.141	1581.501
TBM-B43	587264.379	2823963.757	1587.987
TBM-B42	587589.978	2823698.659	1603.799
TBM-B41	587657.481	2823679.774	1602.651
TBM-B40	587682.963	2823379.754	1618.536
TBM-B39	587674.656	2823384.395	1618.348
TBM-B38	587981.137	2822818.510	1626.103
TBM-B37	587982.664	2822768.731	1624.878
TBM-M34	588330.374	2822111.238	1646.027
TBM-M33	588333.309	2822120.589	1646.439
TBM-M31	587902.834	2822361.856	1589.014
TBM-M32	587893.089	2822361.629	1588.708
TBM-M30	587996.988	2822591.158	1611.413
TBM-M29	588008.602	2822590.654	1611.983
TBM-D32	588338.142	2821619.086	1629.087
TBM-D31	588328.657	2821620.773	1628.792
TBM-D30	588124.733	2821362.530	1621.427
TBM-D29	588171.705	2821347.529	1624.536
TBM-B25	589687.448	2822248.637	1974.796
TBM-B36	589205.569	2821377.977	1800.377
TBM-B35	589236.110	2821370.248	1803.045
TBM-B34	589295.654	2821427.096	1822.378
TBM-B33	589354.075	2821422.686	1827.036
TBM-B32	589343.797	2821610.355	1844.526
TBM-B31	589481.824	2821759.011	1862.648
TBM-B30	589536.480	2822273.229	1907.377
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TBM-B28	589615.059	2821960.940	1921.871
TBM-B27	589600.494	2821776.199	1929.104
TBM-B26	589677.305	2822101.635	1962.284
TBM-B24	589551.154	2822727.669	2011.028
TBM-B23	589510.104	2822821.657	2017.924
TBM-M28	589092.127	2821615.135	1760.900
TBM-M27	589084.692	2821606.220	1760.943
TBM-M26	588849.680	2821353.649	1708.349
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TBM-M23	588599.749	2821234.566	1672.714



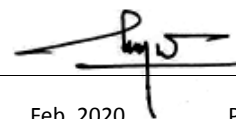
TBM No.	Easting (m)	Northing (m)	R.L. (m)
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TBM-M18	593296.644	2823916.001	1771.462
TBM-M16	592982.353	2823572.303	1812.809
TBM-M15	592991.672	2823570.076	1812.824
TBM-M14	592619.682	2823270.050	1862.666
TBM-M12	592570.616	2822901.871	1883.058
TBM-M11	592561.091	2822902.752	1883.330
TBM-M13	592627.080	2823234.990	1864.298
TBM-B22	593332.237	2824467.477	1727.325
TBM-B21	593323.637	2824472.289	1727.621
TBM-B20	593460.080	2824592.339	1713.837
TBM-B19	593451.758	2824597.337	1713.998
TBM-B9	593756.294	2824888.144	1689.835
TBM-B8	594249.276	2824907.073	1688.989
TBM-B7	594263.904	2824897.166	1688.964
TBM-B6	594532.345	2824737.471	1683.982
TBM-B5	594537.719	2824747.458	1684.025
TBM-B10	593728.296	2824845.546	1689.818
TBM-B4	595125.563	2824808.997	1721.903
TBM-B3	595126.958	2824816.612	1721.869
TBM-D28	590595.359	2822877.659	1986.282
TBM-D27	590645.965	2822905.727	1982.090
TBM-M22	590476.743	2823056.035	2004.677
TBM-M21	590413.914	2823052.771	2008.387
TBM-M20	590066.921	2823079.278	2029.079
TBM-M19	589885.612	2823106.659	2044.952
TBM-D26	590865.620	2822794.640	1953.604
TBM-D25	590894.630	2822753.073	1951.496
TBM-D24	591539.015	2822547.669	1932.049
TBM-D23	591537.078	2822526.295	1931.660
TBM-D22	592174.522	2822373.904	1899.941
TBM-D21	592236.572	2822372.122	1894.509
TBM-D16	592665.614	2822238.137	1892.550
TBM-D15	592658.738	2822268.390	1891.547
TBM-D14	592593.852	2822477.795	1892.177
TBM-D13	592589.570	2822539.495	1892.253
TBM-B18	595523.473	2824391.445	1728.636
TBM-B17	595514.882	2824386.914	1728.489
TBM-B16	595617.058	2824124.532	1729.364



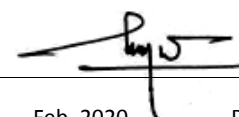

TBM No.	Easting (m)	Northing (m)	R.L. (m)
TBM-B15	595607.408	2824123.223	1729.166
TBM-M9	596605.202	2822528.090	1682.152
TBM-M10	596614.806	2822529.211	1682.412
TBM-M8	596897.729	2823055.537	1691.175
TBM-M7	596887.798	2823061.611	1691.561
TBM-D20	595828.210	2823176.667	1712.224
TBM-D19	595849.427	2823224.854	1712.592
TBM-D18	595752.543	2823695.796	1706.815
TBM-D17	595744.377	2823690.132	1706.359
TBM-B14	595790.629	2822584.038	1716.460
TBM-B13	595883.294	2822470.343	1708.214
TBM-B12	596131.792	2822387.679	1714.269
TBM-B11	596181.863	2822442.971	1715.191
TBM-B2	597495.998	2822777.315	1639.671
TBM-B1	597338.453	2822872.609	1652.930
TBM-M6	598711.150	2823237.785	1469.801
TBM-M5	598701.792	2823214.506	1470.519
TBM-M4	598703.719	2822828.572	1485.345
TBM-M3	598694.686	2822825.002	1485.213
TBM-M2	599357.174	2822642.001	1455.240
TBM-M1	599350.234	2822646.418	1455.271
TBM-D12	597601.137	2822599.576	1624.653
TBM-D11	597609.207	2822594.392	1624.492
TBM-D9	598023.396	2822988.658	1565.930
TBM-D8	598209.086	2823333.708	1519.751
TBM-D7	598205.811	2823342.887	1520.009
TBM-D10	598020.924	2822998.084	1565.810
TBM-D6	598733.020	2823530.977	1464.725
TBM-D5	598732.593	2823553.976	1463.853
TBM-D3	598769.190	2823797.183	1469.768
TBM-D4	598757.343	2823793.475	1470.137
TBM-D2	598447.439	2823581.389	1494.074
TBM-D1	598426.284	2823575.506	1494.843
TBM-J13	603192.119	2815262.221	1601.992
TBM-58	602693.601	2816217.099	1548.581
TBM-J16	601694.105	2814375.703	1633.642
TBM-73	600872.922	2814969.273	1688.824
TBM-72	600866.825	2814961.599	1689.159
TBM-71	600961.995	2814845.770	1678.834
TBM-69	601092.570	2814599.128	1665.034



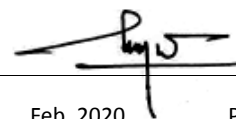

TBM No.	Easting (m)	Northing (m)	R.L. (m)
TBM-70	601084.247	2814593.745	1664.595
TBM-67	601277.245	2814377.130	1664.126
TBM-68	601284.975	2814383.216	1663.982
TBM-66	601441.005	2814226.978	1661.476
TBM-65	602054.213	2814711.010	1569.704
TBM-64	602058.569	2814813.650	1564.596
TBM-63	602084.828	2814920.933	1552.763
TBM-62	602094.385	2814923.684	1554.091
TBM-J14	603201.144	2815258.171	1602.316
TBM-J11	603089.477	2815620.004	1596.256
TBM-59	602636.897	2816268.545	1546.489
TBM-53	603632.971	2814634.166	1594.779
TBM-52	603597.864	2814586.940	1589.909
TBM-18	600419.159	2815523.451	1749.176
TBM-57	602751.963	2816024.394	1561.688
TBM-80	599525.639	2814846.601	1761.588
TBM-J20	598578.766	2814856.342	1756.784
TBM-34	599171.359	2816708.404	1650.615
TBM-33	599228.127	2816692.284	1645.560
TBM-46	598261.402	2817164.270	1723.189
TBM-45	598768.604	2816860.140	1677.657
TBM-44	598891.115	2816804.974	1669.604
TBM-83	598626.906	2815359.357	1732.207
TBM-84	598630.524	2815345.198	1732.228
TBM-J22	599079.588	2814564.017	1768.813
TBM-J21	599077.268	2814573.523	1769.029
TBM-82	599328.485	2814621.396	1764.313
TBM-81	599424.035	2814688.867	1763.982
TBM-79	599532.543	2814842.757	1761.512
TBM-75	599851.306	2815049.830	1756.825
TBM-74	599800.503	2815050.645	1756.187
TBM-76	599684.364	2815079.650	1756.933
TBM-51	603400.225	2814409.428	1576.184
TBM-52	603392.320	2814415.212	1576.069
TBM-J10	603512.584	2813963.957	1541.182
TBM-J9	603480.283	2814002.942	1542.698
TBM-J8	603292.277	2814380.482	1574.207
TBM-J4	603752.596	2813897.993	1473.661
TBM-47	604358.659	2814245.677	1426.956
TBM-48	604321.468	2814192.729	1429.664




TBM No.	Easting (m)	Northing (m)	R.L. (m)
TBM-42	604696.566	2814538.926	1393.622
TBM-43	604507.593	2814349.657	1416.195
TBM-40	605347.052	2815613.749	1306.003
TBM-39	605343.990	2815603.994	1305.804
TBM-37	605222.408	2815134.225	1330.746
TBM-J2	605745.424	2815785.965	1307.781
TBM-J1	605747.996	2815774.578	1307.764
TBM-36	605211.567	2814602.551	1407.891
TBM-J3	603624.685	2813506.142	1500.954
TBM-49	604114.518	2814110.311	1441.543
TBM-41	604666.743	2814691.068	1389.697
TBM-38	605218.822	2815241.553	1321.106
TBM-35	604983.581	2813213.084	1458.657
TBM-31	605297.785	2812612.933	1436.475
TBM-32	605299.542	2812603.158	1436.408
TBM-30	605549.619	2812711.827	1443.462
TBM-29	605551.970	2812702.091	1443.463
TBM-28	606483.558	2813463.691	1440.489
TBM-26	606772.758	2813568.189	1436.243
TBM-27	606782.008	2813565.643	1436.113
TBM-25	607258.296	2813406.436	1428.615
TBM-24	607254.630	2813412.410	1428.572
TBM-23	607636.230	2813602.968	1393.672
TBM-21	607751.151	2813519.753	1385.154
TBM-22	607758.738	2813513.624	1385.053
TBM-20	607387.102	2812861.080	1427.885
TBM-19	607395.528	2812856.527	1427.723
TBM-12	608797.656	2811598.722	1525.191
TBM-11	608797.132	2811608.317	1525.346
TBM-10	608882.160	2811622.332	1525.302
TBM-16	608389.306	2811899.315	1504.505
TBM-15	608379.766	2811897.494	1504.141
TBM-14	608314.569	2811573.233	1513.772
TBM-13	608324.245	2811572.658	1513.843
TBM-18	607431.006	2812362.930	1457.972
TBM-17	607508.589	2812296.563	1463.187
TBM-9	609167.636	2811395.819	1524.680
TBM-8	609089.644	2811328.078	1525.026
TBM-7	608933.533	2811107.533	1515.595
TBM-6	609170.610	2810920.149	1496.649




TBM No.	Easting (m)	Northing (m)	R.L. (m)
TBM-5	609166.480	2810928.721	1496.299
TBM-4	609829.985	2811015.279	1463.922
TBM-3	609818.888	2811020.100	1464.219
TBM-1	610252.994	2811251.245	1427.661
TBM-2	610243.323	2811251.736	1427.832
TBM-97	598639.598	2821018.959	1446.731
TBM-98	598577.137	2821126.040	1449.474
TBM-105	598593.460	2822080.196	1461.874
TBM-100	598369.638	2821377.157	1465.963
TBM-99	598416.654	2821271.731	1461.702
TBM-J41	598710.456	2820939.494	1445.093
TBM-J40	598894.080	2820726.959	1430.722
TBM-J39	599038.440	2820776.576	1424.349
TBM-J37	599205.247	2820721.222	1419.941
TBM-J38	599210.967	2820729.233	1422.573
TBM-95	599678.014	2820541.854	1410.686
TBM-96	599709.339	2820553.067	1411.739
TBM-104	598525.408	2821936.265	1463.521
TBM-103	598485.427	2821806.292	1467.985
TBM-102	598380.760	2821708.330	1472.734
TBM-101	598230.272	2821549.073	1476.021
TBM-J43	599065.802	2822304.751	1468.289
TBM-J42	599509.339	2822595.510	1465.458
TBM-94	600635.354	2820721.709	1460.543
TBM-J26	599630.988	2819513.214	1569.423
TBM-J27	599741.117	2819492.176	1566.570
TBM-J28	600169.440	2819392.967	1551.944
TBM-J28	600402.988	2819294.423	1541.731
TBM-J31	600376.702	2819282.336	1542.501
TBM-J32	600380.391	2819270.478	1543.185
TBM-J33	600486.950	2819480.131	1543.191
TBM-J34	600412.317	2819762.471	1529.922
TBM-J35	600456.324	2820561.437	1470.519
TBM-91	600070.906	2820698.886	1426.775
TBM-91	600424.024	2820682.157	1448.308
TBM-92	600425.876	2820671.811	1447.079
TBM-93	600613.046	2820735.980	1460.530
TBM-J36	600337.621	2820477.388	1483.187
TBM-J5	598093.565	2817956.381	1735.479
TBM-J7	598230.698	2818731.715	1703.115




TBM No.	Easting (m)	Northing (m)	R.L. (m)
TBM-J6	598244.692	2818508.007	1717.175
TBM-J22A	599263.444	2819240.446	1594.773
TBM-J23	599279.330	2819220.770	1597.201
TBM-87	599412.653	2818946.451	1610.035
TBM-88	599409.841	2818967.512	1609.725
TBM-85	599263.853	2818636.444	1621.283
TBM-J24	599202.590	2818829.491	1626.897
TBM-77	598684.819	2819080.833	1666.404
TBM-86	599271.180	2818642.184	1621.240
TBM-78	599078.250	2818792.233	1632.010
TBM-25	599232.964	2818806.969	1627.359

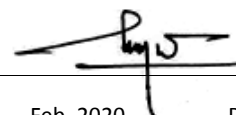
❖ **GPS PILLAR LIST**

GPS No.	Easting (m)	Northing (m)	R.L. (m)
GPS-0	610393.288	2811226.188	1417.686
GPS-0A	610288.311	2811265.613	1421.836
GPS-1	609774.402	2811004.596	1465.156
GPS-2	608865.048	2810947.918	1509.275
GPS-3	609091.054	2811617.981	1526.814
GPS-4	608340.274	2811693.103	1510.013
GPS-5	607706.344	2812055.863	1479.192
GPS-5A	607590.579	2812121.360	1474.372
GPS-6	607337.434	2812674.223	1437.344
GPS-7	607721.406	2813492.679	1385.470
GPS-8	607088.216	2813439.043	1430.734
GPS-9	606410.899	2813401.885	1442.932
GPS-10	605876.319	2812898.378	1454.338
GPS-10A	605785.379	2812832.364	1454.781
GPS-11	604992.876	2812829.187	1449.834
GPS-12	605126.625	2813716.824	1451.176
GPS-13	605205.244	2814604.254	1407.390
GPS-14	605572.969	2815134.826	1359.240
GPS-15	605755.074	2815753.363	1308.142
GPS-15A	605641.820	2815658.434	1305.876
GPS-16	605222.953	2815244.877	1319.993
GPS-17	604666.272	2814693.990	1389.034
GPS-18	604125.826	2814104.274	1440.179
GPS-19	603611.701	2813507.234	1502.392
GPS-20	603293.317	2814386.300	1574.140
GPS-20A	603369.830	2814407.252	1575.122
GPS-21	603261.362	2814915.071	1619.450

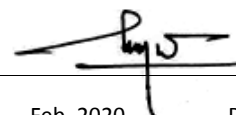
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GPS No.	Easting (m)	Northing (m)	R.L. (m)
GPS-22	603340.404	2815532.948	1595.455
GPS-23	602751.501	2816022.141	1561.136
GPS-24	602502.420	2815655.883	1534.047
GPS-25	601984.422	2815328.635	1531.190
GPS-25A	602024.022	2815160.109	1539.724
GPS-26	602258.312	2814586.914	1588.892
GPS-27	601556.285	2814232.410	1656.649
GPS-28	600953.704	2814854.937	1679.522
GPS-29	600454.013	2815515.484	1747.189
GPS-30	599871.957	2815033.583	1756.779
GPS-30A	599768.652	2815059.140	1757.135
GPS-31	599238.235	2814563.403	1769.130
GPS-32	598579.142	2814843.603	1756.851
GPS-33	598563.043	2815681.884	1713.159
GPS-34	599024.553	2816439.657	1660.779
GPS-35	599026.438	2816754.657	1663.123
GPS-35A	598892.950	2816804.742	1668.570
GPS-36	597911.989	2817348.270	1747.890
GPS-37	598246.664	2817953.915	1736.797
GPS-38	598227.680	2818703.171	1704.394
GPS-39	598687.644	2819092.031	1666.539
GPS-40	599130.224	2818832.785	1629.770
GPS-40A	599197.348	2818831.292	1627.491
GPS-41	599241.691	2819333.786	1587.455
GPS-42	599966.016	2819468.257	1558.493
GPS-43	600409.832	2819765.777	1529.005
GPS-44	600491.664	2820591.178	1466.510
GPS-45	600035.366	2820652.786	1424.700
GPS-45A	599940.527	2820608.656	1422.411
GPS-46	599194.096	2820726.467	1422.241
GPS-47	598627.229	2821056.309	1446.947
GPS-48	598232.352	2821688.268	1482.488
GPS-49	598780.230	2822252.060	1467.004
GPS-50	599522.934	2822610.773	1463.964
GPS-50A	599293.429	2822599.252	1455.144
GPS-51	598711.185	2822778.738	1484.680
GPS-52	598754.310	2823608.064	1464.396
GPS-53	598302.192	2823330.846	1520.222
GPS-54	597787.737	2822781.719	1590.773
GPS-55	597212.444	2823000.310	1665.761
GPS-55A	597104.950	2823026.721	1674.059
GPS-56	596606.505	2822566.101	1681.888
GPS-57	595982.316	2822210.904	1713.422
GPS-58	595798.634	2823001.847	1711.893




GPS No.	Easting (m)	Northing (m)	R.L. (m)
GPS-59	595694.321	2823811.486	1705.864
GPS-60	595411.753	2824622.601	1732.535
GPS-60A	595316.779	2824728.188	1730.348
GPS-61	594509.378	2824732.223	1683.254
GPS-62	593675.577	2824776.453	1691.335
GPS-63	593256.523	2824240.477	1741.956
GPS-64	592907.498	2823490.841	1833.039
GPS-65	592612.512	2822782.983	1885.780
GPS-65A	592594.546	2822588.628	1891.088
GPS-66	592223.385	2822370.052	1895.212
GPS-67	591548.755	2822487.947	1931.695
GPS-68	590861.108	2822964.527	1965.383
GPS-69	590137.222	2823025.281	2019.942
GPS-70	589454.568	2822920.733	2023.653
GPS-70A	589510.477	2822819.007	2017.471
GPS-71	589669.590	2822014.434	1954.029
GPS-72	589557.231	2822166.582	1897.691
GPS-73	589323.580	2821483.239	1819.343
GPS-74	588955.902	2821580.169	1730.150
GPS-75	588508.284	2821424.179	1651.669
GPS-75A	588496.320	2821476.840	1650.797
GPS-76	588351.875	2821708.805	1633.211
GPS-77	587926.788	2822018.665	1615.941
GPS-78	588033.845	2822730.947	1623.033
GPS-79	587713.351	2823549.093	1607.704
GPS-80	587091.123	2824182.049	1577.595
GPS-80A	587006.958	2824207.151	1575.164
GPS-81	586204.766	2824424.269	1528.668
GPS-82	585904.883	2824110.037	1485.022
GPS-83	585713.526	2823468.285	1432.639
GPS-84	585208.102	2822937.093	1386.357
GPS-85	584916.300	2822223.002	1359.791
GPS-85A	584771.493	2822227.654	1361.824
GPS-86	584537.694	2821694.695	1349.116
GPS-87	584272.395	2820966.041	1293.008
GPS-88	584209.063	2820159.656	1234.437
GPS-89	583473.322	2819678.766	1211.687
GPS-90	583045.540	2819449.396	1223.025
GPS-90A	583011.322	2819627.060	1228.407
GPS-91	583271.048	2820269.182	1247.967
GPS-92	583418.644	2821163.352	1272.550
GPS-93	583649.407	2821857.757	1277.343
GPS-94	583528.743	2822910.795	1270.686
GPS-95	582713.115	2823006.643	1245.043




GPS No.	Easting (m)	Northing (m)	R.L. (m)
GPS-95A	582612.477	2822978.190	1242.272
GPS-97	581141.272	2823056.297	1207.731
GPS-98	580586.815	2822370.543	1176.498
GPS-99	580151.584	2822242.498	1148.685
GPS-100	579690.708	2822903.790	1102.025
GPS-100A	579606.591	2822814.254	1095.216
GPS-101	579010.112	2822466.789	1030.860
GPS-102	578264.070	2821813.467	956.838
GPS-103	577443.774	2821491.140	913.933
GPS-104	577670.184	2821345.792	848.274
GPS-105	577171.022	2820688.426	764.442
GPS-105A	577035.503	2820584.893	751.335
GPS-106	577049.552	2820508.140	710.102
GPS-107	576474.859	2820268.422	659.829
GPS-108	576256.354	2821071.469	659.865
GPS-109	576945.313	2822869.639	724.269
GPS-110	576923.577	2823686.047	719.044
GPS-110A	576991.276	2823786.583	715.550
GPS-111	576709.077	2823955.801	729.270
GPS-112	576524.875	2823788.024	810.187
GPS-113	576120.431	2824246.828	907.392
GPS-114	576108.167	2823958.950	963.118

The survey has been done involving the following sequential steps:

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

Following features were recorded during detailing, in general:

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

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



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

4.2.6 TRAFFIC SURVEY

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

- Classified Traffic Volume Count Survey
- Axle Loading Characteristics Survey
- Intersection Volume Count Survey
- Origin - Destination Survey
- Pedestrian Count Survey
- Speed & Delay Survey

The details of the Traffic Survey Locations and Analysis of traffic survey data are provided in Chapter - 6 of the Main Report.

4.2.7 SUB-GRADE INVESTIGATION

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

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

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

Composition of Existing Pavement

The layer composition of the existing pavement noted from each excavated pit is given in Appendix: 4.6 of Main Report. Brief summary of existing crust details is shown in Table 4.5.

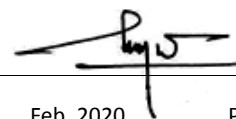
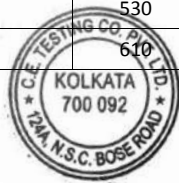


TABLE- 4.5: SUMMARY OF CRUST DETAILS

Chainage	TP. No.	Bitumen	Aggregate, boulder and soil	Aggregate, soil and stone dust	Boulder and soil	Aggregate and stone dust	Aggregate and soil	Boulder, aggregate and stone dust	Boulder, soil and stone dust	Decomposed rock	Clayey silt with decomposed rock	Boulder and stone dust	Soil	Boulder, aggregate, stone dust and soil	Soil, decomposed rock and aggregate	Clay silt and rock	Stone dust and soil	Total Thickness
75.000	151	20				130						250						400
75.500	152	30				90						250						370
76.000	153	30				150						370						550
76.500	154	20				220			420									660
77.000	155	20				190			410									620
77.500	156	20				160			280									460
78.000	157	10				170			260									440
78.500	158	20				240			480									740
79.000	159	20				120			240									380
79.500	160	20				150			320									490
80.000	161	30				130			290									450
80.500	162	30				180			320									530
81.000	163	30				180			320									530
81.500	164	40				200			350									590
82.000	165	20				190			320									530
82.500	166	20				180			320									520
83.000	167	20				240												260
83.500	168	30				250			570									850
84.000	169	30				130			370									530
84.500	170	30				150			320									500
85.000	171	40				240			440									720
85.500	172	20			500	240												760
86.000	173	20		180	520													720



Chainage	TP. No.	Bitumen	Aggregate, boulder and soil	Aggregate, soil and stone dust	Boulder and soil	Aggregate and stone dust	Aggregate and soil	Boulder, aggregate and stone dust	Boulder, soil and stone dust	Decomposed rock	Clayey silt with decomposed rock	Boulder and stone dust	Soil	Boulder, aggregate, stone dust and soil	Soil, decomposed rock and aggregate	Clay silt and rock	Stone dust and soil	Total Thickness
86.500	174	20		140	360													520
87.000	175	20		280	580													880
87.500	176	20		180	300													500
88.000	177	20			680	280											40	980
88.500	178	20			320	180												520
89.000	179	20			180	150												350
89.500	180	30			380	250												660
90.000	181	20			300	180												500
90.500	182			30	250													280
91.000	183	20			280	180												480
91.500	184					160			240									400
92.000	185					220			520									740
92.500	186	20			300	220												540
93.000	187	20				130	380		230									760
93.500	188					180	360		280									820
94.000	189	20			450	280												750
94.500	190	20			320	220												560
95.000	191	30	330		500	200												940
95.500	192	20				280												300
96.000	193	20			420			220										660
96.500	194	30	370			210												610
97.000	195	20			280	180												480
97.500	196	20			350	220												590
98.000	197	30			310	190												530
98.500	198	20			280	310												610



Chainage	TP. No.	Bitumen	Aggregate, boulder and soil	Aggregate, soil and stone dust	Boulder and soil	Aggregate and stone dust	Aggregate and soil	Boulder, aggregate and stone dust	Boulder, soil and stone dust	Decomposed rock	Clayey silt with decomposed rock	Boulder and stone dust	Soil	Boulder, aggregate, stone dust and soil	Soil, decomposed rock and aggregate	Clay silt and rock	Stone dust and soil	Total Thickness
99.000	199	20			320	120		240										700
99.500	200	20				220												240
100.000	201	10						300										310
100.500	202	30	340		520	210												900
101.000	203	20		180	360												40	600
101.500	204	30			300	270												600
102.000	205	20						280										300
102.500	206	20			250	160												430
103.000	207	30			550									320				900
103.500	208	20				240												260
104.000	209	40			380	280												700
104.500	210	20	280															300
105.000	211	20			320	220												560
105.500	212	30				260												290
106.000	213	20			230	160												410
106.500	214	30				180												210
107.000	215	No Pavement Found																
107.500	216	No Pavement Found																
108.000	217	Trial pit not possible due to new cutting area																
108.500	218																	
109.000	219	Trial pit not possible due to new cutting area																
109.500	220																	
110.000	221		150															150
110.500	222		120							240								360



Analysis of Sub-grade Characteristics

The results of field and laboratory investigations for determination of sub-grade characteristics have been compiled in the form of tables and figures and summarized in **Appendix: 4.7**. The factual results and the corresponding interpretations will be instrumental to assess the actual scenario of the existing road construction and will form a basis for the design of pavement structure. Summary of laboratory test result is given in **Table 4.6**.

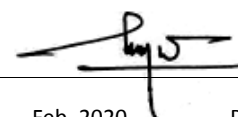


TABLE- 4.6: SUMMARY OF LABORATORY TEST RESULT

SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)							ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75mm	2.00mm	425m	75m	LL (%)	PL (%)	PI (%)	MDD (gm/cc)			OMC (%)	Test 1		Test 2		Test 3			
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1	0.000	TP-01	TRIAL PIT NOT POSSIBLE DUE TO CROSS ROAD AREA																				
2	0.500	TP-02	TRIAL PIT NOT POSSIBLE DUE TO MARKET AREA																				
3	1.000	TP-03	TRIAL PIT NOT POSSIBLE DUE TO MARKET AREA																				
4	1.500	TP-04	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
5	2.000	TP-05	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
6	2.500	TP-06	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
7	3.000	TP-07	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
8	3.500	TP-08	87	73	56	45	34	29	Non-Plastic		SM	0.00	2.135	8.75	1.725	19.237	1.968	31.29	2.118	61.99	52.34		
9	4.000	TP-09	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
10	4.500	TP-10	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
11	5.000	TP-11	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
12	5.500	TP-12	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
13	6.000	TP-13	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
14	6.500	TP-14	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
15	7.000	TP-15	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
16	7.500	TP-16	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
17	8.000	TP-17	56	42	34	27	21	13	Non-Plastic		GM	0.00	2.205	8.50	1.911	22.064	2.055	30.42	2.213	76.24	54.67		
18	8.500	TP-18	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
19	9.000	TP-19	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
20	9.500	TP-20	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
21	10.000	TP-21	49	38	30	25	20	15	Non-Plastic		GM	4.76	2.185	9.10	1.834	33.350	2.038	40.09	2.147	60.16	55.09		

SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75mm	2.00mm	425m	75m	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	10.500	TP-22	SAMPLES COULD NOT BE COLLECTED DUE TO ROCK BED AVAILABLE.																			
2	11.000	TP-23	60	39	27	20	16	13	Non-Plastic			GM	0.00	2.176	7.00	1.796	42.256	2.116	63.08	2.187	67.49	62.73
3	11.500	TP-24	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
4	12.000	TP-25	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
5	12.500	TP-26	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
6	13.000	TP-27	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
7	13.500	TP-28	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
8	14.000	TP-29	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
9	14.500	TP-30	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
10	15.000	TP-31	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
11	15.500	TP-32	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
12	16.000	TP-33	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
13	16.500	TP-34	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
14	17.000	TP-35	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
15	17.500	TP-36	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
16	18.000	TP-37	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
17	18.500	TP-38	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
18	19.000	TP-39	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
19	19.500	TP-40	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
20	20.000	TP-41	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
21	20.500	TP-42	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
22	21.000	TP-43	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			



SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)							ATTERBERG LIMIT			I.S. CLASSI- FICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75mm	2.00mm	425m	75m	LL (%)	PL (%)	PI (%)	MDD (gm/cc)			OMC (%)	Test 1		Test 2		Test 3			
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
23	21.500	TP-44	ROCK PIECES IN SUBGRADE HENCE MODIFIED PROCTOR AND CBR TEST NOT POSSIBLE																				
24	22.000	TP-45	49	36	25	19	15	12	Non-Plastic			GM	0.00	2.138	9.50	1.732	40.621	2.069	54.33	2.106	59.33	55.01	
25	22.500	TP-46	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
26	23.000	TP-47	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
27	23.500	TP-48	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
28	24.000	TP-49	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
29	24.500	TP-50	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
30	25.000	TP-51	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
31	25.500	TP-52	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
32	26.000	TP-53	74	70	65	62	59	55	38	24	14	CI	4.76	1.895	15.30	1.550	6.531	1.723	8.47	1.891	14.58	12.66	
33	26.500	TP-54	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
34	27.000	TP-55	90	87	82	77	71	67	39	24	15	CI	11.90	1.890	14.20	1.586	4.011	1.763	6.07	1.857	11.93	10.45	
35	27.500	TP-56	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
36	28.000	TP-57	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
37	28.500	TP-58	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
38	29.000	TP-59	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
39	29.500	TP-60	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
40	30.000	TP-61	91	68	53	43	35	29	Non-Plastic			SM	0.00	2.142	9.05	1.849	18.267	2.036	29.71	2.166	58.87	39.11	
41	30.500	TP-62	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
42	31.000	TP-63	57	52	44	37	30	25	Non-Plastic			GM	0.00	2.126	8.90	1.792	26.004	1.933	30.90	2.092	55.18	50.67	



SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)							ATTERBERG LIMIT			I.S. CLASSI- FICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75mm	2.00mm	425m	75m	LL (%)	PL (%)	PI (%)	MDD (gm/cc)			OMC (%)	Test 1		Test 2		Test 3			
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
43	31.500	TP-64	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
44	32.000	TP-65	81	50	36	27	20	16	Non-Plastic			GM	0.00	2.165	8.25	1.876	16.073	2.018	28.33	2.173	79.30	55.31	
45	32.500	TP-66	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
46	33.000	TP-67	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
47	33.500	TP-68	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
48	34.000	TP-69	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
49	34.500	TP-70	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
50	35.000	TP-71	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
51	35.500	TP-72	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
52	36.000	TP-73	78	59	48	43	37	20	Non-Plastic			SM	0.00	2.135	9.15	1.835	20.249	1.975	27.84	2.104	53.51	46.94	
53	36.500	TP-74	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
54	37.000	TP-75	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
55	37.500	TP-76	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
56	38.000	TP-77	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
57	38.500	TP-78	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
58	39.000	TP-79	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
59	39.500	TP-80	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
60	40.000	TP-81	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
61	40.500	TP-82	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
62	41.000	TP-83	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
63	41.500	TP-84	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																				
64	42.000	TP-85	77	72	67	63	53	40	31	20	11	SC	0.00	1.848	15.00	1.571	13.136	1.780	20.22	1.839	22.24	20.65	



***Final Detailed Project Report
Investigation and Analysis***

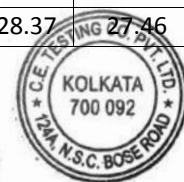
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C.E. TESTING PVT. LTD.
KOLKATA
700 092
12/A, N.S.C. BOSE ROAD

***Final Detailed Project Report
Investigation and Analysis***



SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75mm	2.00mm	425m	75m	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
109	64.500	TP-130	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
110	65.000	TP-131	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
111	65.500	TP-132	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
112	66.000	TP-133	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
113	66.500	TP-134	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
114	67.000	TP-135	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
115	67.500	TP-136	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
116	68.000	TP-137	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
117	68.500	TP-138	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
118	69.000	TP-139	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
119	69.500	TP-140	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
120	70.000	TP-141	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
121	70.500	TP-142	100	96	94	91	85	67	42	30	12	MI	4.50	1.854	14.30	1.613	7.356	1.785	10.11	1.869	10.99	10.25
122	71.000	TP-143	95	94	93	90	79	71	43	26	17	CI	6.55	1.860	15.20	1.626	2.986	1.721	4.60	1.864	10.47	8.02
123	71.500	TP-144	87	85	83	80	70	52	42	30	12	MI	7.00	1.830	13.50	1.586	7.644	1.675	9.10	1.861	13.87	11.67
124	72.000	TP-145	100	100	100	98	95	88	48	27	21	CI	8.33	1.760	14.70	1.510	3.212	1.637	3.52	1.791	4.37	3.90
125	72.500	TP-146	100	91	86	79	74	70	45	20	25	CI	5.60	1.875	15.75	1.612	3.516	1.734	4.36	1.848	7.40	6.62
126	73.000	TP-147	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
127	73.500	TP-148	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
128	74.000	TP-149	88	70	63	57	52	31	31	21	10	SC	2.50	1.918	10.95	1.649	9.943	1.774	14.89	1.890	29.10	25.47
129	74.500	TP-150	88	75	61	51	42	26	Non-Plastic			SM	0.00	1.859	11.00	1.580	22.025	1.774	32.39	1.868	35.95	33.48
130	75.000	TP-151	82	59	52	45	41	35	30	22	8	SC	3.50	1.980	12.45	1.721	13.483	1.816	16.71	1.930	28.37	27.46



SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75mm	2.00mm	425m	75m	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
131	75.500	TP-152	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
132	76.000	TP-153	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
133	76.500	TP-154	92	90	85	82	72	48	33	22	11	SC	0.00	1.850	12.90	1.553	9.544	1.725	13.06	1.818	19.99	18.24
134	77.000	TP-155	67	63	61	58	53	40	31	20	11	SC	7.50	1.823	13.80	1.550	10.858	1.769	16.71	1.814	18.38	16.69
135	77.500	TP-156	Samples could not be collected due to rock bed available.																			
136	78.000	TP-157	95	91	83	78	70	34	30	18	12	SC	11.11	1.995	12.25	1.716	9.817	1.868	14.87	2.013	29.20	21.50
137	78.500	TP-158	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
138	79.000	TP-159	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
139	79.500	TP-160	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
140	80.000	TP-161	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
141	80.500	TP-162	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
142	81.000	TP-163	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
143	81.500	TP-164	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
144	82.000	TP-165	42	37	31	27	24	14	Non-Plastic			GM	4.50	1.944	10.14	1.652	35.777	1.882	55.07	1.934	60.56	55.49
145	82.500	TP-166	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
146	83.000	TP-167	100	91	84	79	71	35	33	19	14	SC	5.00	2.014	10.90	1.749	9.317	1.908	13.95	2.024	27.27	19.18
147	83.500	TP-168	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
148	84.000	TP-169	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
149	84.500	TP-170	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
150	85.000	TP-171	93	81	72	66	59	29	Non-Plastic			SM	2.50	2.108	10.70	1.814	13.567	1.974	20.88	2.127	47.57	33.23
151	85.500	TP-172	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
152	86.000	TP-173	90	72	58	49	42	30	34	17	17	SC	17.07	2.060	10.42	1.751	19.355	1.986	29.78	2.049	32.76	30.33



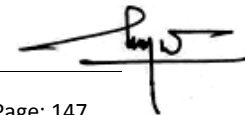
SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75mm	2.00mm	425m	75m	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
153	86.500	TP-174	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
154	87.000	TP-175	100	91	74	58	47	28	Non-Plastic			SM	0.00	2.095	9.95	1.809	24.021	1.991	29.77	2.118	50.54	36.47
155	87.500	TP-176	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
156	88.000	TP-177	80	78	69	62	56	28	Non-Plastic			SM	14	2	10	2	17	2	26	2	60	39
157	88.500	TP-178	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
158	89.000	TP-179	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
159	89.500	TP-180	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
160	90.000	TP-181	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
161	90.500	TP-182	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
162	91.000	TP-183	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
163	91.500	TP-184	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
164	92.000	TP-185	90	77	70	62	55	31	27	19	8	SC	4.76	2.050	10.60	1.741	15.629	1.877	19.37	2.026	32.88	29.47
165	92.500	TP-186	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
166	93.000	TP-187	80	70	61	55	49	30	Non-Plastic			SM	2.50	2.068	10.75	1.779	24.607	1.937	29.58	2.086	44.39	36.43
167	93.500	TP-188	83	48	32	22	16	13	Non-Plastic			GM	0.00	2.170	8.45	1.852	25.244	2.063	33.46	2.150	56.84	44.77
168	94.000	TP-189	87	76	71	64	56	37			0	SM	5.26	2.088	10.95	1.813	23.405	1.978	32.18	2.099	61.85	43.81
169	94.500	TP-190	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
170	95.000	TP-191	60	51	44	40	37	28	Non-Plastic			GM	18.18	1.996	12.00	1.697	36.520	1.906	56.19	1.986	61.81	58.32
171	95.500	TP-192	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
172	96.000	TP-193	72	66	57	50	44	27	Non-Plastic			SM		2.090	10.15	1.811	22.304	1.913	27.49	2.125	49.72	39.47
173	96.500	TP-194	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
174	97.000	TP-195	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			



SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75mm	2.00mm	425m	75m	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
175	97.500	TP-196	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
176	98.000	TP-197	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
177	98.500	TP-198	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
178	99.000	TP-199	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
179	99.500	TP-200	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
180	100.000	TP-201	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
181	100.500	TP-202	100	83	69	57	49	43	46	23	23	SC	4.35	2.018	13.50	1.635	14.350	1.959	21.10	2.036	22.37	21.07
182	101.000	TP-203	100	100	77	68	59	53	40	20	20	CI	8.70	1.825	13.75	1.540	5.337	1.708	6.61	1.807	11.23	9.49
183	101.500	TP-204	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
184	102.000	TP-205	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
185	102.500	TP-206	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
186	103.000	TP-207	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
187	103.500	TP-208	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
188	104.000	TP-209	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
189	104.500	TP-210	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
190	105.000	TP-211	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
191	105.500	TP-212	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
192	106.000	TP-213	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
193	106.500	TP-214	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
194	107.000	TP-215	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
195	107.500	TP-216	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
196	108.000	TP-217	TRIAL PIT NOT POSSIBLE DUE TO NEW CUTTING AREA																			



SL NO	LOCATION / CHAINAGE (KM)	Sample No.	SIEVE ANALYSIS (% PASSING BY WEIGHT)						ATTERBERG LIMIT			I.S. CLASSIFICATION	Differential Free swell Index %	Laboratory Compaction (Heavy)		SOAKED CBR AT 3 ENERGY LEVELS						SOAKED CBR AT 97 % OF MDD
			20 mm	10 mm	4.75mm	2.00mm	425m	75m	LL (%)	PL (%)	PI (%)			MDD (gm/cc)	OMC (%)	Test 1		Test 2		Test 3		
																DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	DD (gm/cc)	Soaked CBR %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
197	108.500	TP-218	TRIAL PIT NOT POSSIBLE DUE TO NEW CUTTING AREA																			
198	109.000	TP-219	TRIAL PIT NOT POSSIBLE DUE TO NEW CUTTING AREA																			
199	109.500	TP-220	TRIAL PIT NOT POSSIBLE DUE TO NEW CUTTING AREA																			
200	110.000	TP-221	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			
201	110.500	TP-222	Samples could not be collected due to Rock Bed/ Very high percentage of Rock pieces in subgrade																			




4.2.8 BENKELMAN BEAM DEFLECTION SURVEY

The test has been carried out at the following location mentioned in the table on the basis of pavement condition survey. **Appendix 4.8** shows the calculation of rebound deflections measured using Benkelman Beam Deflection method (as per IRC- 81:1997) and calculation of characteristic deflections which will be required for overlay design. **Table-4.7** represents the characteristic deflection along along with the recommended overlay thickness.

TABLE- 4.7: CHARACTERISTIC DEFLECTION WITH RECOMMENDED OVERLAY THICKNESS

Existing Chainage (Km)		Length (m)	Average Characteristics deflection (mm)	Design MSA	Required BM (mm)	Equivalent BC+DBM (mm)	Calculated Overlay Thickness (mm)		Recommended Overlay Thickness (mm)	
From	To						BC	DBM	BC	DBM
0.000	1.000	1000	0.939	20	30	21	40	0	40	50
1.000	2.000	1000	0.828	20	70	49	40	9	40	50
2.000	3.000	1000	0.648	20	70	49	40	9	40	50
3.000	4.000	1000	0.760	20	70	49	40	9	40	50
4.000	5.000	1000	0.499	20	70	49	40	9	40	50
5.000	6.000	1000	0.533	20	70	49	40	9	40	50
6.000	7.000	1000	0.580	20	70	49	40	9	40	50
7.000	8.000	1000	0.551	20	70	49	40	9	40	50
8.000	9.000	1000	0.514	20	70	49	40	9	40	50
9.000	10.000	1000	0.580	20	70	49	40	9	40	50
10.000	11.000	1000	0.558	20	70	49	40	9	40	50
11.000	12.000	1000	1.702	20	160	112	40	72	40	90
12.000	13.000	1000	0.735	20	70	49	40	9	40	50
13.000	14.000	1000	0.677	20	70	49	40	9	40	50
17.000	18.000	1000	0.626	20	70	49	40	9	40	50
18.000	19.000	1000	0.533	20	70	49	40	9	40	50
19.000	20.000	1000	0.645	20	70	49	40	9	40	50
20.000	21.000	1000	0.682	20	70	49	40	9	40	50
21.000	22.000	1000	0.575	20	70	49	40	9	40	50
81.000	82.000	1000	0.793	20	70	49	40	9	40	50
82.000	83.000	1000	0.739	20	70	49	40	9	40	50
83.000	84.000	1000	0.774	20	70	49	40	9	40	50
84.000	85.000	1000	0.734	20	70	49	40	9	40	50

3.2.2 QUARRY MATERIAL

The material investigation for road construction material required to be carried out to identify the potential sources of construction materials and to assess their general availability, engineering

[Signature]



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

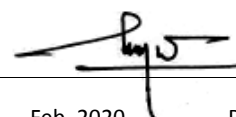
- Granular materials for sub-base works
- Crushed stone aggregates for base, bituminous surfacing and cement concrete works
- Sand for bituminous and cement concrete works, sub-base, filter materials and filling materials etc.
- Borrow earth/ moorum materials for embankment, sub-grade and filling

OBJECTIVE

The following are the basic objective to make material investigation:

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

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



A) Coarse Aggregate:

Hard stone aggregate, fulfilling the requirements of concrete works, base, sub base and asphaltic works are considered from Barak near Dzuku with a distance of 2 km from the start of the project road.

DETAILS OF COARSE AGGREGATE SOURCES

Quarry Location	Material	Distance from Source to Start/ End Point of Project Road (km)	Probable purpose of use of material
Barak near Dzuku	Coarse Aggregate	2	GSB, WMM, Bituminous and concrete works

B) Fine Aggregate:

Fine and Coarse Sand is available from Barak near Dzuku, fulfilling the requirements of concrete works and filling works. The distance is 2 km by road from start point of the project road.

DETAILS OF FINE AGGREGATE SOURCES

Quarry Location	Material	Distance from Source to Start/ End Point of Project Road (km)	Probable purpose of use of material
Barak near Dzuku	Fine Aggregate	2	Filling works

C) Bitumen:

Bitumen is available from Imphal. The distance is 160 km by road from start point of the project road.

DETAILS OF BITUMEN SOURCES

Quarry Location	Material	Distance from Source to Start/ End Point of Project Road (km)	Probable purpose of use of material
Imphal	Bitumen	160	Wearing course



D) Cement:

Cement is available from Imphal. The distance is 160 km by road from start point of the project road.

DETAILS OF CEMENT SOURCES

Quarry Location	Material	Distance from Source to Start/ End Point of Project Road (km)	Probable purpose of use of material
Imphal	Cement	160	Structural Work

E) Reinforcement:

Steel is available from Imphal. The distance is 160 km by road from start point of the project road.

DETAILS OF STEEL SOURCES

Quarry Location	Material	Distance from Source to Start/ End Point of Project Road (km)	Probable purpose of use of material
Imphal	Steel	160	Structural Work

3.2.3 BORROW AREA REQUIREMENT

For Package-III:

Total Earthwork in Cutting = 42,28,411.00 cum (Ref. Quantity Calculation for Road Works of Volume-VII: Cost Estimation) Total Ordinary Rock Cutting volume = 8,45,682.20 cum

So, Total Earthwork in soil = (42,28,411.00 – 8,45,682.20) cum. = 33,82,728.80 cum

Earthwork used for filling in embankment (approximately 8% of total earthwork in soil) from Roadway cutting material = 2,70,618.30 cum

Total Earthwork in Filling comes to 2,41,979 cum., which is much lesser than the total earthwork in soil;

So, no Earthwork required for Package-III for embankment construction from Borrow area.

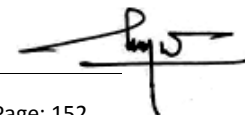
3.2.4 MUCK DISPOSAL

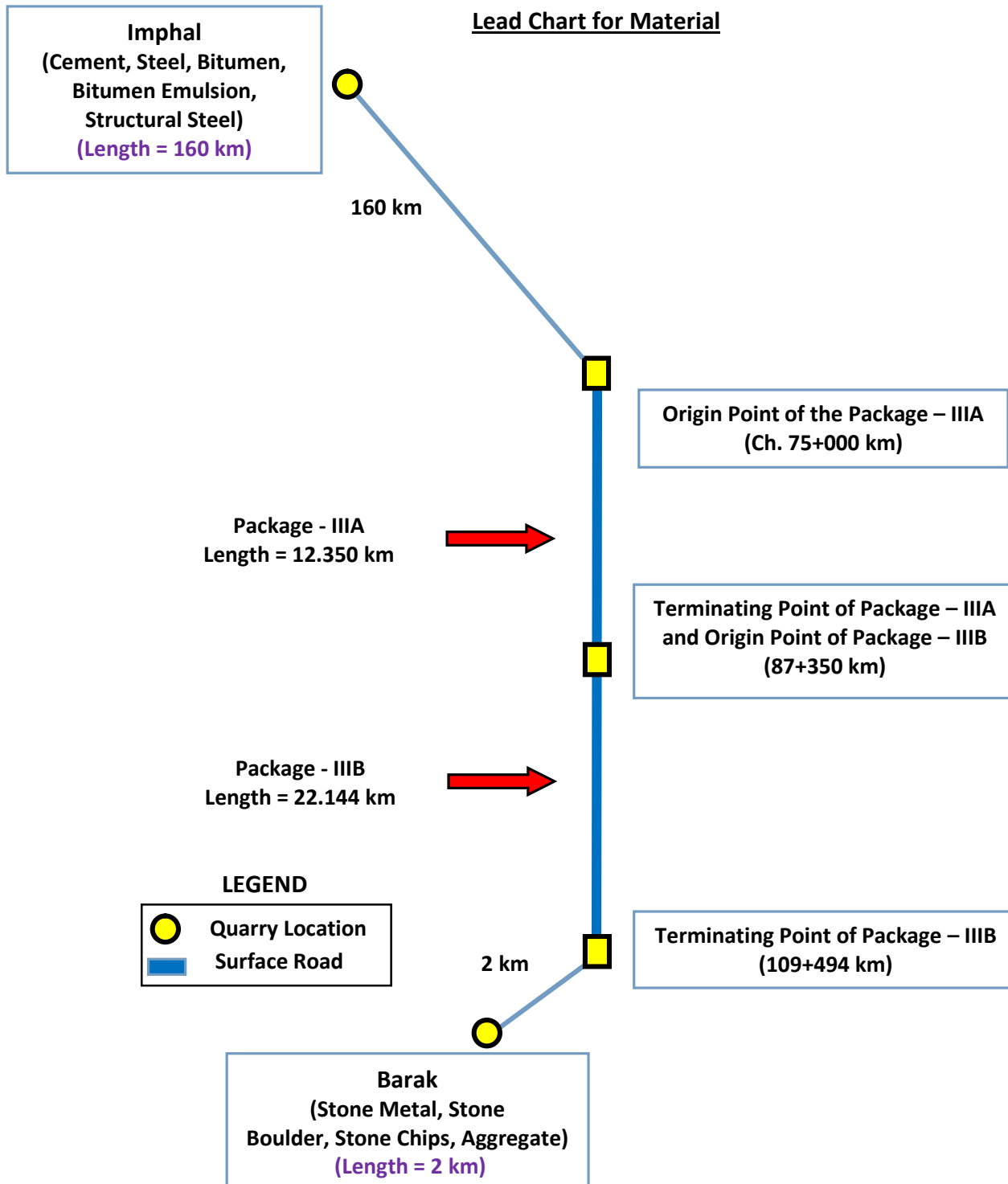
The muck from hill cutting and construction activities will be safely disposed at suitable locations. Principle adopted for selecting muck dumping areas was to avoid sensitive areas like dense vegetation, natural water courses and areas prone to landslides. During the selection of the dumping sites preference was given on the following aspects.

- The muck does not fall/ flow into stream/river.
- Dumping sites should be at least 30 m (horizontal) away from the High Flood Level of the River/ stream.
- The sites are free from active landslides or creeps.
- The sites should not fall within pristine forest nor are these habitats of threatened species of flora and fauna.
- The sites are located close to its source in order to avoid long distance haulage.

Requirement of total Muck Disposal area has given below:

Muck Disposal Estimate (Maram-Peren Road Stretch)											
PKG No.	Chainage(M)		Quantity of Muck/Debris generated in Cum	Quantity of Muck with 30% swell factor in Cum	Total Quantity of Muck/Debris including swell factor in Cum	Estimated Quantity of Muck/Debris proposed to be utilized for Filling in cum	Estimated quantity of muck/debris proposed to be dumped in cum.	Estimated quantity of muck/debris dumped in other location in Cum	Avg. Dumping Height in M.	Avg. Dumping Area (Sqm.)	Avg. Dumping Area (Ha.)
	From	To									
PKG-III	75,000	109,494	4,228,021.00	1,268,406.30	5,496,427.30	241,979.00	5,254,448.30	5,254,448.30	15.00	350,296.55	35.03



3.2.5 SUB-SOIL EXPLORATION

Subsoil exploration is not required for any bridge location of Maram-Peren Road Stretch.

3.2.6 PHOTOGRAPHS

Photographs of field activities are given below:



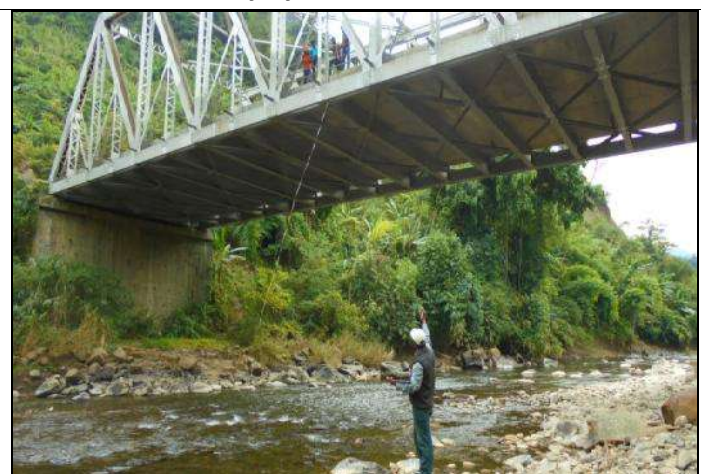
Culvert Inventory at Ch. 1+905 km



Road Inventory by rodometer at Ch. 4+489 km



Sinking Zone at Ch. 12+500 km



Dzuku Bridge Inventory at Ch. 105+560 km



Topographic Survey at Ch. 45+300 km



Trial Pit at Ch. 11+000 km



TMC Survey



CTVC Survey



Axle Load survey



OD Survey



Pedestrian Survey



BBD Survey

CHAPTER – 5

SOCIAL ANALYSIS

5.1 INTRODUCTION AND BACKGROUND

5.1.1 THE PROJECT

Manipur is one of the Border States in the north-eastern part of the country having an international boundary of about 352 kms long stretch of land with Myanmar in the southeast. It is bounded by Nagaland in the north, Assam in the west and Mizoram in the south. It has a total area of 22327 sq. kms. It lies between 23.80 N to 25.70 N latitude and 93.50 E to 94.80 E longitudes.

Geographically, the State of Manipur could be divided into two regions, viz. the hill and the valley. The valley lies in the central part of the State and the hills surround the valley. The average elevation of the valley is about 790 m above the sea level and that of the hills is between 1500 m and 1800m. Manipur earlier had 9 districts - Imphal West, Imphal East, Bishnupur, Thoubal, Ukhrul, Senapati, Tamenglong, Churachandpur and Chandel and the newly formed districts are Kangpokpi, Tengnoupal, Pherzawl, Noney, Kamjong, Jiribam and Kakching. The hill districts occupy about 90 percent (20089 sq km) of the total area of the State and the valley occupies only about tenth (2238 sq km) of the total area of the State. Imphal is the capital city of Manipur.

In the need of development of the newly created state the Government of India under the vehicle of National Highway Authority of India had initiated in constructing/upgrading the road conditions in the state. The district of Senapati in the state of Manipur, does not have any railway connectivity so there was an urgent requirement of the development of the roadways.

Realizing the above fact National Highways & Infrastructure Development Corporation Limited (NHIDCL) has taken up one prestigious road network improvement projects namely developing a road from Maram and ending at Dzuko Bridge (Near Peren Town) in the District of Senapati of Manipur. The upgraded road will connect Manipur (Maram) and Nagaland at Dzuko bridge (Near Peren Town). The Design road length is 34.494 km. The road starts Maram and end at Peren. The project road has distributed in three packages. Details are given in **Table 5.1**.

Table 5.1: Project Road Distribution

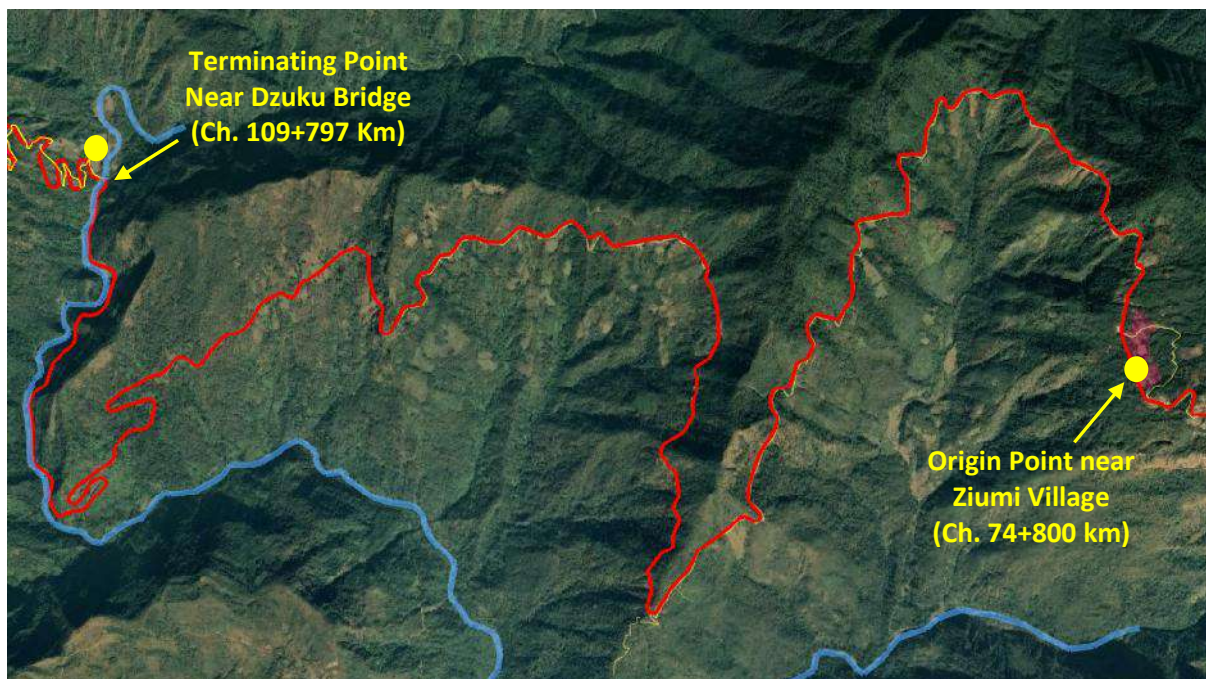
Sl.	Package Nos	Starting Chainage (Km)	Ending Chainage (km)
1	Package – III	75+000	109+494

Provision of a high class access controlled facility for high mobility in the form of NH/SH may be useful in bypassing the city by external traffic, if it is not connected to the core by proper road network. It will not be helpful in decongesting the core area. Realizing this need NH has proposed 30 National Highways in its master plan. The National Highways not only provide connectivity between the cities but also serve as a connecting link between proposed townships and the cities. They also help in serving the traffic expected to be generated by the exploring activities in the outer municipalities. The NH with its service roads connected to the cities by National Highway network is expected to direct the development of Project Influence Area and will be a position to cater the

travel demand patterns generated by these developments.

The National Highway Infrastructural Development Corporation Limited (NHIDCL) Manipur Wing planned to develop the major arterial roads to facilitate smooth traffic flow on existing major arterials and State Highways.

Figure 5.1: Depicting Map of the Project Road



Adequate attention has been given during the feasibility phases of the project preparation to minimize the adverse impacts on land acquisition and resettlement impacts. However, technical and engineering constraints were one of the major concerns during exploration of various alternative alignments. With the available options, best engineering solution have been adopted to avoid large scale land acquisition and involuntary resettlement impacts.

This Resettlement Plan (RP) is prepared to mitigate all unavoidable negative impacts caused due to the project, resettle the displaced persons and restore their livelihoods. This Full Resettlement Plan has been prepared on the basis of census survey findings and consultation with various stakeholders. The plan complies with National Highway policy for involuntary resettlement and rehabilitation.

5.1.2 SCOPE OF LAND ACQUISITION AND RESETTLEMENT IMPACTS

The Existing RoW varies from 7.0m to 16.4m (avg. ROW 10m) along the project road. However, the existing ROW is not sufficient to accommodate proposed 2-laning proposal and therefore, additional land is to be acquired to implement the proposal.

As discussed the scope of land acquisition is quite significant in the project because of availability of limited ROW and construction of two lanes new Bypasses / Realignment are suggested. According to the Land Acquisition Plan (LAP), Land to be acquired comes out as: Package-III: 51.2168 ha. A project census survey was carried out to identify the persons who would be displaced by the project and to make an inventory of their assets that would be lost to the project, which would be the basis of calculation of compensation.

As per requirement of the Resettlement Action Plan Package-III a 100% census survey of the likely affected Displaced Persons (DP) have been conducted again in November 2018 of affected land and non-land assets of the project has been taken up. The impacts can be broadly classified as (i) impacts on private land, (ii) impacts on private structures including (Encroachers and Squatters), (iii) impacts on livelihoods due to loss of private properties and (iv) loss of common property resources.

The census survey reveals that altogether in 9 private structures units will be affected due to the project work. As per the socio economic survey, total household 7 comprising of 41 DPs will be affected (By Affected Structure) in the project for Package-III.

The details of project impacts as revealed in the study have been depicted in the following section and the summary of the project impacts are presented in the **(Table 5.2)**.

Table: 1.2: Brief Summary of the Resettlement Impact

Sl.	Impacts	PKG. III Number
1	Total land acquisition requirements (in ha)	51.2168
2	Total no. of private Residential structures	7
3	Total no. of private Commercial structures	0
4	Total number of Residential cum Commercial structures	1
5	Total number of other private structure	1
6	Total No. of Affected Families by affected structure	7
7	Total Number of Vulnerable households affected of Affected structure	7
8	Total number of displaced persons (DPs)	41
9	Total number of CPRs affected Community and Religious)	6

Source: Census Survey on November, 2018

5.1.3 STAKEHOLDERS CONSULTATION AND PARTICIPATION

Focus Group Consultations with various stakeholders were carried out during various phases of project preparation. Key person and focus group consultations at section of the society were arranged at the stage of project preparation to ensure peoples' participation in the planning phase of this project and to treat public consultation and participation as a continuous two-way process. Aiming at promotion of public understanding and fruitful solutions of developmental problems such as local needs and problem and prospects of resettlement, various sections of DPs and other stakeholders were consulted through focus group discussions and individual interviews.

To keep more transparency in planning and for further active involvement of DPs and other stakeholders, the project information will be disseminated through disclosure of resettlement planning documents. This report with the Entitlement Matrix after accepted by the EA and National Highway would be available for disclosure on both EA's and National Highway's website.

5.1.4 LEGAL AND POLICY FRAMEWORK

The legal framework and principles adopted for addressing resettlement issues in the Project have been guided by the proposed legislation and policies of the Government of Manipur, Government of

India, Safeguard Policies and guidelines of National Highway's guidelines. Prior to the preparation of the Resettlement Plan, a detailed analysis of the proposed national and state policies was undertaken and an entitlement matrix has been prepared for the entire program. The section below provides details of the various national and state level legislations studied and their applicability within this framework. This RP is prepared based on the review and analysis of all applicable legal and policy frameworks of the country and National Highway policy requirements.

The objectives of the Resettlement Framework as per the policies are as follows: -

- ❖ To minimize displacement and to identify non-displacing or least-displacing alternatives.
- ❖ To plan the resettlement and rehabilitation of Project Affected Families, (PAFs) including special needs of Tribal and vulnerable sections.
- ❖ To provide better standard of living to DPs; and
- ❖ To facilitate harmonious relationship between the Requiring Body and DPs through mutual cooperation.
- ❖ The involuntary resettlement would be avoided wherever possible or minimized as much as possible by exploring project and design alternatives.
- ❖ The Project or all sub-projects under the program will be screened to identify past, present, and future involuntary resettlement impacts and risks.
- ❖ The scope of resettlement planning will be determined through a survey and/or census of displaced persons, including a gender analysis, specifically related to resettlement impacts and risks.
- ❖ Meaningful consultations with affected persons, host communities, and PIU will be carried out and all displaced persons will be informed of their entitlements and resettlement options participation in planning, implementation, and monitoring and reporting of resettlement programs will be ensured.
- ❖ Particular attention will be paid to the needs of vulnerable groups, especially those below the poverty line, the landless, the elderly, women and children, and Indigenous Peoples, and those without legal title to land, and ensure their participation in consultations.
- ❖ An effective grievance redress mechanism will be established to receive and facilitate resolution of the displaced persons' concerns. The social and cultural institutions of displaced persons and their host population will be supported through proper planning. Where involuntary resettlement impacts and risks are highly complex and sensitive, compensation and resettlement decisions should be preceded by a social preparation phase.
- ❖ The livelihoods of all displaced persons will be improved or at least restored through (i) land-based resettlement strategies when affected livelihoods are land based where possible or cash compensation at replacement value for land when the loss of land does not undermine livelihoods, (ii) prompt replacement of assets with access to assets of equal or higher value, (iii) prompt compensation at full replacement cost for assets that cannot be restored, and (iv) additional revenues and services through benefit sharing schemes where possible.

- ❖ Physically and economically displaced persons will be provided with needed assistance, including (i) if there is relocation, secured tenure to relocation land, better housing at resettlement sites with comparable access to employment and production opportunities, integration of resettled persons economically and socially into their host communities, and extension of project benefits to host communities; (ii) Transportation support and development assistance, such as land development, credit facilities, training, or employment opportunities; and (iii) civic infrastructure and community services, as required.
- ❖ The standards of living of the displaced poor and other vulnerable groups, including women, will be improved to at least national minimum standards. In rural areas legal and affordable access to land and resources will be provided, and in urban areas appropriate income sources and legal and affordable access to adequate housing will be provided to the displaced poor.
- ❖ If land acquisition is through negotiated settlement, procedures will be developed in a transparent, consistent, and equitable manner to ensure that those people who enter into negotiated settlements will maintain the same or better income and livelihood status. If, however, the negotiated settlement fails, the normal procedure of land acquisition will be followed.
- ❖ Displaced persons without titles to land or any recognizable legal rights to land will be ensured that they are eligible for resettlement assistance and compensation for loss of non-land assets.
- ❖ A resettlement plan will be prepared elaborating on displaced persons' entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring and reporting framework, budget, and time-bound implementation schedule.
- ❖ The draft resettlement plan, including documentation of the consultation process will be disclosed in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected persons and other stakeholders. The final resettlement plan and its updates will also be disclosed to displaced persons and other stakeholders.
- ❖ Involuntary resettlement will be conceived and executed as part of a development project or program. Full costs of resettlement will be included in the presentation of project's costs and benefits. For a project with significant involuntary resettlement impacts, consider implementing the involuntary resettlement component of the project as a stand-alone operation.
- ❖ All compensation will be paid and other resettlement entitlements will be provided before physical or economic displacement. The resettlement plan will be implemented under close supervision throughout project implementation.
- ❖ Resettlement outcomes, their impacts on the standards of living of displaced persons will be monitored; it will be assessed whether the objectives of the resettlement plan have been achieved by taking into account the baseline conditions and the results of resettlement

monitoring. Monitoring reports will be disclosed to DPs.

- ❖ Land acquisition for the project would be done as per National Highway Act, 1956 and the RFCTLARR Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014. To meet the replacement cost of land payment of compensation in revised rate.
- ❖ The uneconomic residual land remaining after land acquisition will be acquired as per the provisions of Land Acquisition Act. The owner of such land/property will have the right to seek acquisition of his entire contiguous holding/ property provided the residual land is less than the average land holding of the district.
- ❖ People moving in the project area after the cut-off date will not be entitled to any assistance. In case of land acquisition, the date of publication of preliminary notification for acquisition under RFCTLARR Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014 will be treated as the cut-off date.
- ❖ All common property resources (CPR) lost due to the project will be replaced or compensated by the project.

The project will recognize three types of displaced persons like (i) persons with formal traditional rights to land lost in its entirety or in part; (ii) persons who lost the land they occupy in its entirety or in part who have no formal legal rights to such land, but who have claims to such lands that are recognized or recognizable under national laws; and (iii) persons who lost the land they occupy in its entirety or in part who have neither formal traditional rights nor recognized or recognizable claims to such land but occupying the land for than three years. The involuntary resettlement requirements apply to all three types of displaced persons.

5.1.5 ENTITLEMENTS, ASSISTANCE AND BENEFITS

The project will have three types of displaced persons i.e., (i) persons with formal legal/traditional rights to land lost in its entirety or in part; (ii) persons who lost the land they occupy in its entirety or in part who have no formal/traditional legal rights to such land, but who have claims to such lands that are recognized or recognizable under national laws; and (iii) persons who lost the land they occupy in its entirety or in part who have neither formal legal rights nor recognized or recognizable claims to such land. The involuntary resettlement requirements apply to all three types of displaced persons.

Compensation eligibility is limited by a cut-off date as set for this project on the day of the beginning of the census survey which is 13th November 2018. DPs who settle in the affected areas after the cut-off date will not be eligible for compensation. They, however, will be given sufficient advance notice, requested to vacate premises and dismantle affected structures prior to project implementation. Their dismantled structures materials will not be confiscated and they will not pay any fine or suffer any sanction.

Compensation for the lost assets to all displaced persons will be paid on the basis of replacement cost. Resettlement assistance for lost income and livelihoods will be provided to both title holders. Special resettlement and rehabilitation measures will be made available to the "Vulnerable Group" comprises of DPs living below poverty line (BPL), SC, ST, women headed households, the elderly and

the disabled. The detail of the assistance and entitlements has been discussed in the following chapters.

5.1.6 RELOCATION OF HOUSING AND SETTLEMENTS

The EA will provide adequate and appropriate replacement land and structures or cash compensation at full replacement cost for lost land and structures, adequate compensation for partially damaged structures, and relocation assistance, according to the Entitlement Matrix. The EA will compensate to the title holders for the loss of assets other than land, such as dwellings, and also for other improvements to the land, at full replacement cost.

5.1.7 INCOME RESTORATION AND REHABILITATION

Due to loss of land and structures, many households shall lose their livelihoods or shall get economically displaced. The DPs losing their livelihoods includes titleholders land, agricultural labourers, agricultural tenants, and sharecroppers, DPs having commercial structures and employees of the affected structures. In the case of economically displaced persons, regardless of whether or not they are physically displaced, the EA will promptly compensate for the loss of income or livelihood sources at full replacement cost. The EA will also provide assistance such as credit facilities, training, and employment opportunities so that they can improve, or at least restore, their income-earning capacity, production levels, and standards of living to pre-displacement levels.

5.1.8 RESETTLEMENT BUDGET

The resettlement cost estimate for this project includes eligible compensation, resettlement assistance and support cost for RP implementation. The support cost, which includes staffing requirement, monitoring and reporting in project implementation and other administrative expenses are part of the overall project cost. The unit cost for land and other assets in this budget has been derived through field survey, consultation with affected families, relevant local authorities and reference from old practices. Contingency provisions have also been made to take into account variations from this estimate.

The total R&R budget for the Package-III of proposed project RP works out to Rs 3.17 Cr as per Minimum Guidance Value and Rs. 33.59 Cr as per as per Avarage Market Rate.

Table 5.3: R&R Budget

	Package-III
Minimum Guidance Value	3.17 Cr
Avarage Market Rate	33.59 Cr

5.1.9 INSTITUTIONAL ARRANGEMENTS

For implementation of RP there will be a set of institutions involve at various levels and stages of the project. The Executing Agency (EA) for the Project is NHIDCL. They have already set up a Project Implementing Unit (PIU) headed by a Project Director (PD) with Technical Manager and Deputy Managers (DGM) assisted by other staffs. This office will be functional for the whole Project duration.

The EA, headed by PD will have overall responsibility for implementation of the project and will also be responsible for the overall coordination among NHAI, Government of Manipur and PIU. For resettlement activities, PIU will do the overall coordination, planning, implementation, and financing. Project Implementation Unit (PIU) will be established at project level for the implementation of sub-projects.

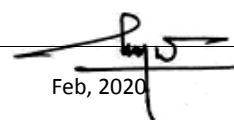
5.1.10 IMPLEMENTATION SCHEDULE

Implementation of RP mainly consists of compensation to be paid for affected structures and rehabilitation and resettlement activities. A composite implementation schedule for R&R activities in the project including various sub tasks and time line matching with civil work schedule is prepared and presented in the following chapters. The cut-off date will be notified formally for titleholder as the date of LA notification. However, the sequence had change or delay had occurred due to circumstances beyond the control of the Project and accordingly the time can be adjusted for the implementation of the plan. The present implementation schedule may be structured through package wise. The entire stretch can be divided in to various contract packages and the completion of resettlement implementation for each contract package shall be the pre-condition to start of the civil work at that particular contract package.

5.1.11 MONITORING AND REPORTING

Monitoring and reporting are critical activities in involuntary resettlement management in order to ameliorate problems faced by the DPs and develop solutions immediately. Monitoring is a periodic assessment of planned activities providing midway inputs. It facilitates change and gives necessary feedback of activities and the directions on which they are going. In other words, monitoring apparatus is crucial mechanism for measuring project performance and fulfilment of the project objectives.

PIU responsible for supervision and implementation of the RP will prepare monthly progress reports on resettlement activities and submit to EA. The Resettlement Expert under CSC would be responsible for monitoring of the RP implementation will submit a quarterly review report to determine whether resettlement goals have been achieved, more importantly whether livelihoods and living standards have been restored/ enhanced and suggest suitable recommendations for improvement. All the resettlement monitoring reports will be disclosed to DPs as per procedure followed for disclosure of resettlement documents by the EA. An External Monitor to be engaged to review and monitor the implementation process and time frame of the resettlement and rehabilitation of the DPs. The External Monitor may submit a biannual report on the progress of the implementation of the Resettlement action plan to NHIDCL.



5.2 PROJECT DESCRIPTION

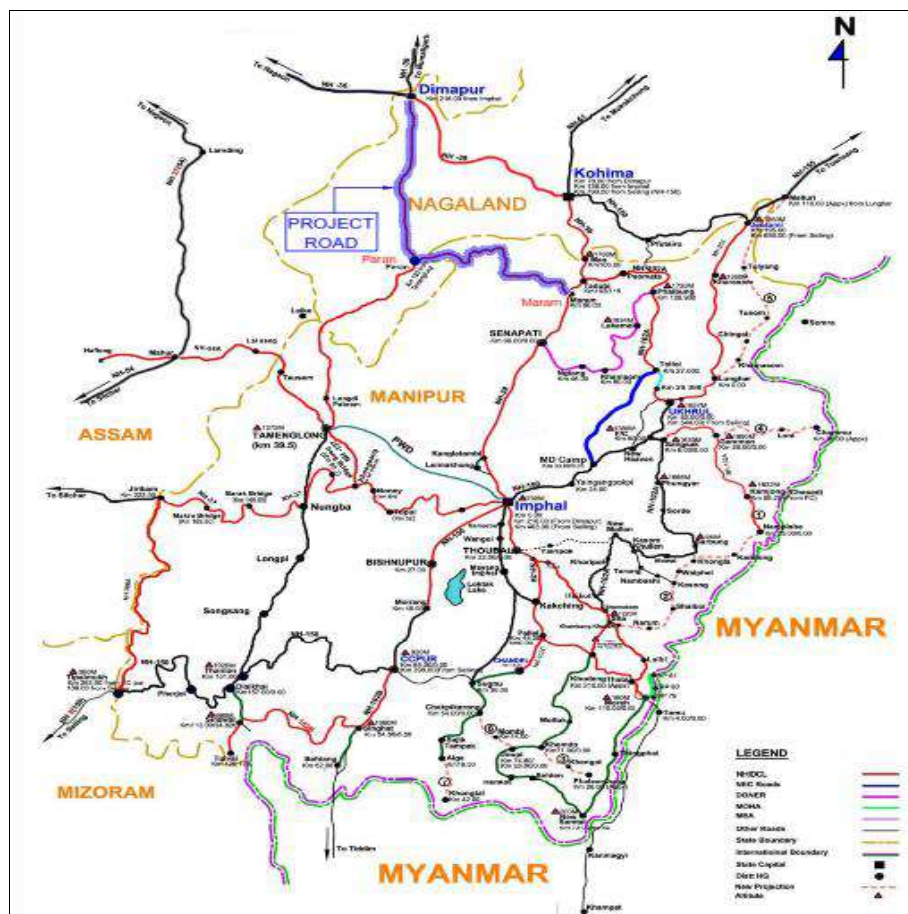
GENERAL

National Highway Infrastructure Development Company Limited has decided to prepare a Project Report for NH-129A with a minimum of 2-Lane with Hard shoulder configuration starting from Maram and ending at Dzuko Bridge near Peren town in the District of Senapati, Manipur, on Engineering, Procurement & Construction (EPC) basis.

5.2.1 THE PROJECT ROAD AND ITS LOCATION

The project road starts from Maram village (NH-39) and ends at Dzuko bridge (Near Peren Town) in Senapati district of Manipur. However, as per design, the length of the project road comes out as 109.494 km. Project road is located in Hilly Terrain. This road has significant importance as the road will be a vital link between two States (Manipur & Nagaland) and connects to important nearby villages/localities Maram village, Kabanam, Bungram, Magaimai, Duigam center village, Sankumai, Willong, Kamlung, Paukilwa, Yangkhullen, Bendramai, Bakie, Ziumi center village and Tampung. A location Map of the project road is enclosed in Figure 5.2

Figure 5.2: Location Map



THE PROFILE OF THE DISTRICT OF SENAPATI

The Senapati District was earlier known as Manipur North District which came into existence wef 14 November 1969 with its headquarters at Karong. Later the district headquarter was shifted to Senapati on 13 December 1976. The District came to be known as Senapati District wef 15 July 1983.

The Senapati District is located in the northern part of the state of Manipur. It is bounded on the east by the Ukhrul District; on the west by Tamenglong District; on the north by the Phek District, state of Manipur; and on the south by the Imphal East and Imphal West Districts. The District is at an altitude varying from 1061 m to 1788 m above sea level. The hills run along the north south direction and gradually slope down towards south and meet the Imphal Valley.

Table 5.4: Senapati District

1. Geography		
(i)Climate	Maximum: 34.1 ⁰ C	Mininum: 3.4 ⁰ C
(ii)Location	Latitude: 24.37 ⁰ N-25.37 ⁰ N	Longitude: 93.29 ⁰ E-94.15 ⁰ E
(iii)High Peaks	Isii (Iso), Khouchi, Houdu, Ngapu, Koubru	
(iv)Rainfall	The annual rainfall ranges from 670 to 1,450 mm	
2. Administrative & Development Structure		
Sub Divisional Offices		
i. Mao-Maram	viii. Saikul	
ii. SongSong	ix. Saitu-Gamphazol	
iii. Paomata	x. Champhai	
iv. Purul	xi. T.Waichong	
v. Willong	xii. Kangchup Geljang	
vi. Phaibung	xiii. Bungte Chiru	
vii. Kangpokpi	xiv. Island	
3. Police Service		
(i) Police Outposts	3 Nos.	
(ii) Police Station	8 Nos.	
4. Assembly Constituencies		
(i) 46- Saikul	(iv) 49-Tadubi	
(ii) 47-Karong	(v) 50-kangpokpi	
(iii) 48-Mao	(vi) 51-Saitu	

5. People		
i. Population as per 2011 census		Male: 247323 Female: 231825 Total: 479148
ii. Literacy Rate as per 2011 census		63.60%
6. No. of Villages		687(2011 Census)
7. Area		3,271 Square kms
8. Forest		2183 sqkm, out of which 233 sqkm is under very dense forest, 870 sqkm is under moderately dense forest and the remaining 1080 sqkm is under open forest.
9. Roads		
a) National Highway	2002	106 km
b) State Highway	2002	107 km
c) Major District Roads	2002	20 km
d) Other District Roads	2002	54 km
e) Inter Village Roads	2002	522 km
10. Agricultural Area	1989-1990	11101.82 Hectares

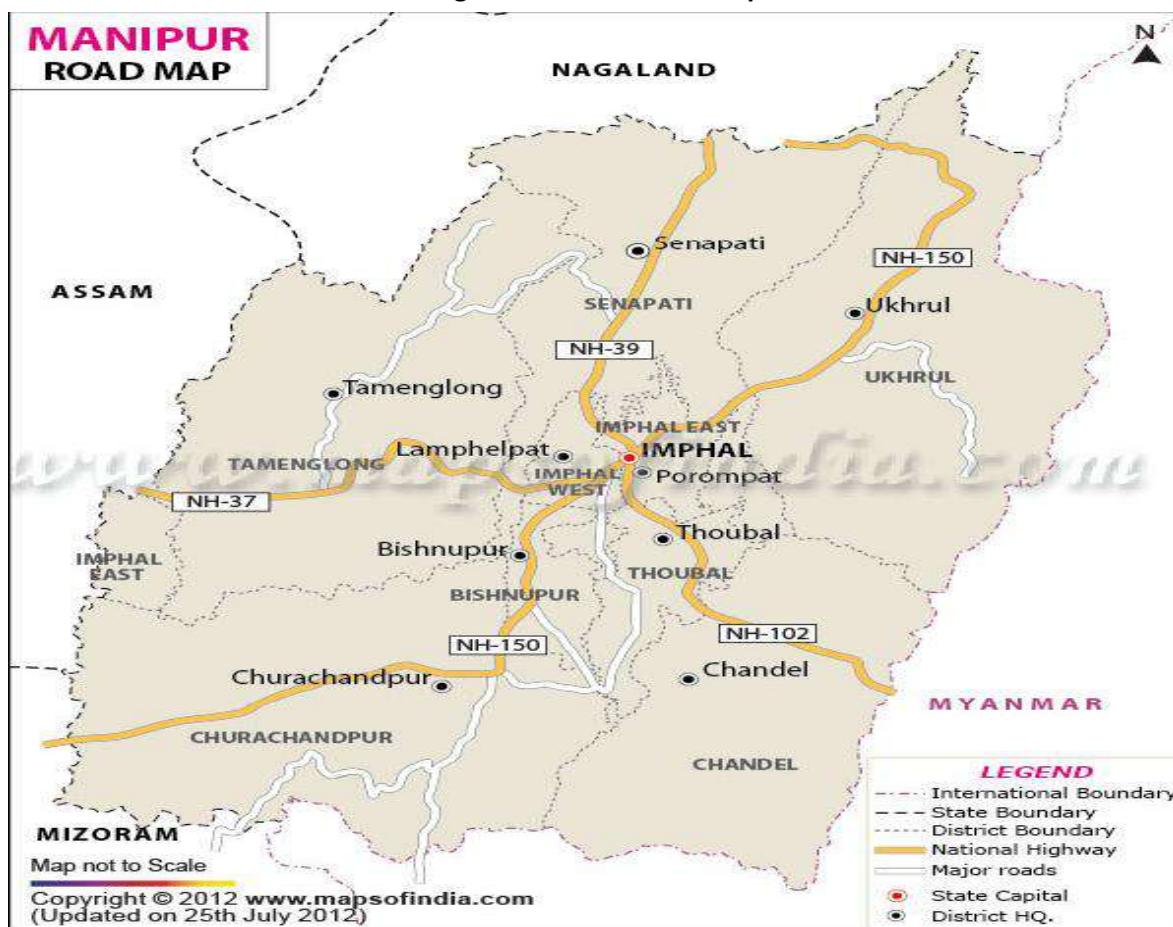
Source: Website of Manipur State

5.2.2 THE PROFILE OF THE STATE OF MANIPUR

Manipur is a state in north eastern India, with the city of Imphal as its capital. It covers an area of 22,347 square kilometres. The state is bounded in the north by Nagaland, in the south by Mizoram, Assam lies in the west and nation of Myanmar is bordering in the east. Manipur has a recorded history of kingship since 33 A.D. with the coronation of Pakhangba followed by a series of kings ruling over the kingdom of Manipur. The independence and sovereignty of Manipur remained uninterrupted until the Burmese invaded and occupied it for seven years in the first quarter of the 19th century (1819-25). In 1891 British Govt. brought it under its rule, and later on it was merged in the Indian Union as part "C" State on 15 October, 1949. This was replaced by a Territorial Council of 30 elected and 2 nominated members. In 1963, a Legislative Assembly of 30 elected and 3 nominated members was established under the Union Territories Act, 1962. Manipur attained full-fledged statehood on 21 January, 1972. With this, a Legislative Assembly consisting of 60 elected members was established.¹¹

¹¹ Wikipedia

Figure 5.3: State Road Map



Physiographically, Manipur is characterised in two distinct physical regions – an outlying area of rugged hills and narrow valleys, and the inner area of flat plain, associated with residual mounds and undulating plains. These two regions are also conspicuous with respective distinct various flora and fauna. The Loktak lake is an important feature of the central plain. The hills cover about 9/10th of the total area of the State. Manipur Valley is about 790 metres above the sea level. The hill ranges are higher on the north and gradually diminish in height as they reach the southern part of Manipur. The valley itself slopes down towards the south. The highest peak is Mt. Iso of 2,994 m altitude near Mao.

Manipur state has four major river basins: the Barak River Basin (Barak Valley) in 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 total water resources of Barak and Manipur river basins are about 1.8487 Mham. The Barak River, the largest of Manipur, originates in the Manipur Hills and is joined by a number of tributaries, all originating from surrounding hills. Rivers in the valley area are in mature stage and deposit their sediments in Loktak. The rivers in the hills cause land erosion and in rainy season turn into turbulent form.

According to 2011 census Manipur has a total population of 2,721,756 and ranked 22nd among Indian states. Its density of population is 115 persons per square kilometre. Population communities of Manipur comprise Meitei, Pangal, Naga, Kuki and Mizo. The Meitei, who live primarily in the state's valley region, form the primary ethnic group (60% of the total population). They occupy about 10% of the total land area. The Muslims (the Meitei-Pangal) also live in the valley. The Kuki, Naga,

Mizo and several other smaller tribal communities make up about 40% of the population but occupy the remaining 90% of the total area of Manipur.

5.2.3 IMPACT AND BENEFITS

The road project is associated with some adverse impacts as well as some benefits. The major impacts of the road project include loss of agricultural land due to acquisition of land all along the project corridor and in Realignment. But it should be kept in mind that the project road strategically interconnects two states namely Manipur and Nagaland. Boost in agricultural and industrial development can be viewed as boosting economic growth and poverty reduction which will bring substantial social and economic development in the region. The social benefits arising due to the project will be triggered off due to improved accessibility to various services such as easy access to markets, health facilities, schools, workplace etc. which in turn increases the income of the locals, and ultimately elevating their standard of living. The possible direct and indirect positive impacts of the project are listed below.

- ❖ Road network will not only link the village communities to better national markets, but also open up wider work opportunities in distant places. People can shuttle to distant worksites and engage in construction, mining, factories, business as well as domestic works.
- ❖ The immediate benefits of road construction and improvement will come in the form of direct employment opportunities for the roadside communities and specially those who are engaged as wage labourers, petty contractors and suppliers of raw materials.
- ❖ Effective drainage system to ensure that there will be no pooling of water
- ❖ Safety measures for Highway signs, Pavement marking, Traffic signals, Truck lay byes, Bus stops and Bus bays
- ❖ Rectification of geometric deficiencies (both Horizontal & Vertical).
- ❖ Provision of Pedestrian passes.
- ❖ Provision of ROBs to fly over the traffic and minimize the traffic congestion, if required.
- ❖ Provision of ROBs over railway crossings, if required.
- ❖ Slope protection.
- ❖ Provision of crash barrier at Bridge approaches.
- ❖ Improvement of all Major and Minor Intersections.
- ❖ Facilities for public amenities such as Restrooms, Telephone booths, Toilets, shops and Trauma Centres.

Other benefits: -

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

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

5.2.4 PROJECT FEATURE

The project road lies in the district of Senapati, Manipur. Most part of the District is in Hilly Terrain. The Project Road is the alternate route of Imphal to Dimapur. This Road is passing through Maram village, Kabanam, Bungram, Magaimai, Duigam center village, Sankumai, Willong, Kamlung, Paukilwa, Yangkhullen, Bendramai, Bakie, Ziumi center village and Tampung. The project road lies in Senapati district of Manipur. The length of the road is 109.494 km (as per Design).

The Existing RoW is not sufficient to accommodate proposed 2 laning proposal and hence additional land is to be acquired to implement the proposal.

Minimizing Resettlement

As per the NH's guidelines, adequate attention has been given during the feasibility and detailed project design phases of the project preparation to minimize the adverse impacts on land acquisition and resettlement impacts. However, technical and engineering constraints were one of the major concerns during exploration of various alternative alignments. With the available options, best engineering solution have been adopted to avoid large scale land acquisition and resettlement impacts. Following are the general criteria adopted for the selection of the alignment:

- ❖ It should serve as uninterrupted traffic for proposed Tourist centres
- ❖ It should provide linkage to other roads in the region
- ❖ It should take in to account the future traffic growth and management
- ❖ It should be coordinated with local and national development plans
- ❖ It should minimize environment impact along the corridor
- ❖ It should take in to consideration the opinions of local people in selection of Alignment

The specific measures adopted for minimizing the resettlement impacts for the sub-project is as follows:

- ❖ Exploration of several alternate alignments in consultation with engineering team, concerned government departments and local community
- ❖ Avoiding major settlements and urban areas to minimize the large scale physical displacement
- ❖ Avoiding productive agricultural land to minimize the adverse economic displacement
- ❖ Diverting the alignment towards the available unused government land to minimize impact on private property

5.2.5 SCOPE AND OBJECTIVE OF RESETTLEMENT PLAN (RP)

The aim of this Resettlement Plan (RP) is to mitigate all such unavoidable negative impacts caused due to the project and resettle the displaced persons and restore their livelihoods. This Full Resettlement Plan has been prepared on the basis of project census survey findings and consultation with various stakeholders. The legal framework and principles adopted for addressing resettlement issues in the Project have been guided by the proposed legislation and policies of the Government of Manipur, Government of India, Safeguard Policies and guidelines of National Highway's guidelines. The issues identified and addressed in this document are as follows:

- ❖ Type and extent of loss of land/ non-land assets, loss of livelihood, loss of common property resources and social infrastructure
- ❖ Impacts on indigenous people, vulnerable groups like poor, women and other disadvantaged sections of society
- ❖ Public consultation and people's participation in the project
- ❖ Proposed legal and administrative framework and formulation of resettlement policy for the project
- ❖ Preparation of entitlement matrix, formulation of relocation strategy and restoration of businesses/income
- ❖ R&R cost estimate including provision for fund and Institutional framework for the implementation of the plan, including grievance redress mechanism and monitoring & reporting

5.2.6 PRIMARY RESPONSIBILITY FOR LAND ACQUISITION & RESETTLEMENT

The NHIDCL Department, Manipur is the nodal agency for implementation of the proposed project. Therefore, the prime responsibility for land acquisition lies with the NHIDCL, Manipur. However, such land acquisition is normally done through the State Level District Administration and the compensation amount is deposited with the District Administration by the acquiring body for disbursement. Similarly, the resettlement of the affected population will be implemented by the NHIDCL, Manipur like it is being done in other projects. The NHIDCL do conduct RAP implementation through PIU. An independent External Monitor would be engaged to review and monitor the implementation process and time frame of the resettlement and rehabilitation of the DPs. The Monitor may submit a biannual report on the progress of the implementation of the Resettlement action plan to EA.

5.3 METHODOLOGY FOR IMPACT ASSESSMENT

This Chapter presents an analysis of the project impacts based on census survey data. The purpose of the analysis is to (a) develop profiles of DPs and communities affected by the project. (b) Identify the nature and types of losses. The following sections briefly describe the methods used to ascertain various types of impacts.

1.3.1 THE CENSUS SURVEY

The census survey was carried out in the month of November 2018 by a team of trained enumerators. The objectives of the census survey were to generate an inventory of social impacts on the people affected by the project, their structures affected, social profile of the project affected people, their poverty, their views about the project and also their views on various options of rehabilitation and resettlement. A questionnaire was used to collect detailed information on affected households/business for a full understanding of impacts in order to develop mitigation measures and resettlement plan for the DPs. A structured census questionnaire was used to collect detailed information on affected households/ properties for a full understanding of impacts in order to develop mitigation measures and resettlement plan for the DPs. The census survey includes the following: -

- ❖ Inventory of the affected assets
- ❖ Categorization and measurements of potential loss
- ❖ Physical measurements of the affected assets/structures
- ❖ Identification of trees and crops
- ❖ Household characteristics, including social, economic and demographic profile
- ❖ Identification of titleholders
- ❖ Assessment of potential economic impact

The present census survey has covered 100% structures affected within the proposed ROW including private and customary owners. The additional information about the private land holders land is being collected from village Council. The results of census survey presented in the report will also be updated further after completion of landholders' data collection.

1.3.2 LAND ACQUISITION PLANNING

The alignment was finalized as per the detailed engineering design. Initially, the numbers of affected villages were identified as per the alignment. All the village maps were collected from the local revenue offices. The village maps were digitized by the consultant. Following the digitization of village maps, the engineering design of the alignment was superimposed in the digitized cadastral map in order to identify the number of land parcels and their demarcation including the quantification. The superimposition of alignment on the village map provided all the plot numbers. A Land Acquisition Plan (LAP) has been prepared accordingly.

1.3.3 INVENTORY OF ASSETS

The alignment was finalized as per the detailed engineering design. Initially, the numbers of affected villages were identified as per the alignment. All the village maps and documents were collected from the local village council offices. The village maps were digitized by the consultant. Following the digitization of village maps, the engineering design of the alignment was superimposed in the digitized cadastral map in order to identify the number of land parcels and their demarcation including the quantification. The superimposition of alignment on the village map provided all the plot that are to be affected.

1.3.4 SURVEY OF AFFECTED STRUCTURES

Different types of structures will be affected by the road improvements. In order to assess market/replacement value for the affected structures, the survey considered the types of construction, material used for roof, walls and floor; levels/ stories of structures, and land area of each structure.

1.3.5 PUBLIC CONSULTATION

To ensure peoples' participation in the planning phase and aiming at promotion of public understanding and fruitful solutions of developmental problems such as local needs of road users and problem and prospects of resettlement, various sections of affected persons and other stakeholders were consulted through focus group discussions, individual interviews and formal and informal consultations. The vulnerable sections of DPs and women were also included in this consultation process.

5.4 SOCIO ECONOMIC PROFILE OF THE PROJECT AREA

To understand the socio-economic profile of project area, the socio-economic information of DPs was collected through the Socio Economic Survey (SES) and Census survey.

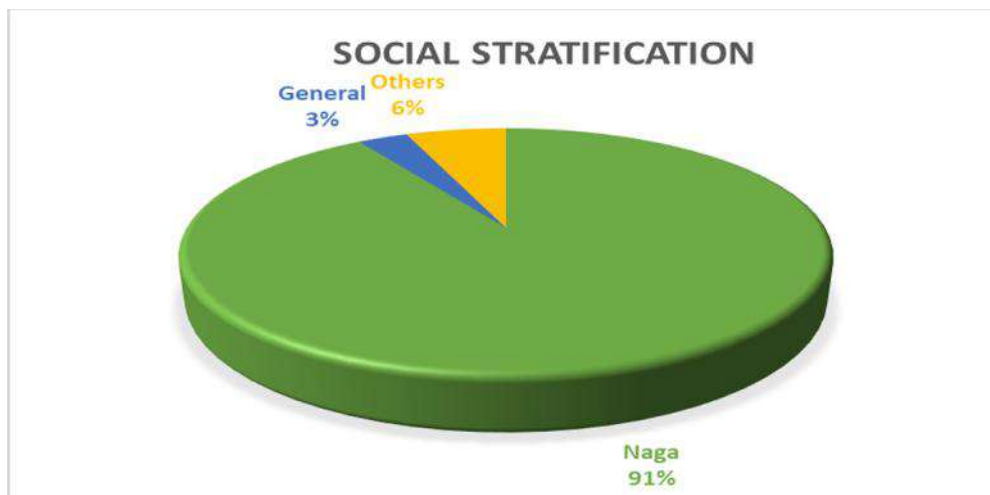
The total number of Displaced Household (DH) for Package – III is 9 (Private Structure owner, Tenant & Employee in commercial Structures) occupying 7 private structures would be affected as per proposed ROW. The total number of Displaced Population (DP) 41 living within this affected structures (Including Private Structure, Tenant & Employee in commercial Structures).

The gross findings of the survey are presented in the following sections.

5.4.1 SOCIAL CATEGORIES OF THE DPS

The social stratification of the project area shows the dominance of Naga Tribes population with 91% households. The second stratum of the social grouping in the area is of General Caste Hindu population in the project area is 3% and others population with 6% households. There are different Naga Clans and tribes inhabited in the whole alignment of the proposed road. The Social stratification is depicted in **Figure 5.4**.

Figure 5.4: Social Categories of DPs along the Project Road

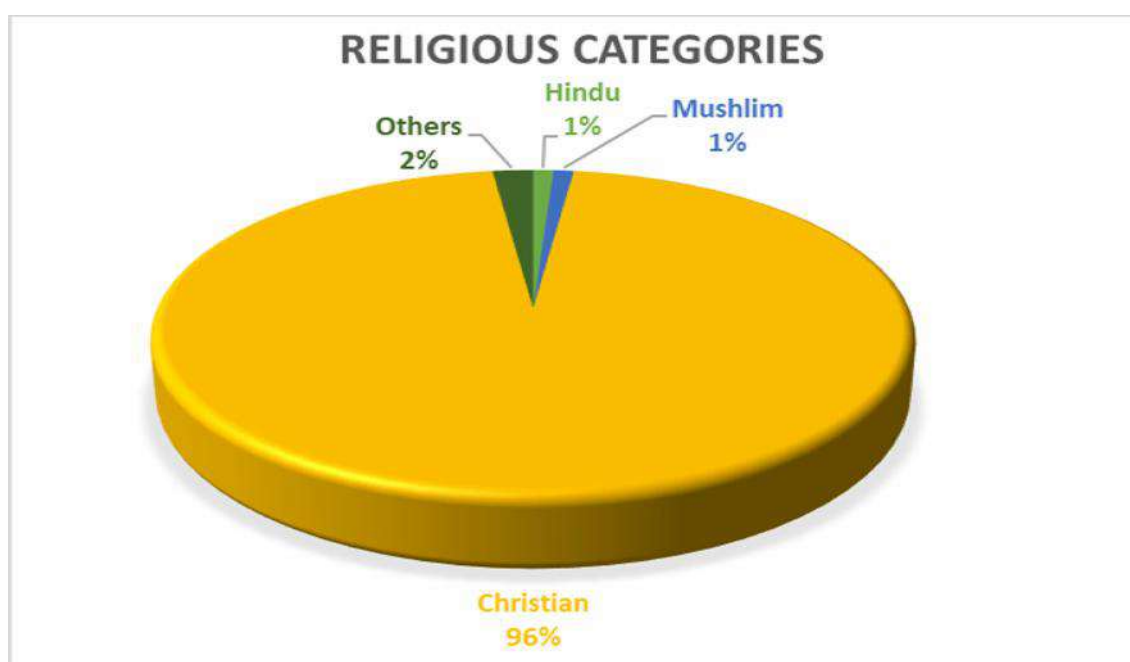


Source: Census Survey on November, 2018

5.4.2 RELIGIOUS CATEGORIES OF THE DISPLACED HOUSEHOLDS

The project area is dominated by Christian community and ST as they form 96% of the total Displaced Households (DH). There is only 2% household, who are not Hindus by faith are being affected by the Project. There are still very few household following animistic belief. The detail of the same is graphically represented in **Figure 5.5**

Figure 5.5: Religious Categories of DPs along the Project Road



Source: Census Survey on November, 2018

5.4.3 NUMBER OF DISPLACED PERSONS (DPS)

There are altogether 41 DPS (Including Private Structure, Tenent & Employee in commercial Structures) for Package-III,

That is being affected by the project. It includes 50% males and 40% females. The number of DPS is substantially significant in the project area mainly because presence of joint family system and a large number of shareholders of landed properties.

Table 5.5: Displaced Persons (DPS)

Package No.	Displaced Persons (DPS)
Package-III	41

5.4.4 VULNERABLE HOUSEHOLDS BEING AFFECTED IN THE PROJECT

In the project area there are 92% households falling in the vulnerable category. In this project among other vulnerable group there, 92% households are ST category. For preparation of

5.4.5 ANNUAL INCOME LEVEL OF THE AFFECTED HOUSEHOLDS

The number of BPL population, is further strengthen from the data analysed on the basis of monthly income of the households, which reflects that there are no households, which are having an average monthly income of less than Rs. 30000/-. About 6 % DPS are having income in the range of Rs. 30000-50000, while 52% are earning in the range of Rs. 50000-100000. It has been observed that about 42% households are annually earning more than Rs. 100000/-. The average income level of households in the project area is summarized in the (Table 5.6).

Table 5.6: Annual Income Level of the Affected Households

Sl.	Annual Income Categories in (Rs)	Percentage
1	>30000 and <50000	6%
2	>50000 and <100000	52%
3	<100000	42%
	Total	100%

Source: Census Survey on November, 2018

5.4.6 OCCUPATION BY DPS

The occupational status of head of the households i.e. the primary occupation by the households reveals that 16% households are depending on agricultural or allied agricultural services, whereas about 63% of the population depends on business and this includes the business they are carrying out in the road side mainly shops. About 11% households are wage earnings as their primary source of income and 4% are engaged in Government jobs. The details of occupations by the DP are presented in the (**Table 5.7**).

Table 5.7: Occupational Status of DP

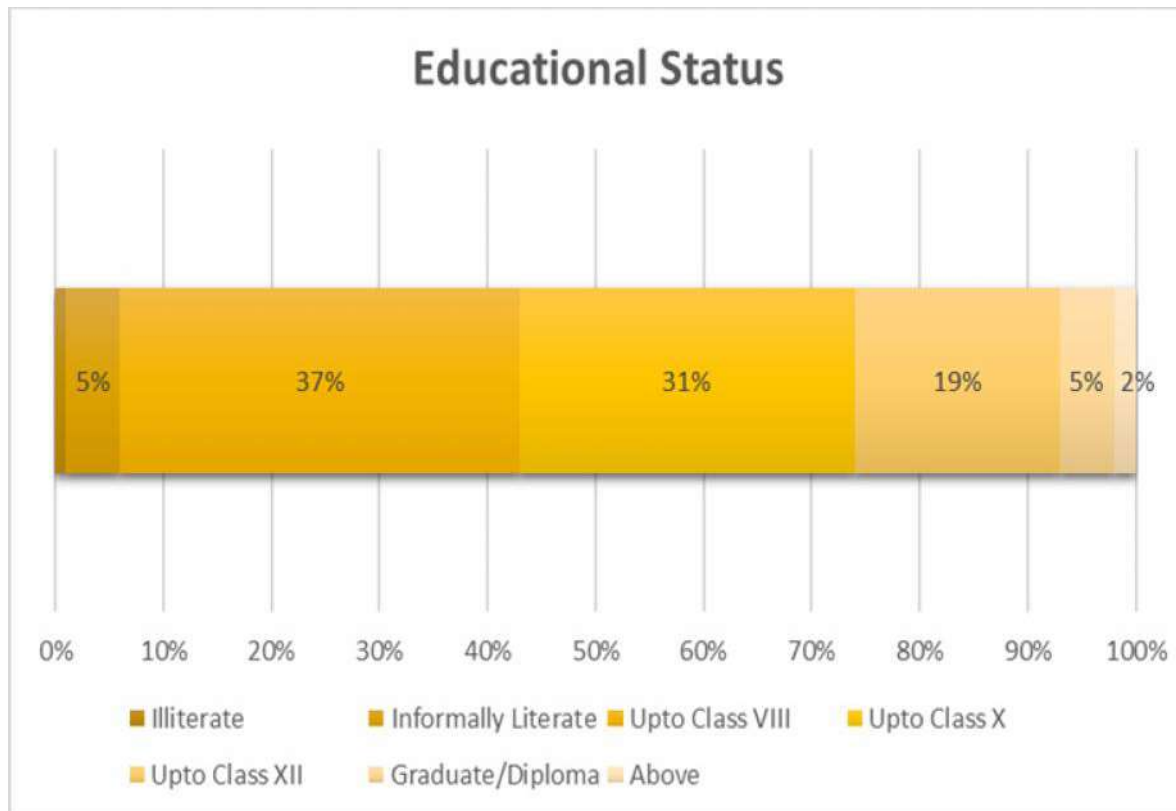
Sl.	Occupational Status of APs	Percentage
1	Government/ Semi Government Service	4%
2	Agriculture	16%
3	Business	63%
4	Wage Earner	11%
5	Private Service	4%
6	Professional	2%
	Total	100%

Source: Census Survey on November, 2018

5.4.7 EDUCATIONAL STATUS OF DPS

The educational status of head of the households reveals that overall scenario of literacy level is not encouraging in the project area as significant percentage of population, i.e., 1% are still illiterate. Another 37% has attained the education up to Class VIII level. About 5% DP are informally literate; while very few (7%) have degree of master and above, which are presented in the (**Figure 5.6**).

Figure 5.6: Educational Status of DPs



Source: Census Survey on November, 2018

5.4.8 IMPACT ON INDIGENOUS PEOPLE

The Scheduled Tribes (STs) in the project area is considered to be IP. The presence of ST population in the affected state as displaced person is more than 99%. The census survey reveals that the majority of the population belongs to the ST community, thus this is the mainstream population of the region.

5.4.9 GENDER IMPACT AND MITIGATION MEASURES

The gender composition of DPs shows that the male accounts for 50% and female accounts for 50%. The gender disparity is not acute as the sex ratio among DPs i.e. 998 against state level statistic having 985 as per provisional census data of India, 2011.

Figure 5.7: Gender Ratio in study area



Source: Census Survey on November, 2018

The participation of women in FGDs during the census survey was not encouraging because of their shy nature and ignorance. Some of their specific concerns are summarized below.

The working women and girl students face lot of problem for travel, due to non-availability of good road and transport network. Especially in rainy season, the problem increases manifold which sometimes compels the girl students abstains from classes.

Only primary health centers (PHCs) are located at some villages and the quality of treatment and medical facilities are less than satisfactory. In emergency they have to reach hospitals at district headquarters only.

Health status will improve as they will be able to visit Govt. hospital at Imphal if sick and especially during pregnancy and will not have to depend on uneducated rural midwife for safe delivery, which are common in villages. Incidence of child mortality & maternal mortality rate will reduce with easy access to Govt. health care facility centres.

The women feel that their mobility will increase as market & relatives' places will be easily accessible for them as better road condition will induce more transport vehicles to operate. More shops, markets will open within the village approach area and as a result they will get quality leisure time at their disposal.

Women from poor families will get job opportunity during construction work as casual labour or at office. Besides, women can operate individual / family enterprise by opening small tea stalls, shops/eateries to provide meals to the construction labourers. This will enhance their family income as well as their entrepreneurial skill which may be useful in future.

Women labourers feel that improved road network will provide them with better job opportunity as they will be able to travel further and even can commute from home. Moreover, travel by public transport system, like Govt. bus service, will become cheaper and money saved on transport can be better utilized for household needs.

The girl students will be able to attain higher education at colleges, since journey time and cost will be greatly reduced and the girls can commute from home all by themselves free of hazard.

Women will not be affected negatively due to the program. Any negative impacts of the project on female-headed households will be taken up on a case-to-case basis and assistance to these households will be treated on a priority basis. During disbursement of compensation and provision of assistance, priority will be given to female-headed households. Additionally, women headed households are considered as vulnerable and provision for additional assistance (lump sum amount @ Rs. 25,000/- per affected households) has been made in the entitlement of the RP. Provision for equal wage and health safety facilities during the construction will be ensured by the EA. Therefore, the sub project activities will not have any negative impact on women.

5.5 DEFINITIONS

The Definition of various terms used in this Policy Document are as follows:

- (a) “Administrator for Resettlement and Rehabilitation” means an officer not below the rank of District Collector of the State Government appointed by it for the purpose of resettlement and rehabilitation of the Project Affected Families of the Project concerned provided that if the appropriate Government in respect of the project is the Central Government, such appointment shall be made in consultation with the Central Govt.
- (b) “affected zone”, in relation to a project, means declaration of this Policy by the appropriate Government area of villages or locality under a project for which the land is being acquired under Land Acquisition Resettlement and Rehabilitation, 2013 or any other Act in force or an area that comes under submergence due to impounding of water in the reservoir of the project.
- (c) “agricultural family” means a family whose primary mode of livelihood is agriculture and includes family of owners as well as sub-tenants of agricultural land, agricultural labourers, occupiers of forest lands and of collectors of minor forest produce.
- (d) “agricultural labourer” means a person normally resident in the affected zone for a period of not less than three years immediately before the declaration of the affected zone who does not hold any land in the affected zone but who earns his livelihood principally by manual labour on agricultural land therein immediately before such declaration and who has been deprived of his livelihood.
- (e) “Agricultural land” includes lands used or capable of being used for the purpose of-
Agriculture or horticulture;
Dairy farming, poultry farming, pisciculture, breeding or livestock and nursery growing medical herbs.
Raising of crops, grass or garden produce; and
Land used by an agriculturist for the grazing of cattle, but does not include land used for the cutting of wood only.
- (f) “Appropriate Government” means, -
(i) In relation to acquisition of land for the purposes of the NHIDCL, the Central Government;
(ii) in relation to a project which is executed by Central Government agency(NHIDCL)/Central Government undertaking or by any other agency on the orders/directions of Central Government, the Central Government, otherwise the State Government and in relation to acquisition of land for other purposes, the State Government.
- (g) ‘BPL Family’: The Below Poverty Line Families shall be those as defined by the Planning Commission of India from time to time.
- (h) “Commissioner for Resettlement and Rehabilitation”, in relation to a project, means the Commissioner for Resettlement and Rehabilitation appointed by the State Government not below the rank of Commissioner/Secretary of that Government.

- (i) “Displaced family” means any tenure holder, tenant, Government lessee or owner of other property, who on account of acquisition of his land including plot in the abadi or other property in the affected zone for the purpose of the project, has been displaced from such land or other property.
- (j) “Family” means Project Affected Family consisting of such persons, his or her spouse, minor sons, unmarried daughters, minor brothers or unmarried sisters, father, mother and other members residing with him and dependent on him for their livelihood.
- (k) “Holding” means the total land held by a person as an occupant or tenant or as both;
- (l) “Marginal farmer” means a cultivator with an unirrigated land holding up to one acres or irrigated land holding up to half acres.
- (m) “non-agricultural laborer” means a person who is not an agricultural laborer but is normally residing in the affected zone for a period of not less than three years immediately before the declaration of the affected zone and who does not hold any land under the affected zone but who earns his livelihood principally by manual labour or as a rural artisan immediately before such declaration and who has been deprived of earning his livelihood principally by manual labour or as such artisan in the affected zone.
- (n) “Notification” means a notification published in the Official Gazette;
- (o) “Occupiers” mean members of Scheduled Tribe community in possession of forest land prior to 25th October, 1980;
- (p) “Project” means a project displacing 500 families or more enmasse in plain areas and 250 families or more enmasse in hilly areas, DDP blocks, areas mentioned in Schedule V and Schedule VI of the Constitution of India as a result of acquisition of land for any project.
- (q) “displaced family” means a family/person whose place of residence or other properties or source of livelihood are substantially affected by the process of acquisition of land for the project and who has been residing continuously for a period of not less than three years preceding the date of declaration of the affected zone or practicing any trade, occupation or vocation continuously for a period of not less than three years in the affected zone, preceding the date of declaration of the affected zone.
- (r) “Resettlement zone”, in relation to a project, means the declaration of any area under our National Policy by the appropriate Government acquired or proposed to be acquired for resettlement and rehabilitation of Project Affected Families as a resettlement zone.
- (s) “Requiring Body” shall mean any company, a body corporate, an institution, or any other organization for whom land is to be acquired by the appropriate Government, and includes the appropriate Government if the acquisition of land is for such Government either for its own use or for subsequent allotment of such land in public interest to a body corporate, institution, or any other organization or to any company under lease, license or through any other system of transfer of land to such company, as the case may be.
- (t) “Small farmer” means a cultivator with an unirrigated land holding up to two acres or with an irrigated land holding up to one acre.

5.6 SCOPE OF LAND ACQUISITION AND RESETTLEMENT

5.6.1 SCOPE OF LAND ACQUISITION

As discussed earlier also the scope of land acquisition is quite significant in the project because of availability of limited ROW and construction of road as the applicable code for road construction.

According to the Land Acquisition Plan (LAP) prepared as a part of Project Report (Package-III), 51.2168 ha of Total land will be acquired for the sub-project.

The area is excluding the area that already lies with PIU in terms of proposed roads falling in the alignment. A project census survey was carried out to identify the persons who would be displaced by the project and to make an inventory of their assets that would be lost to the project, which would be the basis of calculation of compensation. The major findings of the land acquisition estimates and census of 100% affected structures are discussed in the following sections which will be further updated after completion of landholder's data collection.

5.6.2 USES OF AFFECTED STRUCTURE

During the census survey in addition to structures belong to private holders, large number of customary right holders were also enumerated along the proposed road.

Based on the social survey data (Package-III) a total of 23 structures would be affected due to the improvement of the project road within the proposed RoW. Out of 23 affected structures, 7 are Residential, 1 is structures are of Residential cum Commercial and there are 10 CPRs as detailed in (**Table 5.8**).

Table 5.8: Uses of Affected Structure

Sl.	Type of Uses	No. of Properties	Percentage
1	Residential	7	30.4%
2	Commercial	0	0.0%
3	Residential cum Commercial	1	4.3%
4	CPR	10	43.5%
5	Other Government Structure	4	17.4%
6	Other Private Structure	1	4.3%
	Total	23	100%

Source: Census Survey on November, 2018

5.6.3 TYPE OF CONSTRUCTION OF AFFECTED STRUCTURE

The construction type of structures being affected in the project area is of various types such as temporary, semi-permanent and permanent. More than 60% of the structures are temporary. The details of type of constructions of the affected structures are summarized in the (**Table 5.9**) for Package-III.

Table 5.9: Type of Construction of Affected Structure for Package-III

Sl.	Type of Construction	Total	Percentage
1	Temporary	15	65.2%
2	Semi-permanent	2	8.7%
3	Permanent	6	26.1%
	Total	23	100.0%

Source: Census Survey on November, 2018

5.6.4 AGE OF STRUCTURES BEING AFFECTED

To know the condition of structures, the age of structures being affected due to the project was enumerated during the census survey.

Among 23 affected structures, 91.3% structures are constructed within 10 years only. The details of age of affected structures are presented in the (**Table 5.10C**)

Table 5.10: Age of Structures Being Affected for Package-III

Sl.	Age of Structure	Percentage
1	Up to 10 Years	91.3%
2	Above 10 Years	8.7%
	Total	100.0%

Source: Census Survey on November, 2018

5.6.5 TYPE OF COMMERCIAL STRUCTURES AFFECTED

Only 1 Residential-cum-Commercial structure is affected in the sub-project. The details of structures are given in the (**Table 5.11**) for Package-III.

Table 5.11: Type of Commercial Establishment Affected for Package-III

Sl.	Type of Structure	No. of Structure	Percentage
1	Residential-cum-Commercial	3	100.0%

Source: Census Survey on November, 2018

5.6.6 TYPE OF MIXED STRUCTURES AFFECTED

Out of 23 private structures in Package-III, 1 structure belongs to mixed category i.e. residential and commercial type where the road side people doing some business and living also.

5.6.7 TYPE OF OTHER STRUCTURES AFFECTED

As per census survey findings, among the private structures within the ROW, many other type of structures like Abandoned and Camp are affected in the project for Package-III (**Table 5.12A and 1.12B**).

Table 5.12A: Type of Other Private Structures Affected for Package-III

Sl.	Type of Structure	No. of Structure	Percentage
1	Abandoned	1	100.0%
2	Cattel Shed	0	0.0%
3	Private Memorial Structure	0	0.0%
	Total	1	100.0%

Source: Census Survey on November, 2018

Table 5.12B: Type of Other Government Structures Affected for Package-III

Sl.	Type of Structure	No. of Structure	Percentage
1	Check Post	0	0.0%
2	Camp	4	40.0%
	Total	4	100.0%

Source: Census Survey on November, 2018

Status of Ownership

As per census survey for Package-III, out of 18 affected Owners in the sub-project 7 belong to Titeld-holders, whose structures are affected by the project. The details of Ownership according to their legal status are given in the (**Table 5.13**).

Table 5.13: Status of Ownership for Package-III

Sl.	Ownership Status	No. of Structure	Percentage
1	Private	7	38.9%
2	Community	9	50.0%
3	Government	2	11.1%
	Total	18	100.0%

Source: Census Survey on November, 2018

5.6.8 SCALE OF IMPACT ON STRUCTURE

The severity of impact on any structure is determined by percentage of impact on the properties and the usable status of residual part of the structure. The impact percentage on the structures is being examined from its distance from the centre line and the total area of the structures. This analysis helps to know that whether the remaining part of the structure would serve any purpose. As per the collected information during the social survey it is found that the impact is Category A in most of the structures. The exact details for scale of impact on structures are given in (**Table 5.14**).

Table 5.14: Scale of Impact on Structure for Package-III

Sl.	Scale of Impact	Percentage
1	Category A (more than 50%)	43.5%
2	Category B (less than 50% but more than 25%)	30.4%
3	Category C (less than 25% more than 10%)	17.4%
4	Category D (less than 10%)	8.7%
	Total	100.0%

Source: Census Survey on November, 2018

5.6.9 LOSS OF LIVELIHOODS

Due to loss of structures many people will be losing their livelihoods and will be economically displaced.

As per the census survey for Package-III DPs losing livelihood 1 owner of residential- cum-commercial structure where he performs business. The details of impact on livelihoods in the project are presented in the (**Table 5.15**).

Table 5.15: Loss of Livelihoods for Package-III

Sl.	Loss	No. of Person	Percentage
1	Owners of Commercial Structure (TH)	0	0.00%

2	Owners of Residential cum Commercial Structure (TH)	1	100.00%
3	Commercial tenant	0	0.00%
4	Employee in commercial Structures	0	0.00%
	Total	1	100.00%

Source: Census Survey on November, 2018

5.6.10 LOSS OF COMMUNITY PROPERTY RESOURCES (CPRS)

During census for Package-III, it was observed that there are 10 structures of community property resources are affected considering the Toe Line of Impact including community, religious and government properties within the proposed right of way as well as proposed ROW.

Table 5.16: Type of Affected CPRs for Package-III

Sl.	Type of Ownership	No. of Properties
1	Memorial Structure	0
2	Water Tank	5
3	Toilet	0
4	Gate	0
5	Waiting Shed	0
6	Community Commercial	1
7	Community Residential	1
8	Community Cattel shed	0
9	Community Hall	0
10	Clud	1
11	Temple	1
12	Rest Room	1
13	Primary Health Sub-Center	0
	Total	10

Source: Census Survey on November, 2018

5.6.11 Summary Project Impacts

Table 5.17: Summary Project Impacts

Sl.	Impacts	PKG. III
1	Total land acquisition requirements (in ha)	51.2168
2	Total no. of private Residential structures (Nos.)	7
3	Total no. of private Commercial structures (Nos.)	0
4	Total number of Residential cum Commercial structures (Nos.)	1
5	Total number of other private structure (Nos.)	1

Sl.	Impacts	PKG. III
6	Total No. of Affected Families by affected structure (Nos.)	7
7	Total Number of Vulnerable households affected of Affected structure (Nos.)	7
8	Total number of displaced persons (DPs) (Nos.)	41
9	Total number of CPRs affected Community and Religious (Nos.)	6

5.7 REHABILITATION AND RESETTLEMENT PLAN

The procedure mentioned in this chapter shall be followed for declaration of the affected area, carrying out survey and census of affected persons, assessment of government land available and land to be arranged for rehabilitation and resettlement, declaration of the resettlement area or areas, preparation of the draft rehabilitation and resettlement scheme or plan and its final publication.

Where the appropriate Government is of the opinion that there is likely to be involuntary displacement of four hundred or more families enmasse in plain areas, or two hundred or more families enmasse in tribal or hilly areas, DDP blocks or areas mentioned in the Schedule V or Schedule VI to the Constitution due to acquisition of land for any project or due to any other reason, it shall, declare, by notification in the Official Gazette, area of villages or localities as an affected area.

Every declaration made in our policy shall be published in at least three daily newspapers, two of which shall be in the local vernacular having circulation in villages or areas which are likely to be affected, and also by affixing a copy of the notification on the notice board of the concerned gram panchayats or municipalities and other prominent place or places in the affected area and the resettlement area, and/or by any other method as may be prescribed in this regard by the appropriate Government.

Once the declaration is made, the Administrator for Rehabilitation and Resettlement shall undertake a baseline survey and census for identification of the persons and families likely to be affected.

Every such survey shall contain the following village-wise information of the affected families: -

- ❖ Members of the family who are permanently residing engaged in any trade, business, occupation or vocation in the affected area.
- ❖ families who are likely to lose, or have lost, their house, agricultural land, employment or are alienated wholly or substantially from the main source of their trade, business, occupation or vocation.
- ❖ Agricultural labourers and non-agricultural labourers.
- ❖ Families belonging to the Scheduled Caste or Scheduled Tribe categories.
- ❖ Vulnerable persons such as the disabled, destitute, orphans, widows, unmarried girls, abandoned women, or persons above sixty years of age; who are not provided or cannot immediately be provided with alternative livelihood, and who are not otherwise covered as part of a family.
- ❖ families that are landless (not having homestead land, agricultural land, or either homestead or agricultural land) and below poverty line, but residing continuously for a period of not less than three years in the affected area preceding the date of declaration of the affected area.
- ❖ Scheduled Tribes families who are or were having possession of forest lands in the affected area prior to the LA Notice Publication date.

- ❖ Every survey undertaken under shall be completed within a period of ninety days from the date of declaration.

On completion of the above survey on expiry of a period of ninety days, whichever is earlier, the Administrator for Rehabilitation and Resettlement shall, by notification, and also in such other manner so as to reach all persons likely to be affected, publish a draft of the details of the findings of the survey conducted by him and invite objections and suggestions from all persons likely to be affected thereby. This draft shall be made known locally by wide publicity in the affected area.

On the expiry of thirty days from the date of publication of the draft of the details of survey and after considering the objections and suggestions received by him in "this behalf, the Administrator for Rehabilitation and Resettlement shall submit his recommendations thereon along with the details of the survey to the appropriate Government.

Within forty-five days from the date of receipt of the details of the survey and recommendations of the Administrator for Rehabilitation and Resettlement, the appropriate Government shall publish the final details of survey in the Official Gazette. The appropriate Government shall, by notification, declare any area (or areas) as a resettlement area (or areas) for rehabilitation and resettlement of the affected families.

The Administrator for Rehabilitation and Resettlement shall ensure that the affected families may be settled, wherever possible, in a group or groups in such resettlement areas. However, it has to be ensured that the affected families may be resettled with the host community on the basis of equality and mutual understanding, consistent with the desire of each group to preserve its own identity and culture.

The Administrator for Resettlement and rehabilitation shall draw up a list of lands that may be available for rehabilitation and resettlement of the affected families.

The lands drawn up shall consist of: -

- ❖ Land available or acquired for the project and earmarked for this purpose
- ❖ Government wastelands and any other land vesting in the Government available for allotment to the affected families.
- ❖ Lands that may be available for purchase or acquisition for the purposes of rehabilitation and resettlement scheme or plan.
- ❖ A combination of one or more of the above.

However, the Administrator for Rehabilitation and Resettlement should ensure that such acquisition of land does not lead to another set of physically displaced families. The Administrator for Rehabilitation and Resettlement, on behalf of the appropriate Government, may either purchase land from any person through consent award and may enter into an agreement for this purpose, or approach the state Government concerned for acquisition of land for the purposes of rehabilitation and resettlement scheme or plan.

After completion of baseline survey and census of the affected families and assessment of the requirement of land for resettlement, the Administrator for Rehabilitation and Resettlement shall

prepare a draft scheme or plan for the rehabilitation and resettlement of the affected families after consultation with the representatives of the affected families including women and the representative of the requiring body.

The draft rehabilitation and resettlement scheme or plan shall contain the following particulars, namely: -

- (a) The extent of land to be acquired for the project and the name(s) of the affected village(s);
- (b) A village-wise list of the affected persons, family-wise, and the extent and nature of land and immovable property owned or held in their possession in the affected area, and the extent and nature of such land and immovable property which they are likely to lose or have lost, indicating the survey numbers thereof;
- (c) A list of agricultural laborers in such area and the names of such persons whose livelihood depends on agricultural activities;
- (d) A list of persons who have lost or are likely to lose their employment or livelihood or who have been or likely to be alienated wholly or substantially from their main sources of trade business, occupation or vocation consequent to the acquisition of land for the project or involuntary displacement due to any other cause;
- (e) A list of non-agricultural laborers, including artisans;
- (f) A list of affected landless families, including those, without homestead land and below poverty line families;
- (g) A list of vulnerable affected persons.
- (h) A list of occupiers, if any;
- (i) A list of public utilities and government buildings which are affected or likely to be affected;
- (j) Details of public and community properties, assets and infrastructure;
- (k) A list of benefits and packages which are to be provided to the affected families;
- (l) Details of the extent of land available in the resettlement area for resettling and for allotment of land to the affected families.
- (m) Details of the amenities and infrastructural facilities which are to be provided for resettlement.
- (n) The time schedule for shifting and resettling the displaced persons in the resettlement area or areas.
- (o) Such other particulars as the Administrator for Rehabilitation and Resettlement may consider necessary.

The draft scheme or plan may be made known locally by wide publicity in the affected area and the resettlement area (or areas) in such manner as may be prescribed by the appropriate Government.

The draft rehabilitation and resettlement scheme or plan shall also be discussed in gram sabhas in rural areas and in public hearings in urban and rural areas where gram sabhas don't exist.

The consultation with the gram sabha or the panchayats at the appropriate level in. the Scheduled Areas under' Schedule V of the Constitution shall be in accordance with the provisions of the Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996 (40 of 1996).

In cases of involuntary displacement of two hundred or more Scheduled Tribes families from the Scheduled Areas, the concerned Tribes Advisory Councils may also be consulted.

While preparing a draft scheme or plan, the Administrator for Rehabilitation and Resettlement shall ensure that the entire estimated cost of the rehabilitation and resettlement scheme or plan forms an integral part of the cost of the project for which the land is being acquired. The entire expenditure on rehabilitation and resettlement benefits and the expenditure for rehabilitation and resettlement of the affected families are to be borne by the requiring body for which the land is being acquired. The Administrator for Rehabilitation and Resettlement shall ensure that the entire estimated cost of rehabilitation and resettlement benefits and other expenditure for rehabilitation and resettlement of the affected families is communicated to the requiring body for incorporation in the project cost.

The Administrator for Rehabilitation and Resettlement shall submit the draft scheme or plan for rehabilitation and resettlement to the appropriate Government for its approval. In case of a project involving land acquisition on behalf of a requiring body, it shall be the responsibility of the appropriate Government to obtain the consent of the requiring body, to ensure that the necessary approvals as required under this policy have been obtained, and to make sure that the requiring body has agreed to bear the entire cost of rehabilitation and resettlement benefits and other, expenditure for rehabilitation and resettlement of the affected families as communicated by the Administrator for Rehabilitation and Resettlement, before approving it. After approving the rehabilitation and resettlement scheme or plan, the appropriate Government shall publish the same in the Official Documents. On final notification of the rehabilitation and resettlement scheme or plan, it shall come into force.

It shall be the responsibility of the requiring body to provide sufficient funds to the Administrator for Rehabilitation and Resettlement for proper implementation of the rehabilitation and resettlement scheme or plan. As soon as the rehabilitation and resettlement scheme or plan is finalized, the requiring body shall deposit one-third cost of the rehabilitation and resettlement scheme or plan with the Administrator for Rehabilitation and Resettlement. The administrator for Rehabilitation and Resettlement shall keep proper books of accounts and records of the funds placed at his disposal and submit periodic returns to the appropriate Government in this behalf.

In case of a project involving land acquisition on behalf of a requiring body, an exercise for fast-track updating of land records shall be undertaken on currently with the land acquisition proceedings. Persons who have acquired any right prior to the date of issue of the notification under sub-section (1) of section 24 of the RFCTLARR Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014 (or such notification under any other Act of the Union or a State for the time being in force under which land acquisition is being undertaken) as per the updated' records shall also have right to proportionate compensation along with the original landowners referred to in the notification.

(a) The compensation award shall be declared well in time before displacement of the affected families. Full payment of compensation as well as adequate progress in resettlement shall be

ensured in advance of the actual displacement of the affected families.

(b) The compensation award shall take into account the market value of the property being acquired, including the location-wise minimum price per unit area fixed (or to be fixed) by the State Government.

(c) Conversion to the intended category of use of the land being acquired (for example, from agricultural to non-agricultural) shall be taken into account in advance of the acquisition, and the compensation award shall be determined as per the intended land use category.

(d) The applicable conversion charges for the change in the land use category shall be paid by the requiring body, and no reduction shall be made in the compensation award on this account.

In case of a project involving land acquisition on behalf of a requiring body, and if the requiring body is a company authorized to issue shares and debentures, the affected families who are entitled to get compensation for the land or other property acquired, shall be given the option to take up to twenty percent of the compensation amount due to them in the form of shares or debentures or both of the requiring body, as per the guidelines to be notified by the Central Government: Provided that the appropriate Government, at its discretion, may raise this proportion up to fifty percent of the compensation amount.

Land compulsorily acquired for a project cannot be transferred to any other purpose except for a public purpose, and after obtaining the prior approval of the appropriate Government.

If land compulsorily acquired for a project or part thereof, remains unutilized for the project for a period of five years from the date of taking over the possession by the requiring body, the same shall revert to the possession and ownership of the appropriate Government without payment of any compensation or remuneration to the requiring body. Whenever any land acquired for a public purpose is transferred to an individual or organization (whether in private sector, public sector or joint sector) for a consideration, eighty percent of any net unearned income so accruing to the transferor, shall be shared amongst the persons from whom the lands were acquired or their heirs, in proportion to the value at which the lands were acquired. The fund shall be kept in a separate account which shall be administered in such manner as may be prescribed.

5.8 REHABILITATION AND RESETTLEMENT BENEFITS FOR THE AFFECTED FAMILIES

The rehabilitation and resettlement benefits shall be extended to all the affected families who are eligible as affected families on the date of publication of the declaration under as stated above, and any division of assets in the family after the said date may not be taken into account.

Any affected family owning house and whose house has been acquired or lost, may be allotted free of cost house site to the extent of actual loss of area of the acquired house but not more than two hundred and fifty square meter of land in rural areas, or one hundred and fifty square meter of land in urban areas, as the case may be, for each nuclear family. Provided that, in urban areas, a house of up to one hundred square meter carpet area may be provided in lieu thereof. Such a house, if necessary, may be offered in a multi-storied building complex.

Each affected below poverty line family which is without homestead land and which has been residing in the affected area continuously for a period of not less than three years preceding the date of declaration of the affected area and which has been involuntarily displaced from such area, shall be entitled to a house of minimum one hundred square meter carpet area in rural areas, or fifty square meter carpet area in urban areas (which may be offered, where applicable, in a multi-storied building complex), as the case may be, in their settlement area:

Provided that any such affected family which opts not to take the house offered, shall get a suitable one-time financial assistance for use construction, and the amount shall not be less than what is given under any programme of house construction by the Government of India.

Each affected family owning agricultural land in the affected area and whose entire land has been acquired or lost, may be allotted in the name of the khatedar(s) or holder of Village Council Pass in the affected family, agricultural land or cultivable wasteland to the extent of actual land loss by the khatedar(s) in the affected family subject to a maximum of one acres of irrigated land or two acres of irrigated land or cultivable wasteland, if Government land is available in the resettlement area. This benefit shall also be available to the affected families who have, as a consequence of the acquisition" or loss of land, been reduced to the status of marginal farmers.

In the case of irrigation or hydel projects, the affected families shall be given preference in allotment of land-for-land in the command area of the project, to the extent possible. Such lands may be consolidated, and plots of suitable sizes allotted to the affected families who could be settled their in-groups. In case a family cannot be given land in the command area of the project or the family opts not to take land there, such a family may be given monetary compensation on replacement cost basis for their lands lost, for purchase of suitable land elsewhere.

In the case of irrigation or hydel projects, the State Governments may formulate suitable schemes for providing land to the affected families in the command areas of the projects by way of pooling of the lands that may be available or, otherwise, could be made available in recommended areas of such projects.

(a) In the case of irrigation or hydel projects, fishing rights in the reservoirs shall be given to the



affected families, if such rights were enjoyed by them in the affected area; (b) In other cases also, unless there are special reasons, fishing rights shall be given preferentially to the affected families.

In case of a project involving land acquisition on behalf of a requiring body, the stamp duty and other fees payable for registration of the land or house allotted to the affected families shall be borne by the requiring body.

The land or house allotted to the affected families under this policy shall be free from all encumbrances.

The land or house allotted to the affected families under this policy may be in the joint names of wife and husband of the affected family.

In case of allotment of wasteland or degraded land in lieu of the acquired land, each khatedar in the affected family shall get a one-time financial assistance of such amount as the appropriate Government may decide but not less than fifteen thousand rupees per acres for land development.

In case of allotment of agricultural land in lieu of the acquired land, each khatedar in the affected family shall get a one-time financial assistance of such amount as the appropriate Government may decide but not less than ten thousand rupees, for agricultural production.

Each affected family that is displaced and has cattle, shall get financial assistance of such amount as the appropriate Government may decide but not less than fifteen thousand rupees, for construction of cattle shed. Each affected family that is displaced shall get a one-time financial assistance of such amount as the appropriate Government may decide but not less than ten thousand rupees, for shifting of the family, building materials belongings and cattle.

Each affected person who is a rural artisan, small trader or self-employed person and who has been displaced shall get a one-time financial assistance of such amount as the appropriate Government may decide but not less than twenty-five thousand rupees, for construction of working shed or shop.

In case of a project involving land acquisition on behalf of a requiring body, -

- ❖ The requiring body shall give preference to the affected families – at least one person per nuclear family - in providing employment in the project, subject to the availability of vacancies and suitability of the affected person for the employment.
- ❖ Wherever necessary, the requiring body shall arrange for training of the affected persons, so as to enable such persons to take on suitable jobs.
- ❖ The requiring body shall offer scholarships and other skill development opportunities to the eligible persons from the affected families as per the criteria as may be fixed by the appropriate Government.
- ❖ The requiring body shall give preference to the affected persons or their groups or cooperatives in the allotment of outsourced contracts, shops or other economic opportunities coming up in or around the project site.
- ❖ The requiring body shall give preference to willing landless labourers and unemployed affected persons while engaging labour in the project during the construction phase.

- ❖ The affected persons shall be offered the necessary training facilities for development of entrepreneurship, technical and professional skills for self-employment.

In case of a project involving land acquisition on behalf of a requiring body, the affected families who have not been provided agricultural land or employment shall be entitled to a rehabilitation grant equivalent to seven hundred fifty days minimum agricultural wages or such other higher amount as may be prescribed by the appropriate Government: Provided that, if the requiring body is a company authorized to issue shares and debentures, such affected families shall be given the option of taking up to twenty percent of their rehabilitation grant amount in the form of shares or debentures of the requiring body, in such manner as may be prescribed provided further that the appropriate Government may, at its discretion, raise this proportion up to fifty per cent of the rehabilitation grant amount.

In cases where the acquisition of agricultural land or involuntary displacement takes place on account of land development projects, in lieu of land-for-land or employment, such affected families would be given site(s) or apartment(s) within the development project, in proportion to the land lost, but subject to such limits as may be defined by the appropriate Government.

In case of a project involving land acquisition on behalf of a requiring body, each affected family which is involuntarily displaced shall get a monthly subsistence allowance equivalent to twenty-five days' minimum agricultural wages per month for a period of one year from the date of displacement.

The project authorities shall, at their cost, arrange for annuity policies that will pay a pension for life to the vulnerable affected persons, of such amount as may be prescribed by the appropriate Government subject to a minimum of five hundred rupees per month.

If land is acquired in cases of urgency under the RFCTLARR Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014, each affected family which is displaced shall be provided with transit and temporary accommodation, pending rehabilitation and resettlement scheme or plan, in addition to the monthly subsistence allowance and other rehabilitation and resettlement benefits due to them under this policy.

In case of linear acquisitions, in projects relating to railway lines, highways, transmission lines, laying of pipelines and other such projects wherein only an arrow stretch of land is acquired for the purpose of the project or is utilized for right of way, each khatedar in the affected family shall be offered by the requiring body an ex-gratia payment of such amount as the appropriate Government may decide but not less than twenty thousand rupees, in addition to the compensation or any other benefits due under the Act or programme or scheme under which the land, house or other property is acquired provided that, if as a result of such land acquisition, the land-holder becomes landless or is reduced to the status of a "small" or "marginal" farmer, other rehabilitation and resettlement benefits available under this policy shall also be extended to such affected family.

5.8.1 REHABILITATION AND RESETTLEMENT BENEFITS FOR PROJECT AFFECTED FAMILIES BELONGING TO THE SCHEDULED TRIBES AND SCHEDULED CASTES

In case of a project involving land acquisition on behalf of a requiring body which involves involuntary

displacement of two hundred or more Scheduled Tribes families, a Tribal Development Plan shall be prepared, in such form as may be prescribed, laying down the detailed procedure for settling land rights due but not settled and restoring titles of tribal on alienated land by undertaking a special drive together with land acquisition. The Plan shall also contain a programme or development of alternate fuel, fodder and non-timber forest produce (NTFP) resources on non-forest lands within a period of five years sufficient to meet requirements of tribal communities who are denied access to forests.

The concerned gram sabha or the panchayats at the appropriate level in the Scheduled Areas under Schedule V of the Constitution or as the case may be, Councils in the Schedule VI Areas shall be consulted in all Cases of land acquisition in such areas including land acquisition in cases of urgency, before issue of a notification under the RFCTLARR Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014, and the consultation shall be in accordance with the provisions of the provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996 and other relevant laws. Further, in cases of involuntary displacement of two hundred or more Scheduled Tribes families from the Scheduled Areas, the concerned Tribes Advisory Councils (TACs) may also be consulted.

Each affected family of Scheduled Tribe followed by Scheduled Caste categories shall be given preference in allotment of land-for-land, if Government land is available in the resettlement area.

In case of land being acquired from members of the Scheduled Tribes, at least one-third of the compensation amount due shall be paid to the affected families at the outset as first installment and the rest at the time of taking over the possession of the land.

In case of a project involving land acquisition on behalf of a requiring body, each Scheduled Tribe affected family shall get an additional one-time financial assistance equivalent to five hundred days' minimum agricultural wages for loss of customary rights or usages of forest produce.

The Scheduled Tribes affected families will be re-settled, as far as possible, in the same Schedule Area in a compact block, so that they can retain their ethnic, linguistic and cultural identity. Exceptions would be allowed only in rare cases where the requiring body in case of a project involving land acquisition, or the State Government in other cases of involuntary displacement is unable to offer such land due to reasons beyond its control.

The resettlement areas predominantly inhabited by the Scheduled Tribes shall get land free of cost for community and religious gatherings, to the extent decided by the appropriate Government.

In case of a project involving land acquisition on behalf of a requiring body, the Scheduled Tribes affected families resettled out of the district will get twenty-five percent higher rehabilitation and resettlement benefits in monetary terms in respect of the items specified in

Any alienation of tribal lands in violation of the laws and regulations for the time being in force shall be treated, as null and void. In the case of acquisition of such lands, the rehabilitation and resettlement benefits would be available to the original tribal land-owners.

In the case of irrigation or hydel projects, the affected Scheduled Tribes, 'other, traditional forest dwellers and the Scheduled Castes families having fishing rights in a river or pond, or' dam in the affected area shall be given fishing rights in the reservoir area of the irrigation or hydel projects.

The Scheduled Tribes and Scheduled Castes affected families enjoying reservation benefits in the affected area shall be entitled to get the reservation benefits at the resettlement area(s).

The affected Scheduled Tribes families, who were in possession of forest / lands in the affected area prior to January, 2013, shall also be eligible for the rehabilitation and resettlement benefits under this policy.

5.8.2 AMENITIES AND INFRASTRUCTURAL FACILITIES TO BE PROVIDED AT RESETTLEMENT AREAS

In all cases of involuntary displacement of four hundred families or more enmasse in plain areas, or two hundred families or more enmasse in tribal or hilly areas, DDP blocks or areas mentioned in the Schedule V or Schedule VI to the Constitution, comprehensive infrastructural facilities and amenities notified by the appropriate Government shall be provided in the resettlement area (such facilities and amenities shall, inter alia, include roads, public transport, drainage, sanitation, safe drinking water, drinking water for cattle, community ponds, grazing land, land for fodder, plantation (social forestry or agro forestry), Fair Price shops, panchayat grams, Cooperative Societies, Post Offices, seed-cum-fertilizer storage, irrigation, electricity, health centers, child and mother supplemental nutritional services, children's playground, community centers, schools, institutional arrangements for training, places of worship, land for traditional tribal institutions, burial / cremation grounds, and security arrangements.

In cases of involuntary displacement of less than four hundred families enmasse in plain areas, or less than two hundred families or more enmasse in tribal or hilly areas, DDP blocks or areas mentioned in the Schedule V or Schedule VI to the Constitution, all affected families shall be provided basic infrastructural facilities and amenities at the resettlement site(s) as per the norms specified by the appropriate Government. It would be desirable that provision of drinking water, electricity, schools, dispensaries, and access to the resettlement sites, amongst others, be included in the resettlement plan approved by the appropriate Government.

If relocation takes place in a proposed settlement area, the same infrastructure shall also be extended to the host community.

While shifting the population of the affected area to the resettlement area, the Administrator for Rehabilitation and Resettlement shall, as far as possible, ensure that:

- a) In case the entire population of the village or area to be shifted belongs to a particular community, such population or families may, as far as possible, be resettled in a compact area, so that socio-cultural relations and social harmony amongst the shifted families are not disturbed.
- b) In the case of resettlement of the Scheduled Caste affected families, it may, as far as possible, be ensured that such families are resettled in the areas close to the villages.

The appropriate Government shall ensure that a resettlement area forms part of a gram panchayat or municipality.

5.8.3 INDEXATION OF REHABILITATION GRANT AND OTHER BENEFITS

The rehabilitation grants and other benefits expressed in monetary terms in this policy shall be indexed to the Consumer Price Index (CPI) with the first day of April following the date of coming into force of this policy as the reference date, and the same shall also be revised by the appropriate Government at suitable intervals.

5.8.4 PERIPHERY DEVELOPMENT

In case of a project involving land acquisition on behalf of a requiring body, the requiring body will be responsible for development of the defined geographic area on the periphery of the project site as decided by the appropriate Government, and will be required to contribute to the socio-economic development of the areas contiguous to its area of operation. For this purpose, the requiring body will earmark a percentage of its net profit or, in case no profit is declared by the requiring body in a particular year, for that year, such minimum alternative amount as may be determined by the appropriate Government after consultation with the requiring body, to be spent within the specified zone. The requiring body will carry out the developmental activity within this zone in close coordination with the Commissioner for Rehabilitation and Resettlement. The State Governments will be free to frame their own rules and guidelines for this purpose.

5.9 GENDER IMPACT AND MITIGATIVE MEASURES

5.9.1 INTRODUCTION

The social economical survey and census survey to the project sites identified some critical social issues related to gender impacts associated with project impacts. Typically, vulnerability is relatively higher among this group. Dislocation and loss of livelihood caused by road widening and development may further aggravate their disadvantaged situation, unless special attention is paid to them. This chapter particularly examines the issues from social safeguard considerations to develop specific mitigation measure.

5.9.2 WOMEN'S PARTICIPATION IN THE PROJECT

The gender composition of DPs shows that the male accounts for 50% and female accounts for 50%. The gender disparity is visible in higher sex ratio among DPs i.e. 998 against state level statistic having 985. The census survey revealed that 6 women headed households will be affected by the sub project.

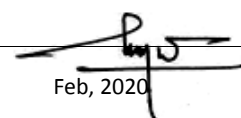
The Gender Development Index (GDI) value for India is very low and the socio-economic profile of the project area shows much lower socio-economic standing for women. They are largely involved in domestic work and have very low economic participation rate (i.e. productive or gainful employment). In the project, women are affected in a variety of ways. For example, they face hardship and stress and continue to suffer during the transition period until the time the project - affected households are able to regain their lost income and livelihood. Often, the duration of this process is lengthened due to delays in payment of compensation, rehabilitation assistance and implementing the R&R., reconstructing the livelihood systems. The longer the transition period, more would be the miseries for women. The vulnerability of women headed households has been addressed in the RAP with social attention and gender specific attention. During project implementation, project affected women will receive preferential treatment for the civil work in the project. Each field team of the RAP implementation agencies/partner agencies shall include at least one-woman investigator/facilitator. The PIU will ensure that the women are consulted and invited to participate in group based activities to gain access and control over the resource as a part of the RAP. The monitoring and evaluation team(s) shall include woman. Further, during RAP implementation, PIU will make sure that women are actually taking part in issuance of identity cards, opening accounts in the bank, receiving compensation amounts by cheque in their names. This will further widen the perspective of participation by the women in the project implementation. The implementing agencies will provide training for upgrading women's skill for alternative livelihoods and income restoration.

5.9.3 HIV/ AIDS AND HEALTH RISKS

HIV/ AIDS are major development challenges in India. Given the epidemic nature of the problem, it may reverse India's achievements in health and development. According to National AIDS Control Organization (NACO) HIV estimates for 2011, India has close to 4 million HIV infected people. This is less than one percent of the adult population but still more than any country in the region. It is

estimated that HIV infection could grow to 5 percent of adult population – more than 57 million by 2016 without successful intervention. HIV infection is typically concentrated among the poor marginalized groups including sex workers, drug users, migrant laborers and truck drivers. These groups, particularly the truckers drive the HIV/AIDS epidemic and many studies indicate that infection is spreading rapidly to the general population. Recently, the Government of India (GOI) has shown increasing commitment to HIV/AIDS control. GOI established a consortium like collaboration of external partners (UNAIDS, USAID, DFID, CIDA and others) to provide technical and financial assistance to NACO to design and help implement GOI's national policy on HIV/AIDS control before mass spread into general community. There is need to improve awareness level in the state, particularly in the project area. Information and education campaign on HIV/AIDS and other sexually transmitted diseases (STDs) will be conducted by PIU during project implementation. The campaign will target the project construction workers at campsites, truckers at truck stops and dhabas and the public at large along the alignment. The PIU will work closely with the relevant state agencies and other proposed networks dedicated to prevention work for further building up of awareness programs in the project area. HIV/AIDS awareness brochures would also be developed for distribution to local communities, local markets, truck/bus stations and other appropriate places to increase awareness about risks/dangers of HIV/AIDS. This would ultimately lead to lowering the risk for the general community in the project affected area.

The Project Area is affected by HIV/AIDS as per NACO reports on 2011 on the study for 2005, 2006 and 2007 the district of the least HIV/AIDS affected districts and the district of Kakching and Chandel lies in the Category A, the second standard HIV/AIDS affected districts of India. As per the guidelines of ADB's SPS 2009 and subsequent publications proper and effective Awareness campaign both in regard of Gender and HIV /AIDS is to be undertaken by the Project Proponent.



5.10 PUBLIC CONSULTATION

Public Consultations or community participation is an integral part and process of any projects which involves resettlement or rehabilitation issues. It helps to incorporate valuable indigenous suggestions and perceptions of development. In the process, stakeholders get the opportunity to address issues, which are resolved after making appropriate changes in design and alternative finalization. The stakeholders become aware of the development schemes and at the same time influence and share to control over these initiatives, decisions and resources. Community consultations also help to avoid opposition to the project, which is otherwise likely to occur. The Table briefly depicts the plan and implementation of Public Consultation and Disclosure of the Project.

Table 5.18: Public Consultation and Disclosure Implementation and Plan

Activity	Task	Timing (Date/Period)	No of People	Agencies	Feedback/ Issues/ Concerns Raised	Remarks
Stakeholder Identification	Mapping of the project area					
Project information Dissemination	Distribution of information leaflets to Displaced persons (DPs)					
Consultative Meetings with DPs during Scoping Phase	Discuss potential impacts of the project					
Public Notification	Publish list of affected lands/sites in a local newspaper; Establish eligibility cut-off date					
Socio-Economic Survey	Collect socioeconomic information on DP's perception on the project					
Consultative Meetings on Resettlement Mitigation Measures	Discuss entitlements, compensation rates, grievance redress mechanisms					
Publicize the resettlement plan (RP)	Distribute Leaflets or Booklets in local language					
Full Disclosure of the RP to DPs	Distribute RP in local language to DPs					
Web Disclosure of the RP	RP posted on NHIDCL and/or EA website					
Consultative Meetings during DMS	Face to face meetings with DPs					
Disclosure after Detailed Measurement Survey (DMS)	Disclose updated RP to DPs					

Activity	Task	Timing (Date/Period)	No of People	Agencies	Feedback/Issues/Concerns Raised	Remarks
Web Disclosure of the Updated RP	Updated RP posted on NHIDCL and/or EA website					

The overall objectives of the consultation program in preparing RAP were to disseminate project information and to incorporate public and DP's views in Resettlement and Environmental Action Plans, which are guided by specific objectives like:

- ❖ Awareness amongst stakeholders by disclosing the updated R.P. according to GOI's involuntary resettlement policy.
- ❖ Improvement in project design minimising potential conflicts and delays in implementation.
- ❖ Facilitate development of appropriate and acceptable entitlement options.
- ❖ Increase project sustainability.
- ❖ Reduce problems of institutional co-ordination.
- ❖ Make the R&R process transparent and reduce leakage.
- ❖ Increase re-settler commitment, ensure effectiveness and sustainability of the income restoration strategies, and improve coping mechanisms.
- ❖ Creating sense of belongingness among the stakeholders.

5.10.1 IDENTIFICATION OF THE STAKEHOLDERS

The stakeholders are all the people getting affected by the project or are responsible for the project, whether directly or indirectly. The community participation programmes in social assessment ensured that information is disseminated to all the DPs and other stakeholders in appropriate ways. The information dissemination has taken place in vernacular, detailing about the main project features and the entitlement framework. Due consideration has also been given to address the views of the vulnerable groups.

Certain issues conditioned the participation of the stakeholders, as follows:

- ❖ Who might be affected (positively or negatively) by the proposed development?
- ❖ Who are voiceless for whom special efforts may have to be made?
- ❖ Who are representatives of those likely to be affected?
- ❖ Who is responsible for what is intended?
- ❖ Who can make what is intended more effective through their participation or less effective by their non-participation or outright opposition?
- ❖ Who can contribute financial and technical resources?
- ❖ Whose behaviour has to change for the effort to succeed?

- ❖ Both primary and secondary stakeholders were identified, based on the above criteria. They were invited to take part in the consultation series, and were solicited to participate in planning and implementation of the R&R programme.

Primary stakeholders included those affected negatively or positively by the project, like the DPS, project beneficiaries and project implementing agencies. Secondary stakeholders included other individuals and groups, with an interest in the project, viz., the NHIDCL, the highway users etc.

5.10.2 DISCLOSER OF PROJECT INFORMATION

The sharing of information is essential for sustainable development. It stimulates public debate on and broadens understanding of development issues, and enhances transparency and accountability in the development process. It also strengthens public support to improve the lives of people, facilitates collaboration among the many parties involved in development, and improves the quality of projects and programs. It is now accepted everywhere that the expanded access to information by the public will enhance the dialogue on development, and make an important contribution to efforts to reduce poverty and promote sustainable development. In this development project the discloser of project information (during the feasibility stage) to the public in general and to the people who are likely to be impacted negatively in particular have been done by way of consultation process. During the consultation session it was observed that the local people are aware of this project through local newspaper, published from time to time.

5.10.3 CONSULTATIONS FOR DETERMINING PRINCIPLE

The consultation process is not only targeted at project information dissemination to the people but another important aspect covered is determining of principle for formulating an entitlement frame work and eligibility policy for the project. The consultation process throws light of the people's expectations, aspirations etc. from the project as well as their expectations in terms of compensation and assistance from the project in case of adverse impacts.

5.10.4 PARTICIPANTS AT DIFFERENT LEVELS

The extent or the likely level of adverse impacts was one of the major criteria in deciding locations for public consultation sessions. The consultation programme has been tiered and conducted at several levels, such as:

- ❖ Heads of the households, likely to be impacted
- ❖ Members of the households, likely to be impacted
- ❖ Clusters of DPS
- ❖ Villagers
- ❖ Village Panchayats
- ❖ Local voluntary organisations and CBOs/NGOs
- ❖ Government agencies and departments

5.10.5 LEVELS OF CONSULTATION

The enactment of the participation and consultations with the stakeholders has been done at different levels throughout the project preparation stage. The Public Consultation was carried out at various stages of project preparation: Social Screening stage and Feasibility stage.

5.10.6 CONSULTATION DURING PROJECT PREPARATION

The Census Survey Team carried out preliminary consultations through Focus Group Discussions (FGD) and meetings with the DPs as well as the general public in the project area. FGDs were conducted primarily in settlements with problems of traffic congestion, dense informal/squatter settlement, close junctions and road intersections, and concentration of DPs. During the survey, intensive discussion and consultation meetings were conducted with large number of DPs in nearly every affected village wherein policy related issues; displacements and other related issues were discussed. Suggestions and comments by DPs were incorporated in the project road design as well as the policy measures for resettlement management. Public discussions were conducted at important points, where people could assemble in large numbers. Panchayat members were contacted to inform the people. The Team also had informal meetings with village head, panchayat and other district level government officials, leaders of local level organization /association, trucker's association, and village women groups.

Illustration of Public Consultation meetings at our project corridor are tagged below:

Mr. Neli, member of village authority and all the officials of the Village Council explain the local people about the project and its impacts and also promised that they would extend their co-operation in our Project work during the implementation of the project.

Suggestions are given below:

- ❖ Mr. Neli, member of village authority, has satisfied as the proposed alignment would be built minimizing resettlement impact in the locality.
- ❖ Mr. Winson & local shop owner are concern about thire affected shop.
- ❖ Local People satisfied that the proposed alignment would be increase connectivity.

The meeting ended with vote of thanks to chair.

5.10.7 PLAN FOR FURTHER CONSULTATION IN THE PROJECT

The effectiveness of the R&R program is directly related to the degree of continuing involvement of those affected by the Project. Several additional rounds of consultations with DPs will form part of the further stages of project preparation and implementation. PIU conducting these consultations during RP implementation, which will involve agreements on compensation, assistance options, and entitlement package and income restoration measures suggested for the sub-project. The consultation will continue throughout the project implementation. The following set of activities will be undertaken for effective implementation of the Plan:

In case of any change in engineering alignment planning the DPs and other stakeholders will be

consulted in selection of road alignment for minimization of resettlement impacts, development of mitigation measures etc.

The Project Implementation Unit (PIU) will conduct information dissemination sessions in the project area and solicit the help of the local community/ leaders and encourage the participation of the DP's in Plan implementation.

During the implementation of RP, PIU will organize public meetings, and will appraise the communities about the progress in the implementation of project works, including awareness regarding road construction.

Consultation and focus group discussions will be conducted with the vulnerable groups like women, SC, ST, and OBC's to ensure that the vulnerable groups understand the process and their needs are specifically taken into consideration.

To make reasonable representation of women in the project planning and implementation they will be specifically involved in consultation.

5.10.8 INFORMATION DISCLOSURE

To keep more transparency in planning and for further active involvement of DPs and other stakeholders the project information will be disseminated through disclosure of resettlement planning documents. The EA will submit the following documents to NHIDCL for disclosure on NHIDCL's website:

- ❖ The final resettlement plan endorsed by the EA after the census of displaced persons has been completed;
- ❖ A new resettlement plan or an updated resettlement plan, and a corrective action plan prepared during project implementation, if any; and
- ❖ The resettlement monitoring reports.

The EA will provide relevant resettlement information, including information from the above mentioned documents in a timely manner, in an accessible place and in a form and language(s) understandable to affected persons and other stakeholders. A resettlement information leaflet containing information on compensation, entitlement and resettlement management adopted for the project will be made available in local language (Manipuri) and distributed to DPs.

5.11 OBJECTIVES AND POLICY FRAME WORK

This Resettlement Plan (RP) has been prepared in accordance with National Highway Safeguard Policies and RFCTLARR Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014. Policies are designed to protect the rights of the affected persons and communities. The primary objectives of the RP are to mitigate the adverse impacts of the project and to assist the displaced persons (DPs) in resettlement and restoration of their income and livelihoods.

The legal framework and principles adopted for addressing resettlement issues in the Project have been guided by the proposed legislation and policies of the GOI, the state Government of Manipur, National Highway Authority of India and in accordance with the principles of NHIDCL. Prior to the preparation of the Resettlement Plan, a detailed analysis of the proposed national and state policies was undertaken and an entitlement matrix has been prepared for the entire program. The section below provides details of the various national and state level legislations studied and their applicability within this framework. This RP is prepared based on the review and analysis of all applicable legal and policy frameworks of the country and NHIDCL's policy requirements. A summary of applicable acts and policies is presented in the following paragraphs and the detailed policy review and comparison is provided in the entitlement matrix.

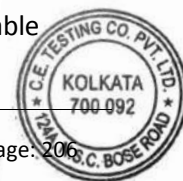
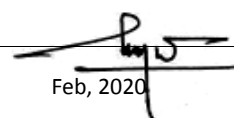
5.11.1 OBJECTIVES OF THE POLICY

The objectives of the Policy are as follows: -

- To minimize displacement and to identify non-displacing or least-displacing alternatives;
- To plan the resettlement and rehabilitation of Project Affected Families, (PAFs) including special needs of Tribal and vulnerable sections;
- To provide better standard of living to DPs; and
- To facilitate harmonious relationship between the Requiring Body and DPs through mutual cooperation.

5.11.2 THE NATIONAL HIGHWAYS ACT

For LA, the Act defines the various DPs of the process as follows: (i) section 3A - power to acquire land; (ii) 3B - power to enter for surveys; (iii) 3C - hearing of objections; (iv) 3D - declaration of acquisition; (v) 3E - power to take possession; (vi) 3F - power to enter into the land where land has vested in the central government; (vii) 3G - determination of amount payable as compensation; and (viii) 3F - deposit and payment of amount. The Act requires that the processes must be completed within a year from 3A to 3D. The acquisition process is faster due to central government co-ordination and provision for arbitration or power of civil court for trying any LA-related dispute. Although NHA Act significantly reduces the time frame for acquisition, the rules and principles of compensation are derived from the LA Act of 1894 amended from time to time. The Act covers only legal title holders and provides for: (i) market value of the land; (ii) a solarium of 30% on the market value for compulsory acquisition; (iii) additional amount for trees, crops, houses or other immovable



properties; (iv) damage due to severing of land, residence, place of business; (v) compensation to sharecroppers for loss of earning; and (vi) an interest of 12% on the market value from the date of notification to award.

The LA Act does not address many of the social and economic issues associated with displacement and resettlement of 'illegal' or non-titled informal settlers/squatters. However, in many donor-funded or DFBOT (Design Finance Built Operate Transfer) projects, EA assisted affected and/or displaced persons even without any legal title. The impacts of the present project are also on the roadside SBEs/households - people who are "non titled" informal dwellers and encroachers.

5.11.3 RIGHT TO FAIR COMPENSATION AND TRANSPARENCY IN LAND ACQUISITION REHABILITATION AND RESETTLEMENT ACT, 2013

The Government of India (GoI) in December 2013 had enacted RFCTLARR Act, 2014 in accordance to Manipur RFCTLARR Rules, 2014 from 1st January 2015. It recognizes the following essential features:

- ❖ That Displaced Households (DHs) not only lose their lands, other assets and livelihoods, they also experience adverse psychological social/cultural consequences.
- ❖ The need to minimize large-scale displacement and where displacement and where inevitable, resettlement and rehabilitation has to be handled with care. This is especially necessary for tribal, small and marginal farmers and women.
- ❖ That cash compensation alone is often inadequate to replace agricultural land, homesteads and other resources. Landless labour, forest dwellers, tenants, artisans are not eligible for cash compensation. The need to provide relief especially to the rural poor (with no assets) and marginal farmers, SCs/STs and women; the revised draft of NPRR include poor (BPL) and deprived groups, vulnerable, an ex-gratia of Rs 20,000/- for linear acquisition, per family.
- ❖ The importance of dialogue between DFs and the administration; responsible for resettlement for smoother implementation of projects R&R.

Displaced agricultural labourer who has been working for a period of minimum three years and who used to earn his livelihood by working on the land which is now under acquisition and who has become jobless because of the acquisition, shall be entitled for onetime payment of two hundred days' wages as fixed by the govt. under minimum wages act and shall also be entitled for National/State level job card under National Rural Employment Guarantee Program.

The policy specifies that the entire cost for Resettlement and Rehabilitation, in addition to the cost of acquisition of land shall be borne by the respective requisitioning authorities. The Requisitioning Authority shall deposit an amount equivalent to 0.5 percent of the estimated cost of land under acquisition for the project to the Collector-cum-Administrator, Resettlement and Rehabilitation through a bank draft subject to maximum of Rs. 2 lacs (Two lacs) only. This amount shall be over and above the amount paid for establishment expenditure under LAA. This additional amount shall be paid for outsourcing the work of survey for Resettlement, Monitoring, Stationeries, POL and other incidentals like vehicle, Computer, Computer Operator, Amins, Drafts man, Chainman etc.

5.11.4 NHIDCL POLICY OF SOCIAL SAFEGUARD

The NHIDCL Guidelines for Confirmation of Environmental and Social Considerations refer not only to the natural environment, but also to social issues such as involuntary resettlement and respect for the human rights of indigenous peoples.

The objective of the Guidelines is to encourage project proponents seeking funding from NHIDCL to implement appropriate environmental and social considerations in accordance with the Guidelines. In doing so, it endeavours to ensure transparency, predictability and accountability in its confirmation of environmental and social considerations.

One of the basic principles of Guidelines regarding confirmation of environmental and social considerations is that the responsibility for environmental and social considerations for the project shall be that of the project proponent. NHIDCL confirms environmental and social considerations by undertaking screening, environmental review, and monitoring and follow ups.

Environmental and social considerations required for funded projects cover underlying principles, examination of measures, scope of impact to be examined, compliance with laws, standards and plans, social acceptability and social impacts, involuntary resettlement, indigenous peoples and monitoring.

The following are summary of requirements under the Guidelines. Social acceptability and social impacts

Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which the project is planned. For projects with a potentially large environment impact, sufficient consultations with stakeholders, such as local residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan; and

Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor and ethnic minorities who are susceptible to environmental and social impact and who may have little access to the decision-making process within society.

5.11.5 INVOLUNTARY RESETTLEMENT

Involuntary resettlement and loss of means of livelihood are to be avoided where feasible, exploring all viable alternatives. When, after such examination, it is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected;

People to be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by project proponents, etc., in a timely manner. The project proponents, etc. must make efforts to enable people affected by project, to improve their standard of living,

Income opportunities and production levels, or at least to restore them to pre project levels.

Measures to achieve this may include: providing land and monetary compensation for losses (to cover land and property losses), supporting the means for an alternative sustainable livelihood, and providing expenses necessary for relocation and re-establishment of community at relocation sites; and

Appropriate participation by the people affected and their communities must be promoted in the planning, implementation and monitoring of involuntary resettlement plans and measures against the loss of their means of livelihood.

5.11.6 INDIGENOUS PEOPLES

When a project may have adverse impact on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of the relevant international declarations and treaties. Efforts must be made to obtain the consent of indigenous peoples after they have fully informed.

5.11.7 NATIONAL HIGHWAY POLICY OF SOCIAL CONSIDERATIONS

The NHAI Guidelines for Confirmation of Environmental and Social Considerations refer not only to the natural environment, but also to social issues such as involuntary resettlement and respect for the human rights of indigenous peoples.

The objective of the Guidelines is to encourage project proponents seeking funding from MoRTH or Funding Agency to implement appropriate environmental and social considerations in accordance with the Guidelines. In doing so, it endeavors to ensure transparency, predictability and accountability in its confirmation of environmental and social considerations.

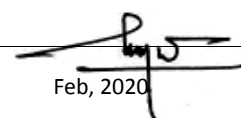
One of the basic principles of Guidelines regarding confirmation of environmental and social considerations is that the responsibility for environmental and social considerations for the project shall be that of the project proponent. NHIDCL confirms environmental and social considerations by undertaking screening, environmental review, and monitoring and follow ups.

Environmental and social considerations required for funded projects cover underlying principles, examination of measures, scope of impact to be examined, compliance with laws, standards and plans, social acceptability and social impacts, involuntary resettlement, indigenous peoples and monitoring.

The following are summary of requirements under the Guidelines.

Social acceptability and social impacts

Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which the project is planned. For projects with a potentially large environment impact, sufficient consultations with stakeholders, such as local residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan; and



Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor and ethnic minorities who are susceptible to environmental and social impact and who may have little access to the decision-making process within society.

5.11.8 POLICY FRAMEWORK FOR THIS PROJECT

Based on the above analysis of applicable legal and policy frameworks of the country and in consistent with state policy requirements the broad resettlement principle for this project shall be the following:

The involuntary resettlement would be avoided wherever possible or minimized as much as possible by exploring project and design alternatives.

The Project or all sub-projects under the program will be screened to identify past, present, and future involuntary resettlement impacts and risks. The scope of resettlement planning will be determined through a survey and/or census of displaced persons, including a gender analysis, specifically related to resettlement impacts and risks.

Meaningful consultations with affected persons, host communities, PIU will be carried out and all displaced persons will be informed of their entitlements and resettlement options. DP's participation in planning, implementation, and monitoring and reporting of resettlement programs will be ensured.

Particular attention will be paid to the needs of vulnerable groups, especially those below the poverty line, the landless, the elderly, women and children, and Indigenous Peoples, and those without legal title to land, and ensure their participation in consultations.

An effective grievance redress mechanism will be established to receive and facilitate resolution of the displaced persons' concerns. The social and cultural institutions of displaced persons and their host population will be supported through proper planning. Where involuntary resettlement impacts and risks are highly complex and sensitive, compensation and resettlement decisions should be preceded by a social preparation phase.

The livelihoods of all displaced persons will be improved or at least restored through (i) land-based resettlement strategies when affected livelihoods are land based where possible or cash compensation at replacement value for land when the loss of land does not undermine livelihoods, (ii) prompt replacement of assets with access to assets of equal or higher value, (iii) prompt compensation at full replacement cost for assets that cannot be restored, and (iv) additional revenues and services through benefit sharing schemes where possible.

Physically and economically displaced persons will be provided with needed assistance, including (i) if there is relocation, secured tenure to relocation land, better housing at resettlement sites with comparable access to employment and production opportunities, integration of resettled persons economically and socially into their host communities, and extension of project benefits to host communities; (ii) Transportation support and development assistance, such as land development, credit facilities, training, or employment opportunities; and (iii) civic infrastructure and community services, as required.

The standards of living of the displaced poor and other vulnerable groups, including women, will be improved to at least national minimum standards. In rural areas legal and affordable access to land and resources will be provided, and in urban areas appropriate income sources and legal and affordable access to adequate housing will be provided to the displaced poor.

If land acquisition is through negotiated settlement, procedures will be developed in a transparent, consistent, and equitable manner to ensure that those people who enter into negotiated settlements will maintain the same or better income and livelihood status. If, however, the negotiated settlement fails, the normal procedure of land acquisition will be followed.

Displaced persons without titles to land or any recognizable legal rights to land will be ensured that they are eligible for resettlement assistance and compensation for loss of non-land assets.

A resettlement plan will be prepared elaborating on displaced persons' entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring and reporting framework, budget, and time-bound implementation schedule.

The draft resettlement plan, including documentation of the consultation process will be disclosed in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected persons and other stakeholders. The final resettlement plan and its updates will also be disclosed to displaced persons and other stakeholders.

Involuntary resettlement will be conceived and executed as part of a development project or program. Full costs of resettlement will be included in the presentation of project's costs and benefits. For a project with significant involuntary resettlement impacts, consider implementing the involuntary resettlement component of the project as a stand-alone operation.

All compensation will be paid and other resettlement entitlements will be provided before physical or economic displacement. The resettlement plan will be implemented under close supervision throughout project implementation.

Resettlement outcomes, their impacts on the standards of living of displaced persons will be monitored; it will be assessed whether the objectives of the resettlement plan have been achieved by taking into account the baseline conditions and the results of resettlement monitoring. Monitoring reports will be disclosed to DPs.

Land acquisition for the project would be done as per both National Highway Safeguard Policies and the RFCTLARR ACT, 2013 in accordance to Manipur RFCTLARR Rules, 2014. To meet the replacement cost of land payment of compensation in revised market rate.

The uneconomic residual land remaining after land acquisition will be acquired as per the provisions of Land Acquisition Act. The owner of such land/property will have the right to seek acquisition of his entire contiguous holding/ property provided the residual land is less than the average land holding of the district.

People moving in the project area after the cut-off date will not be entitled to any assistance. In case of land acquisition, the date of publication of preliminary notification for acquisition under the RFCTLARR Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014 will be treated as the cut-off

date.

All common property resources (CPR) lost due to the project will be replaced or compensated by the project.

The project will recognize three types of displaced persons like (i) persons with formal legal rights to land lost in its entirety or in part; (ii) persons who lost the land they occupy in its entirety or in part who have no formal legal rights to such land, but who have claims to such lands that are recognized or recognizable under national laws; and (iii) persons who lost the land they occupy in its entirety or in part who have neither formal legal rights nor recognized or recognizable claims to such land. The involuntary resettlement requirements apply to all three types of displaced persons.

5.11.9 METHODOLOGY FOR DETERMINATION OF VALUATION OF ASSETS

All lands proposed to be acquired under this project will be compensated as per replacement cost. Land surveys to determine compensation rates will be conducted on the basis current land use and assessment of market value. Records as they are on the cut-off date will be taken into consideration while determining the current use of land. The EA will determine the replacement cost as per RFCTLARR ACT, 2013 in accordance to Manipur RFCTLARR Rules, 2014 based on market survey and in consultation with DPs. After notification for acquisition as per National Highway Safeguard Policies, the EA will negotiate with DPs for voluntary acquisition and ensure payment of additional registration cost and solatium to all DPs. The EA will ensure that the rates established for the project are sufficient to purchase the same quality and quantity of land in the specific area.

The compensation for houses, buildings and other immovable properties will be determined on the basis of replacement cost as on date without depreciation. The EA will determine the replacement cost of structures in consultation with the owners by assessing (i) sources and cost of materials, whether the materials are locally available; (ii) type of shops (private or state-owned); (iii) distance to be traveled to procure materials; (iv) obtaining cost estimates through consultation with three contractors/suppliers in order to identify cost of materials and labor; (v) identifying the cost of different types of houses of different categories and compare the same with district level prices.

Cash compensation for properties belonging to the community if opted by the community, will be provided to enable construction of the same at new places through the community/ local self-governing bodies / appropriate authority in accordance with the modalities determined by such bodies / authority to ensure correct use of the amount of compensation.

Compensation for trees will be based on their market value. Loss of timber trees will be compensated at their replacement cost while the compensation for the loss of fruit bearing trees will be calculated as annual produce value for at next 15 years depending on the nature of crops/trees.

5.11.10 PROCEDURE AND STEPS OF LAND ACQUISITION

The land acquisition in this project context will be accordingly the RFCTLARR Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014, along with additional provision made under RFCTLARR ACT, 2013 in accordance to Manipur RFCTLARR Rules, 2014. The process for land acquisition in the project will be as follows:

- ❖ All the land identified for the project will be placed under the RFCTLARR ACT, 2013 in accordance to Manipur RFCTLARR Rules, 2014 and a notification with Government's intension to acquire land will be issued by the District Collector (DC).
- ❖ Objections if any must be made within 30 days to the District Collector by the landowners.
- ❖ The land will be then placed under the LA Authority where a declaration will be made by the Government for acquisition of land for public purpose.
- ❖ The DC will take steps for the acquisition, and the land is placed and notice will be issued by the DC in the name of persons interested.
- ❖ Once the land is placed under the EA will negotiate with DPs for voluntary acquisition to ensure payment of additional registration cost and solatium to all DPs.
- ❖ The DC will make declaration of award and disburse the compensation to the DPs

5.12 ENTITLEMENTS, ASSISTANCE AND BENEFITS

1.12.1 DEFINITION OF DPS AND ELIGIBILITY

The project will have three types of displaced persons i.e., (i) persons with formal legal rights to land lost in its entirety or in part; (ii) persons who lost the land they occupy in its entirety or in part who have no formal legal rights to such land, but who have claims to such lands that are recognized or recognizable under national laws; and (iii) persons who lost the land they occupy in its entirety or in part who have neither formal legal rights nor recognized or recognizable claims to such land. The involuntary resettlement requirements apply to all three types of displaced persons. DP's entitled for compensation, assistance and rehabilitation provisions under the sub project are:

All DP's losing land either covered by formal legal title, recognizable title, or without legal status;

Tenants and sharecroppers whether registered or not;

Owners of buildings, crops, plants, or other objects attached to the land; and DP's losing business, income, and salaries

Compensation eligibility is limited by a cut-off date as set for this project on the day of the beginning of the census survey which is 13th November 2018 or as decided by the EA. DP's who settle in the affected areas after the cut-off date will not be eligible for compensation. They, however, will be given sufficient advance notice, requested to vacate premises and dismantle affected structures prior to project implementation. Their dismantled structures materials will not be confiscated and they will not pay any fine or suffer any sanction.

1.12.2 ENTITLEMENTS

The entitlement provisions various categories of DP's in terms loss of land house and income as per census survey are detailed below:

Agricultural land impacts will be compensated at replacement cost. Cash compensation at replacement cost will be determined according to RFCTLARR Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014. If the residual plot(s) is (are) not viable, i.e., the DP becomes a marginal farmer, three options are to be given to the DP, subject to his acceptance which are (i) The DP remains on the plot, and the compensation and assistance paid to the tune of required amount of land to be acquired, (ii) Compensation and assistance are to be provided for the entire plot including residual part, if the owner of such land wishes that his residual plot should also be acquired by the EA, the EA will acquire the residual plot and pay the compensation for it and (iii) If the DP is from vulnerable group, compensation for the entire land by means of land for land will be provided if DP wishes so, provided that land of equal productive value is available. All fees, stamp duties, taxes and other charges, as applicable under the relevant laws, incurred in the relocation and rehabilitation process, are to be borne by the EA.

Loss of homestead /Commercial land will be compensated at replacement cost. Cash compensation at replacement cost will be determined according to RFCTLARR Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014. All fees, stamp duties, taxes and other charges, as applicable under the

relevant laws, incurred in the relocation and rehabilitation process, are to be borne by the EA.

Loss of Structures Residential/Commercial/Other will be compensated at replacement value with other assistance. The details on the determination of compensation will be as (i) Compensation of structure will be paid at the replacement cost to be calculated as per latest prevailing basic schedules of rates (BSR) without depreciation or the replacement cost, (ii) Shifting assistance of Rs. 50,000/-, (iii) Right to salvage material from demolished structure and frontage etc., and (iv) Rental assistance as per the prevalent rate in the form of grant to cover maximum three month rentals.

Loss of rental accommodation by the tenants will be compensated as rental assistance and shifting assistance. The details assistance will be as per (i) Rental assistance for both residential & commercial tenants as per the prevalent rate in the form of grant to cover maximum three month rentals, (ii) Additional structures erected by tenants will also be compensated and deducted from owner's compensation amount, (iii) Shifting assistance based on type of house and household assets, (iv) Any advance deposited by the tenants will be refunded from owners total compensation package to the tenant on submission of documentary evidences and (v) Right to salvage material from demolished structure and frontage etc. erected by tenants

Loss of Trees will be compensated to Land holders, Share- croppers and Lease holders based on the market value to be computed with assistance of horticulture department. This can further be detailed in specific ways such as (i) Advance notice to DPs to harvest fruits and remove trees, (ii) b) For fruit bearing trees compensation at average fruit production for next 15 years to be computed at current market value and (iii) For timber trees compensation at market cost based on kind of trees

Loss of Crops will be compensated to Land holders, Share- croppers and Lease holders based on the market value to be computed with assistance of agricultural department. The detailed compensation methods are (i) Advance notice to DPs to harvest crops and (ii) In case of standing crops, cash compensation at current market cost to be calculated of mature crops based on average production.

Loss of Livelihood due to Loss of primary source of income will be compensated through rehabilitation assistances. There are various categories of entitled persons under this category which are (i) Titleholders losing income through business, (ii) Titleholders losing income through agriculture, (iii) Wage earning employees indirectly affected due to displacement of commercial structure, (iv) Agricultural labourer/share-cropper and (v) Licensed mobile vendors and kiosk operators. Details of entitlements for the above categories are described below:

Title holders losing their business establishment due to displacement will be provided rehabilitation assistance through a lump sum Transportation allowance of Rs. 9,000/-

Titleholders losing income through agriculture will be provided with the rehabilitation assistance which are (i) Training Assistance will be provided for income generating vocational training and skill up gradation options as per DPs choice at the rate of Rs. 5,000 per affected household to those households losing their primary source of income and (ii) Employment opportunity for DPs in the road construction work, if available and if so desired by them.

Wage earning employees indirectly affected due to displacement of commercial structure will be assisted through rehabilitation assistance which are; (i) persons indirectly affected due to the

employer having being displaced, on case-by-case, based on local wage rates for three months, (ii) Employment opportunity for DPs in the road construction work, if available and if so desired by them, or (iii) National/State level job card under National Rural Employment Guarantee Program.

Rehabilitation assistance for Agricultural labourer/share-cropper will be paid as per the details such as (i) Assistance is to be paid as per the prevailing local wage rates for 100 days., (ii) b) Employment opportunity for DPs in the road construction work, if available and if so desired by them, or (iii) National/State level job card under National Rural Employment Guarantee Program.

Licensed mobile vendors and kiosk operators will be provided with the rehabilitation assistance which are (i) Mobile vendors are not eligible for compensation or assistance (ii) Those mobile vendors in possession of a permit from local authorities to operate in the affected area will be treated as kiosks operators, (iii) Kiosk operators and vendors licensed to operate from affected locations will be entitled to a one time lump sum assistance of Rs. 10,000/-.

Loss of community infrastructure/common property resources will be compensated either by cash compensation at replacement cost or reconstruction of the community structure in consultation with the affected community

Additional Assistance to vulnerable groups (Vulnerable households including BPL, SC, ST, WHH, disabled and elderly) will be paid with Special Assistance which will be one time lump sum assistance of Rs. 20,000/ to vulnerable households. This will be paid above and over the other assistance(s) as per this entitlement matrix.

Other Unanticipated Impacts (Temporary impact during construction like disruption of normal traffic, damage to adjacent parcel of land / assets due to movement of heavy machinery and plant site) will be compensated to either individual or community in the form of (i) The contractor shall bear the cost of any impact on structure or land due to movement of machinery during construction or establishment of construction plant and (ii) All temporary use of lands outside proposed RoW to be through written approval of the landowner and contractor. Location of Construction camps by contractors in consultation with RCD.

Any unanticipated impacts (if any) due to the project will be documented and mitigated based on the spirit of the principle agreed upon in this entitlement matrix.

1.12.3 ENTITLEMENT MATRIX

Compensation for the lost assets to all displaced persons will be paid on the basis of replacement cost. Resettlement assistance for lost income and livelihoods will be provided to title holders. Special resettlement and rehabilitation measures will be made available to the “Vulnerable Group” comprises of DPs living below poverty line (BPL), SC, ST, women headed households, the elderly and the disabled. An Entitlement Matrix has been formulated, which recognizes and lists various types of losses resulting out of the project and specific compensation and resettlement packages.

Table 5.19: Entitlement Matrix

Sl.	Impact Category	Entitlements	Implementation Guidelines
PART I.TITLE HOLDERS-Compensation for Loss of Private Property			
1	Loss of Land (agricultural, homestead, commercial or otherwise)	1.1 Compensation for land at Replacement Cost or Land for land, where feasible	Land will be acquired by the competent authority in accordance with the provisions of RFCTLARR Act, 2013. Replacement cost for Land will be, higher of (i) market value as per Indian Stamp Act, 1899 for the registration of sale deed or agreements to sell, in the area where land is situated; or (ii) average sale price for similar type of land, situated in the nearest village or nearest vicinity area, ascertained from the highest 50% of sale deeds of the preceding 3 years; or (iii) consented amount paid for PPPs or private companies. Plus 100% solatium and 12% interest from date of notification to award. The multiplier factor adopted by GoM for land in rural area, based on the distance from urban area to the affected area, will be applied. In case of severance of land, house, manufactory or other building, As per Section 94(1), the whole land and /or structure shall be acquired, if the owner so desires.
2	Loss of Structure (house, shop, building or immovable property or assets attached to the land)	2.1 Compensation at replacement cost	The market value of structures and other immovable properties will be determined by replacement cost and/or PWD on the basis of relevant PWD Schedule of rates (SR)N as on date without depreciation. Plus 100% solatium For partly affected structures, the DP will have the option of –claiming compensation for the entire structure, if the remaining portion is unviable.

Sl.	Impact Category	Entitlements	Implementation Guidelines
PART II. REHABILITATION AND RESETTLEMENT- Both Land Owners and Families Whose Livelihood is Primarily Dependent on Land Acquired			
3	Loss of land	3.1	Employment to at least one member per affected family in the project or arrange for a job in such other project as may be required after providing suitable training and skill development in the required field and at a rate not lower than the minimum wages provided for in any other law for the time being in force. Or One-time payment of Rs.5,00,000/-for each affected household. Or Annuity policy that shall pay Rs, 2000/- per month for 20 years with appropriate indexation to CPIAL
		3.2	Monthly subsistence allowance of Rs, 3000/-per month for a period of one year to affected households who require to relocate due to the project
		3.3	Transportation assistance of Rs, 50,000/- for affected households who require to relocate due to the project
		3.4	One time assistance of Rs, 25,000/- to all those who loss a cattle shed
		3.5	One time Resettlement Allowance of Rs, 50,000/- for affected house \hold who have to relocate
		3.6	Additional onetime assistance of Rs, 50,000/-to scheduled caste and scheduled tribe families who are displaced from scheduled areas and who require to relocate due to the project

Sl.	Impact Category	Entitlements		Implementation Guidelines
4	Loss of Residence	4.1	An alternative house for those who have to relocate, as per IAY specification in rural areas and constructed house/flat of minimum 50sq.m. in urban areas or cash in lieu of house if opted (the cash in lieu of house will be Rs, 70,000/-in the line with Gol IAY standards in rural areas and Rs, 1,50,000 in case of urban areas) , for those who do not have any homestead land and who have been residing in the affected areas continuously for a minimum period of 3years	Stamp Duty and registration charges will be borne by the project in case of new houses or sites.
		4.2	Employment to at least one number per affected family in the project or arrange for a job in such other project as may be required after providing suitable training and skill development in the required field and at a rate not lower than the minimum wages provided for any other law for the time being in force. Or One Time payment of Rs, 5,00,000/- for each affected household Or Annuity policy that shall pay Rs, 2000/- per month or 20 years with appropriate indexation to CPIAL	
		4.3	Monthly subsistence allowance of Rs, 3000/- per month for a period of one year to affected households who require to locate due to the project	
		4.4	Transportation assistance of Rs, 50,000/- for affected households who require to relocate due to the project	
		4.5	One time assistance of Rs, 25,000/-to all those who lose	

Sl.	Impact Category	Entitlements		Implementation Guidelines
			a cattle shed	
		4.6	One time assistance of Rs, 25,000/- for each affected family of an artisan or self-employed and who has to relocate	
		4.7	One time Resettlement Allowance of Rs, 50,000/-for affected household who have to relocate	
		4.8	Additional onetime assistance of Rs, 50,000/-to scheduled caste and scheduled tribe families who are displaced from scheduled areas and who require to relocate due to the project	
		4.9	Right to salvage affected materials.	
5	Loss of shop /trade /commercial structure	5.1	Employment to at least one number per affected family in the project or arrange for a job in such other project as may be required after providing suitable training and skill development in the required field and at a rate not lower than the minimum wages provided for in any other law for the Or One-time Payment of Rs,5,00,000/-for each affected household Or Annuity policy that shall pay Rs, 2000/-per month for 20 years with appropriate indexation to CPIAL	
		5.2	Monthly subsistence allowance of 3000/- per month for a period of one year to affected household who require to relocate due to the project	
		5.3	Transportation assistance of Rs, 50,000/-for affected household who require to	

Sl.	Impact Category	Entitlements		Implementation Guidelines
			relocate due to the project	
		5.4	One time assistance of Rs, 25,000/-for each affected family of an artisan or self-employed or small trader and who has to relocate	
		5.5	One time Resettlement Allowance of Rs, 50,000/-for affected household who have to relocate	
		5.6	Additional onetime assistance of 50,000/-to scheduled caste and scheduled tribe families who are displaced from scheduled areas and who require to relocate due- to the project	
		5.7	Right to salvage affected materials	
PART IV.IMPACT TO VULNERABLE HOUSEHOLD				
8	Vulnerable Household	8.1	Training for skill development. This assistance includes cost of training and financial assistance for travel/conveyance and food.	One adult member of the affected household, whose livelihood is affected, will be entitled for skill development.
		8.2	One time assistance of Rs,25,000/-to DHs who have to relocate	The PIU will identify the number of eligible vulnerable displaced persons during joint verification and updating of the RP and will conduct training need assessment in consultations with the DPs so as to develop appropriate training programmes suitable to the DPs skill and the region. Suitable trainers or local resources will be identified by PIU in consultation with local training institutes.
PART V.IMPACT DURING CIVIL WORKS				
9	Impact to structure / assets/tree/crops	9.1	The contractor is liable to pay damages to assets/tree/crops in privet/public land, caused due to civil works	The PIU will ensure compliance

Sl.	Impact Category	Entitlements		Implementation Guidelines
10	Use of private land	10.1	The contractor should obtain prior written consent from the landowner and pay mutually agreed rental for use of private land for storage of material or movement of vehicles and machinery or diversion of traffic during civil works	
PART VI. COMMON PROPERTY RESOURCES				
11	impact to common property resources such as places of worship, community buildings, schools, etc.	11.1	Relocation or restoration, if feasible, or cash compensation at replacement cost.	
12	Utilities such as water supply, electricity, etc.	12.1	Will be relocated and services restored prior to commencement of civil works	The PIU will ensure that utilities are relocated prior to commencement of civil works in that stretch of the road corridor in accordance with the civil works schedule
PART VII. UNFORSEEN IMPACT				
Unforeseen Impacts encountered during implementation will be addressed in accordance with the principles of RFCTLARR2013/ Safeguard policy Guidelines of Multilateral Institutions				

5.13 GRIEVANCE REDRESS CELL

There is a need for an efficient grievance redressal mechanism, which will assist the DPs in resolving queries and complaints. Any disputes will be addressed through the grievance redressal mechanism.

Formation of Grievance Redressal Cell (GRC) is most important for grievance redressal and it is anticipated that most, if not all grievances, are settled by the GRC. Detailed investigation will be undertaken which may involve field investigation with the concerned DPs. The GRCs are expected to resolve the grievances of the eligible persons within a stipulated time.

The GRCs will continue to function, for the benefit of the DPs, during the entire life of the project including the defects liability period. The response time prescribed for the GRCs is 15 days. The GRC will meet once in a fortnight to expedite redressal of grievances.

People are not debarred from moving to the court for issues including those related to R&R Entitlement. However, it is expected that the GRCs will play a very crucial role in redressing grievances of the DPs, and will help the implementation of the project as scheduled.

5.13.1 CONSTITUTION OF GRIEVANCE REDRESSAL COMMITTEE (GRC)

The committee will comprise of representatives of PIU; public representatives (viz., Member of Parliament, Member of Legislative Assembly, etc.) from respective district; representative of women group, squatters and vulnerable DPs; line department and affected persons especially women as well as the representative of respective District Administration. Minimum participation of women in GRC will be 33%. At least two persons from each group will be there in the GRC. The functions of the GRC will be:

- ❖ To provide support for the DPs on problems arising out of Land/ Property acquisition.
- ❖ To record the grievances of the DPs, categorizes and prioritize and solve them within a month.
- ❖ To inform PIU of serious cases within an appropriate time frame; and
- ❖ To report to the aggrieved parties about the development regarding their grievance and decision of PIU.

5.13.2 OPERATIONAL MECHANISM

It is proposed that GRC will meet regularly (at least once in 15 days) on a pre-fixed date (preferably on first 7th day of the month). The committee will look into the grievances of the people and will assign the responsibilities to implement the decisions of the committee. The committee will deliver its decision within a month of the case registration.

The mechanism will be based on proposed laws. The Grievance Redressal Cell (GRC) will be set up at each district. Grievance not resolved amicably at the district level will be routed through PIU to the

GRC. Arbitrator may also be appointed for unresolved cases. Arbitrator will be selected by PIU.

The various queries, complaints and problems that are likely to be generated among the DPs will primarily relate to disputes of ownership of assets, identification of legal heirs of deceased property owner and other non-land related issues.

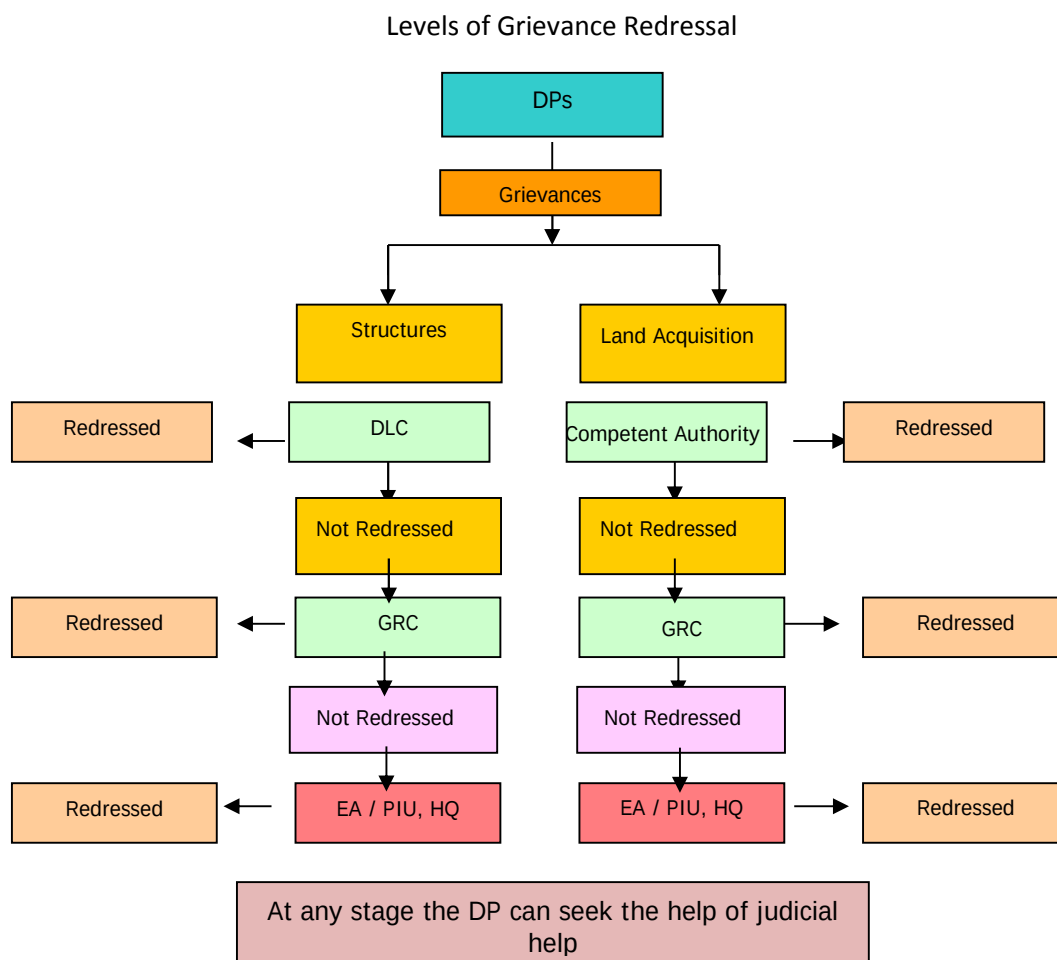
The PIU and office of NHIDCL will act as Public Information Centres, which will be in possession of all documents relating to the Project including compensation packages and grievance redressal procedures, and will provide any information regarding compensation and grievance redressal.

Through public consultations, the DPs will be informed that they have a right to grievance redressal. The DPs can present their grievances or queries to the GRC. The PIU will act as an in-built grievance redressal body.

5.13.3 GRIEVANCE REDRESSAL MECHANISM FOR DPS

The successive grievance redressal stages are illustrated in the flow chart shown below:

Flow Chart



District Level Committees: The first stage will be District Level Committees (DLCs). The DPs will be encouraged to be part of DLCs composed of:

- ❖ Representatives of affected persons;
- ❖ Panchayat members of the affected villages; and
- ❖ PIU's Field worker

33% participation of women from affected families and full participation of women from the women headed households will also be encouraged.

The DLCs will meet at regular intervals as decided by the community, specifically for grievance redressing purposes at a pre-decided date, time and place. The DPs can be formally present in these meetings and discuss their queries and grievances. At the community level, the committee will have the power to resolve matters either by providing information or agreeing on a follow-up action. It may also reject some grievances for not being legitimate. However, it will have to explain to the AP, the premise for not recording the grievance. Legitimate grievances, which the DLC is unable to resolve, will be taken to the GRC, which will then take the necessary action after reviewing the findings of a thorough investigation. The DLC will maintain a register of all queries and grievances, and the subsequent action taken.

The DPs will present their grievance, concerning compensation for structures / land and R&R assistance to the DLC. The DLC will examine the grievance, and where required will review with DRO/CA and will do utmost to reach an amicable settlement to the satisfaction of the DPs.

5.13.4 ROLE OF NHIDCL/EA HEADQUARTERS

The DPs, who would not be satisfied with the decision of the GRC, will have the right to take the grievance to the NHIDCL/EA Head Office for its redressal. Failing the redressal of grievance at NHIDCL/EA, the DPs will take the case to Arbitration. The Arbitrator(s) will be independent but appointed by NHIDCL. Taking grievances to arbitration and Judiciary will be avoided as far possible and the PIU will make utmost efforts at reconciliation at the GRC level.

5.14 INCOME RESTORATION MEASURES

5.14.1 INTRODUCTION

The Development projects have an adverse impact on the income of project-affected persons. They also have a negative impact on the socio- cultural systems of affected communities. Restoration of pre-project levels of income is an important part of rehabilitating socio-economic and cultural systems in affected communities.

As indicated by the Income Restoration Study in road sector projects, income restoration interventions are much more complex due to occupational diversity of DPs. For example, there may be a mix of a large number of land title holders (big, small and marginal farmers) or/and engaged in small business enterprises (vehicle repairing shops, small hotels, other rural/semi urban small activity based shops, commercial squatters etc.) as displaced people. This complex nature of occupational diversity poses a problem for mitigation measures in the context of economic rehabilitation. The task becomes even more challenging due to the inherent pressure of completion of road construction work in a time bound manner.

However, the R&R framework proposed for the project has adequate provisions for restoration of livelihood of the affected communities. Attempts have been made towards improving the Income restoration strategies. The focus of restoration of livelihood is to ensure that the Affected Persons (DPs) are able to at least "regain their previous living standards". To restore and enhance the economic conditions of the DPs, certain income generation and income restoration programs are incorporated in the RP. To begin with, providing employment to the local people during construction phase will enable them to participate in the benefits of the project, reduce the size of intrusive work forces & keep more of the resources spent on the project in the local economy. It will also give the local communities a greater stake & sense of ownership in the project.

The R&R framework of the project provides that the loss of livelihood which would mainly result from the loss of land will be compensated by way of:

- ❖ Alternate economic rehabilitation support and training for up-gradation of skills or imparting new skills; and various R&R assistance such as Transportation Allowance, Economic rehabilitation grant for vulnerable.
- ❖ Preference of providing employment through the contractors for road works specially to those belonging to vulnerable groups.

Alternate village income sources such as village based industries will be promoted by the project in association with the local NGOs/CBOs. Villagers will be supported & encouraged to develop industries that are suited to their resources, skills and interests. Support in the form of technical assistance and training, marketing, business management and coordination will be provided by the PIU. The project affected families eligible for Income Restoration is shown in table below:

Table 5.20: Income Restoration for displaced persons for Package-III

Sl.	Loss	No. of Person	Percentage
1	Owners of Commercial Structure (TH)	2	50.0%
2	Owners of Residential cum Commercial Structure (TH)	1	25.0%
3	Commercial tenant	1	25.0%
4	Employee in commercial Structures	0	0.0%
	Total	4	100.0%

Source: Census Survey on November, 2018

The project will assist the DPs in liaison with PIU, to encourage the DPs to work in the road construction services. The project will:

- ❖ Assist to establish contact with the construction contractors for road works;
- ❖ Encourage to enlist labour for work to handle road related contract services;
- ❖ Compensate them for the loss of livelihood and income resulting from land acquisition;
- ❖ Identify training needs & modules;
- ❖ Assist access to poverty alleviation programs of the Govt. such as Swarnjayanti Gram Swa Rojgar Yojna especially for those below poverty line.
- ❖ Also assist to identify self-employment options.

5.14.2 SELF-EMPLOYMENT GENERATION SCHEME

PAPs will be encouraged to take up training for income generating activities, with active support from the project through the PIU, in self-employment schemes.

Besides the land losers, other DPs namely homestead losers; daily wage labourers and DP in the vulnerable category are eligible for enrolment into the training program. For training and upgradation of skills Rs. 5000 per family has been worked out as per the entitlement matrix. The PIU will take the initiative to make necessary arrangements for providing infrastructure and other institutional support that will be required, to assist the DP to get financial support through local bank and Government program. The PIU would generate awareness among the DPs about the different income earning opportunities and facilitate and training among DPs. The PIU-R&R cell will not only take the initiative for self-employment generating schemes and also arrange for appropriate training programmes so that the trained DPs will be eligible for others jobs.

The principles governing the resettlement and rehabilitation will take into consideration:

- ❖ Rehabilitation assistance in the form of shop space if opted by 50 people or more;
- ❖ Transportation allowance.
- ❖ Women, handicapped and BPLs will be in the vulnerable category, will be given priority in allotment of shops.



- ❖ Compensation for those who don't want shop space, these DPs will be assisted for alternate livelihood scheme. Till then, the amount paid for assistance will be kept in banks as joint account with the Project Authority.
- ❖ Only one shop per DP will be considered, multiple occupations will not be considered.
- ❖ Only those DPs will be eligible for such compensation whose primary source of income is from shops that will be lost.
- ❖ Conditions for shop allotment to DPs will be laid down which will include formation of market committees with DP participation, representative of this committee for smooth operation and maintenance of the complex. A nominal license fee will be charged.
- ❖ Access to loans will be facilitated by the Project Authority.
- ❖ Shops will be allotted based on the type of business carried out prior to eviction.

5.14.3 OPTION OF SELF-EMPLOYMENT AND EA'S ASSISTANCE

It is perceived that the EA will be unable to provide direct employment to the DPs. Hence, an alternative programmes are proposed as outlined in the above sections. Training for self-employment and assistance in setting up micro-enterprises is the primary vehicle of rehabilitation.

The following order of priority would be considered for the DPs entitled for self-employment:

Have the requisite educational qualification.

Have taken training in some micro-enterprise scheme and appeals to the EA for assistance; and

Possess previous experience in running micro-enterprises.

However, relaxation will be made for women, those below poverty line, and minorities and vulnerable DPs who have taken training, but may not have requisite educational qualifications and experience. In both cases, the R&R cell in consultation with the PIU and the DLCs will vet appeals.

The key parameters of the EA level of assistance in setting up of micro-enterprises are as follows:

Survey of marketing opportunities by the PIU and information on DPs under the supervision of R&R Cell.

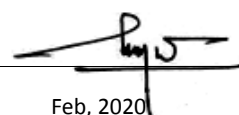
Identification of training needs and modules that matches market opportunities. This will be done by the PIU.

PIU to assist the DPs to form groups/cooperatives that can bid for contracts tendered by the construction contractors or its sub-contractors. Activity to be supervised by R&R Cell.

R&R cell through the PIU will assist the DPs to get access to capital by facilitating formation of a credit window affordable to the DPs as individuals or groups in the local bank.

EA will co-ordinate with the local bank to extend credit to the DPs. EA will extend a letter of introduction to the bank.

Encourage the DPs to service loans and through awareness generation and training programmes by the PIU.



R&R cell in collaboration with the PIU will also facilitate the DPs access to poverty alleviation programmes of the Government.

R&R cell will monitor the ventures established and incomes derived from these programmes. The information will be fed into the R&R database. The ventures and incomes derived will again be monitored by an independent agency and the Lending Institute vets the reports submitted by the PIU-R&R cell.

5.14.4 MARKET FEASIBILITY STUDY

No business enterprise or income restoration program will sustain until and unless it is based on the market need and demand. Hence, EA through it's PIU who will undertake the detailed market feasibility study to clearly prepare the list of all viable and feasible enterprises. The scope of this study covers service and non-service based enterprises, the raw material availability and assured consumer market. The findings of the study will also be matched with the profile of the DPs and accordingly the options will be offered to the DPs. However, R&R consultants in the local district and village markets to make reconnaissance of the proposed demand and supply situation conducted rapid market survey. The local district markets comprise of all types of shops; hardware, construction materials, general store, vegetable markets, cloth stores, auto repair shops etc. The development of the project is expected to increase urbanization and commercialization of the society in particular along the project corridor. Demand for consumer goods in the area would consequently increase. Initiation of road construction activities will also result in a heavy spree of construction activities in and around the project area. This would consequently increase cash flow in the area.

Co-operatives of women markets can be set up for preparation of jams and pickles, basket making and moulding of leaf cups and plates. Poultry and animal husbandry units can also be set up in villages. Nursery to raise plants could also be quite viable since EA is committed to plant trees, as they would be felling many for the project. PIU will facilitate marketing facilities support through backward and forward linkages in order to make the self-employment schemes successful and will conduct periodical monitoring of these units over the implementation period and will take midterm correction measures if required. For marketing purposes, the PIU may tie these units up with khadi and village industries cooperatives (KVIC) or with the export promotion board or similar organizations. After establishment of the initial marketing linkages, the PIU will have to be gradually phase out their involvement.

5.14.5 TRAINING NEEDS OF DPS

Very few DPs possess any professional skills in the project area. Hence, a large scale and intensive training programme need to be undertaken. The DPs eligible for training will either be trained in the Training Institutes identified by PIU. Training will be provided to vulnerable DPs as per the entitlement matrix. It is expected that such training will be organized within 12 months of property acquisition. PIU shall carry out the detail exercise of skill mapping and training need assessment before finalization of any training schemes.



5.14.6 COMPREHENSIVE TRAINING POLICY

Training is an important part of RP. Following training modules will be developed;

5.14.7 TRAINING OF DPS

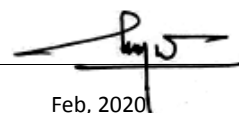
The training imparted will be essentially of two types: a technical training relevant for jobs and the other for non-land and land based self-employment and skill development schemes. The policy is devised under the following parameters:

- ❖ Eligible DP's will get training assistance.
- ❖ Provision for training has already been made in the RP budget. This amount is not redeemable in cash. It is based on an estimate of a minimum of 6 weeks of training per person, which may be stretched to:
- ❖ Maximum of one year, which could allow daily allowance to EP, cost of experts, trainers and other incidental expenses. In case where the type of training requested by the DP's exceeds the budgeted amount, the EA will review the request on a case-by-case basis through the R&R cell or the shortfall will be met from ERG in case DP is eligible for that.
- ❖ DP's will have the right to participate in institutional form of training at proposed institutions facilitated by PIU. DP's will have the right to transfer his/her training entitlement to his/her immediate family member if the DP desires to do so. The PIU will coordinate the process.
- ❖ DP's shall request the EA for participation in a particular training in consultation with the PIU. The EA will approve and pay the Training Institution directly and the cost will be deducted from the DP's training entitlement.
- ❖ Eligibility criteria for training will feature on the ID card.
- ❖ On completion of training DP's will receive an introductory letter/certificate from the EA. This will assist the DP's in approaching the bank for loans to start micro enterprises.

5.14.8 TRAINING MECHANISM

The implementation of the training procedure would involve the following DP's:

- ❖ Regular survey of perceived training needs of DP's by PIU in collaboration with the R&R cell and Panchayat level committees will lead to prioritizing and selection of schemes for training.
- ❖ Identification of Training Institutes/individuals/experts by the PIU can be subcontracted to conduct relevant training demanded by DP's within the financial means of the entitlement and preparation of TOR for the same by the PIU.
- ❖ Preparation of list of trainees (phase wise) by the PIU in collaboration with the DLCs and R&R Cell.
- ❖ Awareness generation and information dissemination on the schemes by the PIU to the selected trainees to ensure transparency about the training schemes and the entitled



amounts.

- ❖ Registration of the DPs, payment of courses and maintenance of all records, regarding portion of entitlement used by DP for a particular course, will be done by the PIU. The PIU will submit the information to the R&R cell, for inclusion in the R&R database.

The PIU, EA will co-ordinate with the different recognized training organization, including professionals who will be engaged by the EA, to impart training in different trades to the DPs either in the project area or any other place fixed by the institutes. Care shall be taken by the R&R cell that the funds for training are utilized in best possible ways.

5.14.9 WOMEN'S NEEDS & PARTICIPATION

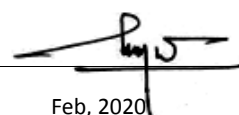
In the process of R&R, women require special attention. Change caused by relocation does not have equal implications for members of both the sexes and may result in greater inconvenience to women. Due to disturbance in production system, reduction in assets like land and livestock, women may have to face the challenge of running a large household in limited income and resources. This in turn may force woman as well as children to participate in work for supplementing the household income. In contrast to this, due to changes that are likely to take places for any development project, especially changes in environment and land labour ratio, those women who at present are engaged in activities like agriculture labour, or collection and sale of forest produce may find themselves unemployed and dependent.

EA would, therefore, make efforts to maintain the social support network for women headed households as far as possible so that they remain closer to their locations and /or provide special services at the new sites. Special assistance would consist of the following:

- ❖ Allowing them priority in site selection
- ❖ Relocating them near site wherever possible
- ❖ Arranging with the contractor to construct their houses
- ❖ Providing assistance with dismantling salvageable materials from their original home
- ❖ Providing them priority access to all other mitigation and development assistance, and
- ❖ Monitoring their nutritional & health status.

Some examples of meeting practical needs of women that will be implemented by EA are: -

- ❖ Reduce women's workloads by providing standpipes, toilet facilities, and the likes.
- ❖ Improve health services by providing safe drinking water, family planning and HIV/AIDS counselling, sanitation training, immunization, etc.
- ❖ Assist in childcare services for wage earning mothers, primary schools, inputs in kitchen gardening etc.
- ❖ Increase access to productive resources.
- ❖ Promote equal opportunities for women's employment.



Encouraging women's participation in development projects is a policy being followed by GoI. There are several ways in which women will be able to participate in the implementation programme: -

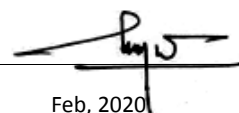
- ❖ The independent agency for monitoring and evaluation will have 33% representation of women key professionals and technical support team.

5.14.10 MEASURES TOWARDS INCOME RESTORATION AND UPLIFT OF VULNERABLE PEOPLE

EA has evolved a number of measures towards resettlement and rehabilitation of the vulnerable families including the women headed households, SC/ST below poverty line and the poor (BPL in general) getting affected by its projects. The considerations therein have been compiled as follows:

- ❖ All the affected families falling under the vulnerable category including the BPL are going to be assisted to uplift their economic status irrespective of their ownership status. Thus, it implies that whether they do or do not possess legal title of the lands/assets, whether they are tenants or encroachers or squatters, they will be assisted in restoring their livelihood.
- ❖ Additional grant for severance of land, residual plots, expenses on fees, taxes, etc. and alternative economic rehabilitation support and training for up-gradation of the skills.
- ❖ In case of loss of non-agricultural private property, option for residential/commercial plot at resettlement site will be provided free of cost to vulnerable families if so opted by a group of them apart from all other considerations like compensation at replacement value, Transportation allowance, shifting allowance, rental allowance for disruption caused to BPL tenants, compensation for advance rental deposits, right to salvage materials for the demolished site, etc.
- ❖ There is a provision for additional support to the vulnerable people who have been affected by the loss of livelihood / primary source of income. The assistance will be the economic rehabilitation grant supported with vocational training of DPs choice. The training will include starting of a suitable production or service activity. In case the money is not spent on the training program, the equivalent amount is to be paid as per DPs choice.
- ❖ Inter agency linkages for income restoration.

Majority of the eligible families for income restoration earn their livelihood from marginal agriculture or petty businesses, and it is imperative to ensure that the DPs are able to reconstruct their livelihood. Based on the market feasibility study, the list of livelihood schemes will be developed, and based on felt needs of the target group population the activities will be prioritized through people's participation. Further, these options will be tested for their viability against availability of skill, raw material and available appropriate technology. Suitable alternative livelihood schemes will be finally selected, where training on skill up gradation, capital assistance and assistance in the form of backward-forward linkages (with respect to the selected livelihood schemes) can be provided for making these pursuits sustainable for the beneficiaries, of the target group. Income generation schemes will be developed in consultation with the project affected/displaced families. The grants received for such purpose for the project, will be used for the



skill development training to upgrade their proposed skill, purchase of small scales capital assets etc. While developing the enterprise development or the income generation activities, the PIU will contact the local financial institutions for financing the economic ventures. The marketing and milk federations will also be contacted for planning sustainable economic development opportunities.

5.14.11 SHORT-TERM INCOME RESTORATION ACTIVITIES

Short term IR activities mean restoring DPs' income during periods immediately before and after relocation. Such activities will focus on the following:

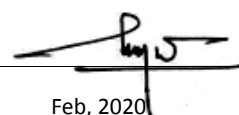
- ❖ Ensuring that adequate compensation is paid before relocation.
- ❖ Transit allowances.
- ❖ Providing short term, welfare based grants and allowances such as:
- ❖ One-time relocation allowance or free transport to resettlement areas or assistance for transport.
- ❖ Free or subsidized items.
- ❖ Special allowance for vulnerable groups as per entitlement framework capacity. Timely establishment & involvement of appropriate R&R institutions would significantly facilitate achievement of objectives of the R&R program. The main R&R institution would include:
 - EA,
 - Local Administration
 - Line departments
 - PIU
 - DLC/GRC
 - Training Institutions
 - M&E Agency

5.14.12 THE PROCESS

EA will initiate the following activities to commence and implement the RP:

- ❖ Establish PIU and field offices
- ❖ Orientation and awareness seminars for Project Implementation Unit (PIU).
- ❖ Appointment of external monitoring and evaluation consultants

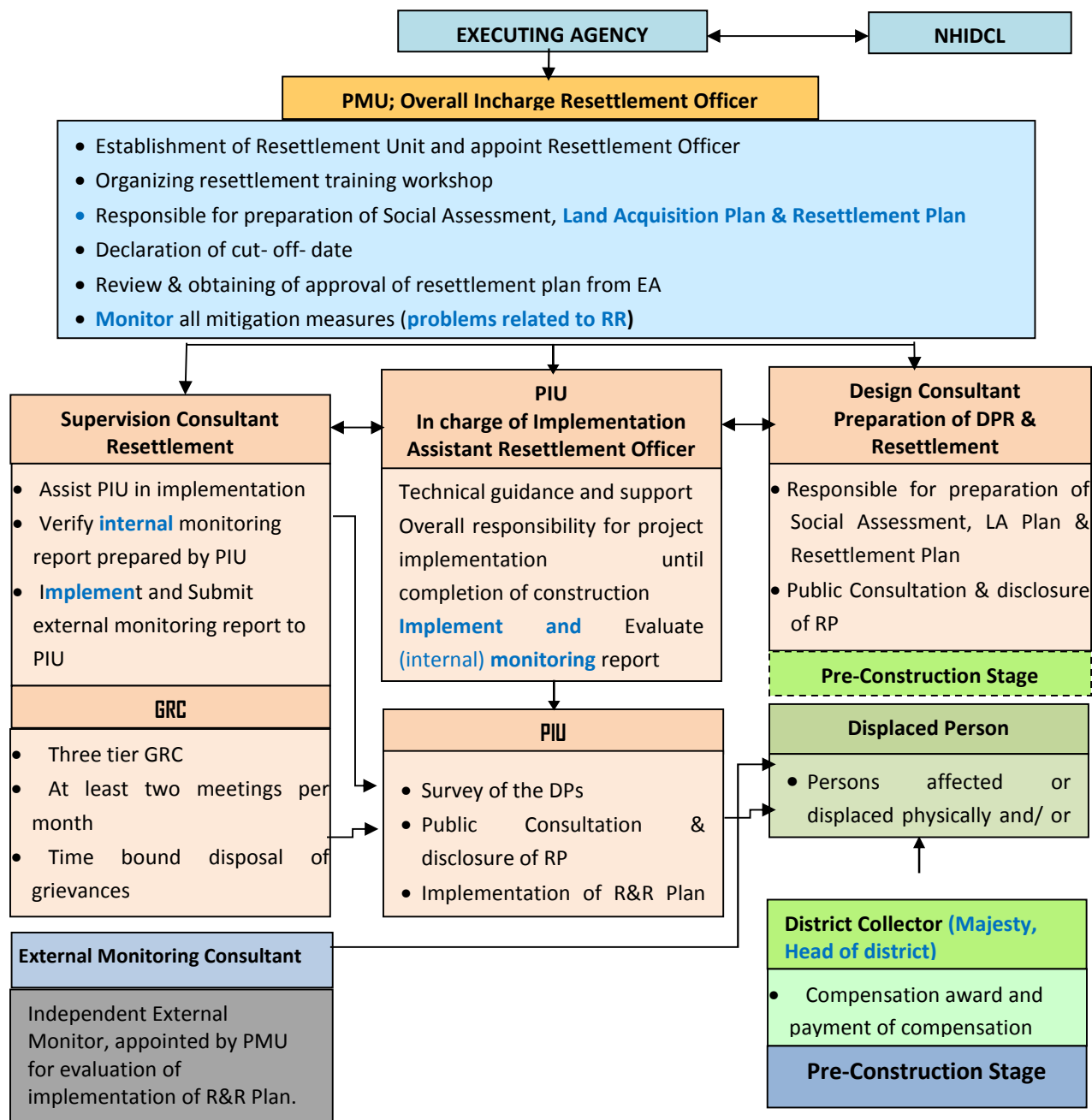
Effective RP implementation will require institutional relationships & responsibilities, rapid organizational development & collaborative efforts by EA, State Govt. The ESDU will establish operational links within EA (for e.g. finance for release of money on approval of micro plan) & with other agencies of Govt. involved in project induced settlement. It will provide means & mechanism for coordinating the delivery of the compensation & assistance entitled to those who will suffer loss.



On behalf of EA, ESDU will assure the responsibility for representing the social impact & resettlement component of the project. The ESDU will also be responsible for disseminating the information to the public & providing additional opportunities for public comment. The ESDU at the apex level will have overall responsibility for policy guidance, coordination, contingency planning, monitoring and overall reporting during RP implementation.

The Organogram for the R&R cell is given in (Figure no. 1.8):

Figure 5.8: Implementation Structures for RAP



5.15 INSTITUTIONS FOR PLANNING & IMPLEMENTATION OF RP

1.15.1 INTRODUCTION

Institutions for planning & implementation of RP vary substantially in terms of their respective roles & capacity. Timely establishment & involvement of appropriate R&R institutions would significantly facilitate achievement of objectives of the R&R program. The main R&R institution would include:

- EA
- Local Administration
- Line departments
- PIU
- DLC/GRC
- Training Institutions
- M&E Agency

1.15.2 THE PROCESS

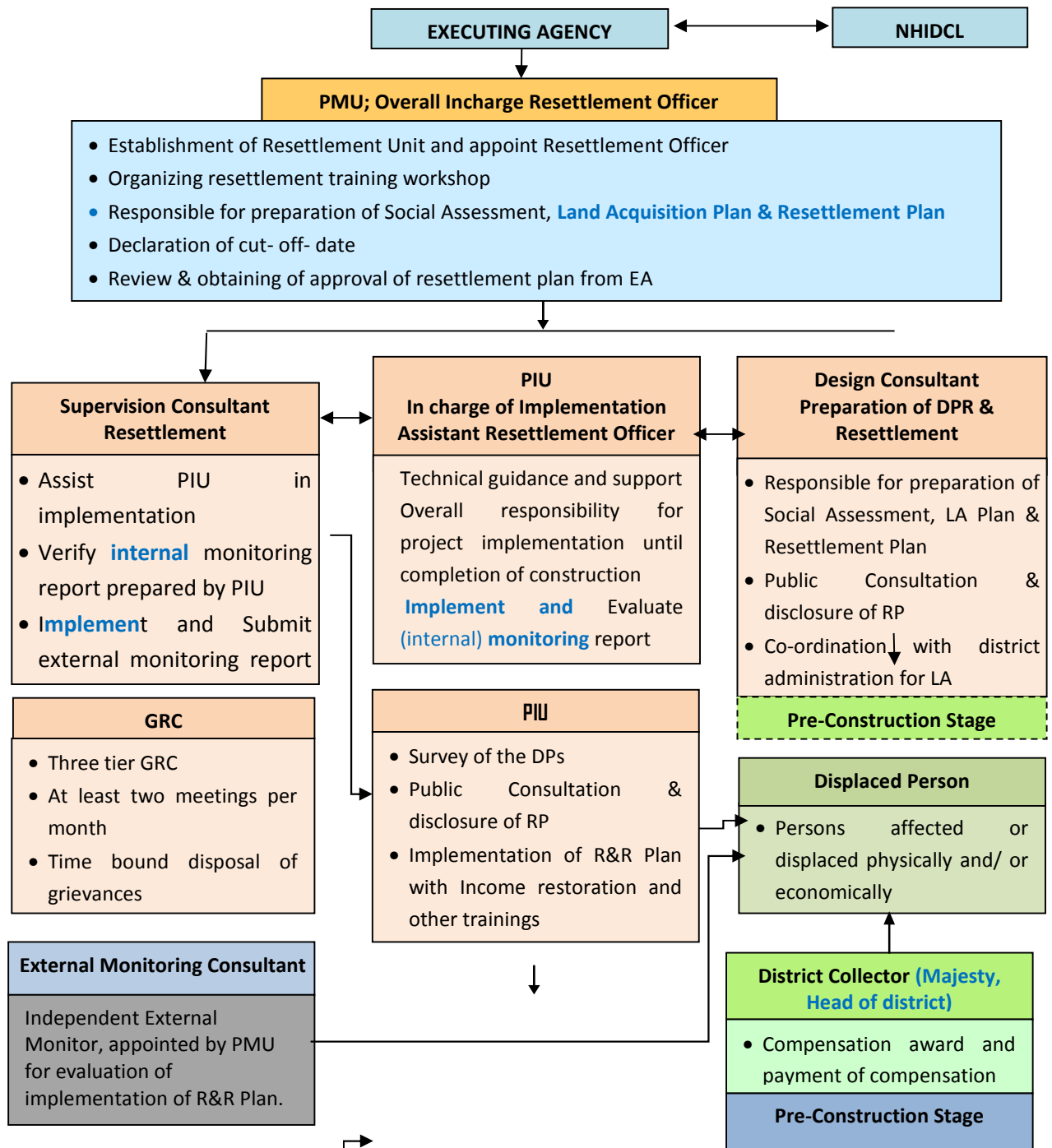
EA will initiate the following activities to commence and implement the RP:

- ❖ Establish PIU and field offices.
- ❖ Orientation and awareness seminars for Project Implementation Unit (PIU).
- ❖ Appointment of external monitoring and evaluation consultants.

Effective RP implementation will require institutional relationships & responsibilities, rapid organizational development & collaborative efforts by EA, State Govt. The ESDU will establish operational links within EA (for e.g. finance for release of money on approval of micro plan) & with other agencies of govt. involved in project induced settlement. It will provide means & mechanism for coordinating the delivery of the compensation & assistance entitled to those who will suffer loss. On behalf of EA, ESDU will assume the responsibility for representing the social impact & resettlement component of the project. The ESDU will also be responsible for disseminating the information to the public & providing additional opportunities for public comment.

The ESDU at the apex level will have overall responsibility for policy guidance, coordination, and contingency planning, monitoring and overall reporting during RP implementation.

Figure 5.9: Institutional arrangement for RAP



1.15.3 ROLES AND RESPONSIBILITIES

The role and responsibilities of the various offices in R&R implementation are presented below:

1.15.4 AT CORPORATE LEVEL

The Project Director: -

- ❖ In-charge of overall project activities.
- ❖ Participate in the State Level Committees to facilitate land acquisition, pre- construction activities and implementation of R&R activities.

EA: -

- ❖ Co-ordinate the implementation of R&R activities with **corporate** and field staff.
- ❖ Review the micro plans prepared by the PIU.
- ❖ Review monthly progress report.
- ❖ Monitor the progress on R&R and land acquisition.
- ❖ Advice PIU/M&E Agency on policy related issues during implementation.
- ❖ Ensure early release of money to PIUs for R&R activities.

1.15.5 PROJECT IMPLEMENTATION UNIT (PIU)

This unit will coordinate the process for land acquisition. Relocation and rehabilitation, distribution of project provided assistance and DPs access to government programs.

- ❖ Survey and verification of the DPs.
- ❖ Verification of land records followed by verification on the spot related to identified plots and owners.
- ❖ Develop rapport with the DPs.
- ❖ Verify and Photograph of each DP for ID cards.
- ❖ Assist to issue identity cards to the DPs.
- ❖ Co-ordinate with the DRO to implement R&R activities.
- ❖ Conduct market feasibility study.
- ❖ Valuation of properties/assets for finalization of replacement value.
- ❖ Participate with the DRO to undertake public information campaign at the commencement of the projects.
- ❖ Distribute the pamphlets of R&R policy to the DPs.
- ❖ Assist the DPs in receiving the compensation.

- ❖ Facilitate the process of arranging loans for DPs.
- ❖ Facilitate the opening of joint accounts.
- ❖ Generate awareness about the alternate economic livelihood and enable the DPs to make informed choice.
- ❖ Prepare micro-plans for R&R.
- ❖ Enable the DPs to identify the alternate sites for agriculture, residential and commercial plots.
- ❖ Participate in the consultation on allotment of shops and residential plots.
- ❖ Ensure the DPs have received their entitlements.
- ❖ Ensure the preparation of rehabilitation sites.
- ❖ Participate in the meetings organized by the PIU.
- ❖ Submit monthly progress reports.
- ❖ Identify training needs and institutions for the DPs for income generating activities.
- ❖ Participate in the disbursement of cheques for the assistance at public places.
- ❖ Coordinate the training programs of the DPs for income generating activities.
- ❖ Coordinate the meeting of District Level Committees.
- ❖ Accompany DP to GRC.
- ❖ Awareness campaigns for highway related diseases.
- ❖ Ensure the DP judiciously uses compensation and R&R assistance

1.15.6 RP IMPLEMENTATION FIELD OFFICES AND TASKS

The PD-PIU will be responsible to carry out the following tasks concerning resettlement of the project:

- ❖ Overall responsibility of Implementation of R&R activities of RP.
- ❖ Responsible for land acquisition and R&R activities in the field.
- ❖ Ensure availability of budget for R&R activities.
- ❖ Liaison with District Administration for support for land acquisition and implementation of R&R.
- ❖ Participate in the district level committees.

1.15.7 DISTRICT RESETTLEMENT AND REHABILITATION OFFICER (DRRO)

- ❖ Co-ordinate with District Administration and PIU for land acquisition and R&R.
- ❖ Translation of R&R policy in local language.

- ❖ Prepare pamphlets of the policy.
- ❖ Printing of the policy and identity cards for the DPs.
- ❖ Ensure development of resettlement sites, wherever required.
- ❖ Participate in the allotment of residential, commercial and agricultural plots.
- ❖ Liaison with District Administration for dovetailing government's income generating and developmental programs for the DPs.
- ❖ Ensure the inclusion of those DPs who may have not been covered during the census survey; facilitate the opening of joint accounts in local banks to transfer assistance for R&R for DPs and organize disbursement of cheques for assistance in the affected area in public.
- ❖ Monitor physical and financial progress on land acquisition and R&R activities.
- ❖ Participate in regular meetings.
- ❖ Organize Bi-monthly meetings with the PIU to review the progress on R&R.
- ❖ Review micro plan & monthly reports submitted by PIU.

1.15.8 DISTRICT LEVEL COMMITTEE (DLC)

RP will be implemented through District Level Committees that will be established in the districts of Senapati in Manipur. The committee would include District Magistrate or his representative, District Land Acquisition Officer, Pradhan of Panchayat Samities, representative of affected villages including women, representative of Revenue Department, Line Departments, PWD, Mining Departments, people's representatives, and representatives of affected population. The formation of DLCs would be facilitated by PIU. The functions of the DLC will be as follows: (i) to meet regularly to review the progress of land acquisition/ R&R; (ii) approval of the micro-plan on the basis of methodology defined in the RP; and (iii) facilitate the implementation of the RP programs in the project-affected area.

The DLC would also: (i) meet regularly at pre-decided dated specifically for grievance redressing purpose; (ii) help in amicable settlement of disputes at community level; (iii) carry forward the ones which are not reconciled at the Grievance Redressal Committee (iv) coordination with local govt. authorities & field offices.

1.15.9 COORDINATION WITH OTHER AGENCIES AND ORGANIZATIONS

R&R Cell will establish networking relationships with line departments and other Govt. & non-Govt. organizations. The Revenue Department has an influencing role in land acquisition proceedings, and initiation of resettlement process. Unless the compensation process is prompt and efficient, implementation process will get delayed. R&R Cell will coordinate with the Project Land Acquisition Officer to expedite the land acquisition process.

Income restoration will be sole responsibility of the Project Authority. PIU will facilitate linkages to be established with the agencies implementing centrally sponsored poverty alleviation programs to

restore the income of DPs.

Restoration of community assets such as hand pumps, bore wells will require help from PHED. EA will extensively work on developing lateral linkages for mobilization of resources to benefit the DPs and to achieve the desired results expected from implementation of RP.

The Revenue Department is responsible for providing land records, acquiring land and other properties and handing them over to the proper authorities. The District Rural Development Agency (DRDA) will extend the IRDP and other developmental schemes to include the DPs. The representative of these departments/agencies will be in contact with the R&R Cell, which will facilitate the integration of the various agencies, involved in the R&R process.

5.16 RESETTLEMENT AND REHABILITATION BUDGET

5.16.1 INTRODUCTION

The resettlement cost estimate for this project includes eligible compensation, resettlement assistance and support cost for RP implementation. The support cost, which includes staffing requirement, monitoring and reporting, project implementation and other administrative expenses are part of the overall project cost. The unit cost for structures and other assets in this budget has been derived through field survey, consultation with affected families, relevant local authorities and reference from old practices. Contingency provisions have also been made to take into account variations from this estimate. Some of the major items of this R&R cost estimate are outlined below:

- ❖ Compensation for agricultural, residential and commercial land at their replacement value
- ❖ Compensation for structures (residential/ commercial) and other immovable assets at their replacement cost
- ❖ Compensation for crops and trees
- ❖ Assistance in lieu of the loss of business/ wage income/ employment and livelihood
- ❖ Assistance for shifting of the structures
- ❖ Resettlement and Rehabilitation Assistance in the form of Training allowance
- ❖ Special assistance to vulnerable groups for their livelihood restoration
- ❖ Cost for implementation of RP.

5.16.2 COMPENSATION

Private Agricultural Land:

The unit rate for agricultural land has been estimated as per Land Acquisition Resettlement and Rehabilitation Act, 2013 in accordance to Manipur RFCTLARR Rules, 2014 and National Highway Authority of India Act, 1956. To meet the replacement cost of land compensation will be calculated over updated land rate with additional as registration cost plus solatium or as decided by District Magistrate. It may be noted that the District Magistrate have the discretionary power in valuation of land in his jurisdiction. The State Government may also announce packages for Land Acquisition.

Residential/ Commercial and other structures:

The compensation cost of structures are arrived at by assessment of market value, consultation with DPs and data collected from building contractors and property agents this meets the replacement cost of the structures.

- The R & R budget has been calculated on the following basis: -
- The R & R budget is calculated on the basis of DLC rates or market value.
- The budget for the compensation of affected structures is based on the rates of various

types as described in Basic Schedule Rates (BSR), PWD, Govt. Of Manipur, 2016 and/or the market values.

The average estimated rate for permanent structures without land has been calculated at Rs. 16,218/m², semi-permanent structures have been calculated at Rs. 12,448/m², and temporary structures have been calculated at the rate of Rs. 3,769/m². The compensation for boundary walls at per running metre is Rs. 6,244/-.

5.16.3 ASSISTANCE

Shifting allowance: Shifting allowance will be provided to all the affected households losing structures and tenants. The unit cost has been derived on a lump sum basis of Rs. 50,000/-.

Rental Assistance: Rental assistance to titleholder (structures) and tenants in structures will be provided in the form of grants to cover maximum three months' rentals @ Rs. 4,000/- per month.

Rehabilitation Assistance to DPs Losing Business Establishment: Title holders losing their business establishment due to displacement will be provided with a lump sum transitional allowance of Rs. 50,000/-. This rate has been fixed based on the estimates of average income for a period of three months.

Training Assistance to Agricultural Titleholders: Training Assistance will be provided for income generating vocational training and skill up-gradation options as per DPs choice at the rate of Rs. 5,000/- per affected household to those households losing their primary source of income.

Rehabilitation Assistance to Employees in Structure: Wage earning employees indirectly affected due to displacement of commercial structure will be provided assistance as per the prevailing local wage rate for 3 plus months i.e. @ Rs. 146/- for 100 days.

Rehabilitation Assistance to Agricultural Labourers/Sharecroppers: Agricultural Labourers/Sharecroppers will be provided with assistance as per the prevailing local wage rate for 100 days @ Rs. 173/- per day.

Assistance to Vulnerable Households: One time lump sum assistance of Rs. 50,000/- will be paid to each vulnerable households. (This will be paid above and over the other assistance(s) as per the entitlement matrix).

5.16.4 COMPENSATION FOR COMMUNITY AND GOVERNMENT PROPERTY

Religious and Community Structures: The religious and community structures are being partially affected and do not require full replacement. However, a lump sum provision of Rs. 3,00,000/- per structure is made in the budget to rebuild and enhance the ambience of these structures. However, any religious or community structure requires full relocation will be compensated in replacement rate.

5.16.5 RP IMPLEMENTATION AND SUPPORT COST

For grievance redress process a lump sum of Rs 4,80,000/- is provided for two years and cost of other RP implementation and administrative activities will be a part of proposed departmental

expenditure. The separate fund for grievance redressal for this project is made based on intensity of impacts. In addition, the process will involve interdepartmental arrangement and include participation by representatives of DPs, particularly of vulnerable DPs, local government representatives, representative of other interest groups besides PIU.

5.16.6 SOURCE OF FUNDING AND FUND FLOW MANAGEMENT

The cost related to land acquisition and resettlement cost will be borne by the EA. EA will ensure allocation of funds and availability of resources for smooth implementation of the project R&R activities. The EA will, in advance, initiate the process and will try to keep the approval for the R&R budget in the fiscal budget through the ministry of finance. In the case of assistance and other rehabilitation measures, the EA will directly pay the money or any other assistance as stated in the RP to DPs. The PIU will be involved in facilitating the disbursement process and rehabilitation program.

5.16.7 R&R BUDGET

A detailed indicative R&R cost is given in **Table 5.2** for different packages.

Table 5.21: Estimates of Entitlements for Package-III

Item	Rate (as per Minimum Guidance Value) (in Rs. Per Ha)	Rate (as per Average Market Rate) (in Rs. Per Ha)	Total Area (Ha)/Number	Cost (as per Minimum Guidance Value) (in Rs.)	Cost (as per Average Market Rate) (in Rs.)
I. Compensation for loss of Private Property					
1. Loss of Land (agricultural, homestead, commercial or otherwise)					
Effective Average Cost of Urban Land			-	-	-
Effective Average Cost of Rural Land	107,639	4,843,755	51.2168	5,512,925.14	248,081,631.08
			Sub Total (A)	5,512,925.14	248,081,631.08
2. Loss of Structure (house, shop, building or immovable property or assets attached to land)					
Type of Structure	Rs. Per Sqm	Area Sqm			
Permanent	16218	24.7		400,260.24	400,260.24
Semi-Permanent	12448	62.8		781,112.00	781,112.00
Temporary	3769	273		1,028,823.93	1,028,823.93
Under construction	6244	0		0.00	0.00
Subtotal (B)				2,210,196.17	2,210,196.17
100% Solatium for Land and Structure (C)				7,723,121.31	-
II. Rehabilitation and Resettlement (Land owners & families dependent on Land)					
3. Loss of Residence					
Special Cash Assistance of Rs. 5 lakhs	500,000	5		2,500,000.00	-
Shifting Assistance to DPs	50,000	5		250,000.00	-
Subsistence Allowance for 12 months	36,000	5		180,000.00	-

Item	Rate (as per Minimum Guidance Value) (in Rs. Per Ha)	Rate (as per Average Market Rate) (in Rs. Per Ha)	Total Area (Ha)/Number	Cost (as per Minimum Guidance Value) (in Rs.)	Cost (as per Average Market Rate) (in Rs.)
Additional Assistance to Vulnerable Groups		50,000	5	250,000.00	-
One Time Resettlement Allowance		50,000	5	250,000.00	-
Subtotal (D)				3,430,000.00	-
4. Loss of Shop/trade/commercial structure					
Special Cash Assistance of Rs. 5 lakhs		500,000	1	500,000.00	-
Subsistence Allowance for 12 months		36,000	1	36,000.00	-
Additional Assistance to Vulnerable Groups		50,000	1	50,000.00	-
Transitional Allowance		50,000	1	50,000.00	-
One Time Resettlement Allowance		50,000	1	50,000.00	-
Subtotal (E)				686,000.00	-
III. Impact to Standing Crops and Trees					
Average cost of the fruit bearing trees		0		-	-
Subtotal (F)				-	-
IV. Impact to Vulnerable Household					
One time Assistance who have to relocate		25,000.00	0	-	-
Subtotal (G)				-	-
V. Impact to Tenant during Construction					
Subsistence Allowance for 3 months		18,000.00	0	0.00	-
Rental Assistance of Rs. 9,000		9,000.00	0	0.00	-
Subtotal (H)				0.00	-
VI. Common Property Resource					
Religious Structures		250,000.00	0	-	-
School/Community Property		100,000.00	0	-	-
Quasi Govt/ VC Buildings		250,000.00	0	-	-
Cost of structure in lieu of community Land		2,500,000.00	0	-	-
Subtotal (I)				-	-
VIII. Unforeseen Impacts					
Contingency of 15%	Total of (A to L)		10%	1,956,224.26	25,029,182.73
Subtotal (J)				1,956,224.26	25,029,182.73
IX. Implementation of RAP					
Support for implementation of RAP (lumpsum)[9]		4,450,000	1	4,450,000.00	4,450,000.00
M & E consultant (lumpsum)		480,000	1	480,000.00	480,000.00
Subtotal (K)				4,930,000.00	4,930,000.00
Total(L) = (A to K)				26,448,466.87	280,251,009.98
Inflation (M) accounted for @ 7% of (L)				1,851,392.68	19,617,570.70

Item	Rate (as per Minimum Guidance Value)	Rate (as per Average Market Rate)	Total Area (Ha)/Number	Cost (as per Minimum Guidance Value)	Cost (as per Average Market Rate)
	(in Rs. Per Ha)	(in Rs. Per Ha)		(in Rs.)	(in Rs.)
Grand Total (N) = (L+M)				28,299,859.55	299,868,580.68

Source: Census Survey on November, 2018

The above estimate is based on rates vide Entitlement Matrix as per the norms of RTFCLARR 2013 and in accordance with National Highway Authority of India's Policies. As escalation of 12% on the said matrix is – allowed to arrive at the current cost of R&R = $1.12 \times \text{Rs. } 28,299,859.55 = \text{Rs. } 31,695,842.70$ say Rs 3.17 Cr as per Minimum Guidance Value and R&R = $1.12 \times \text{Rs. } 299,868,580.68 = \text{Rs. } 335,852,810.36$ say Rs. 33.59 Cr as per as per Average Market Rate for Package-III.

Therefore, Total R&R Cost of the project comes out as Rs. 19.33 Cr as per Minimum Guidance Value and Rs. 98.62 Cr as per as per Average Market Rate.

5.17 IMPLEMENTATION SCHEDULE

5.17.1 INTRODUCTION

Implementation of RP mainly consists of compensation to be paid for affected structures and rehabilitation and resettlement activities. The time for implementation of resettlement plan will be scheduled as per the overall project implementation. All activities related to the land acquisition and resettlement must be planned to ensure that compensation is paid prior to displacement and commencement of civil works. Public consultation, internal monitoring and grievance redress will be undertaken intermittently throughout the project duration.

However, the schedule is subject to modification depending on the progress of the project activities. The civil works contract for each project will only be awarded after all compensation and relocation has been completed for project and rehabilitation measures are in place.

5.17.2 SCHEDULE FOR PROJECT IMPLEMENTATION

The proposed project R&R activities are divided in to three broad categories based on the stages of work and process of implementation. The details of activities involved in these three phases i.e. Project Preparation phase, RP Implementation phase, Monitoring and Reporting period are discussed in the following paragraphs.

Project Preparation Phase

The major activities to be performed in this period include establishment of PMU and PIU at project and project level respectively; submission of RP for approval NHIDCL; and establishment of GRC etc. The information campaign & community consultation will be a process initiated from this stage and will go on till the end of the project.

5.17.3 RP IMPLEMENTATION PHASE

After the project preparation phase the next stage is implementation of RP which includes issues like compensation of award by EA; payment of all eligible assistance; relocation of DPs; initiation of economic rehabilitation measures; site preparation for delivering the site to contractors for construction and finally starting civil work.

5.17.4 MONITORING AND REPORTING PERIOD

As mentioned earlier the internal monitoring will be the responsibility of PMU, PIU and will start early during the project when implementation of RP starts and will continue till the complementation of the sub-project. The independent monitoring and reporting will be the responsibility of Construction Supervision Consultant (CSC) to be hired for the sub project.

5.17.5 R&R IMPLEMENTATION SCHEDULE

A composite implementation schedule for R&R activities in the project including various sub tasks and time line matching with civil work schedule is prepared and presented in the form of Table. The

cut-off date will be notified formally for titleholder as the date of LA notification. However, the sequence may change or delays may occur due to circumstances beyond the control of the Project and accordingly the time can be adjusted for the implementation of the plan. The implementation schedule can also be structured through package wise. The entire stretch can be divided in to various contract packages and the completion of resettlement implementation for each contract package shall be the pre-condition to start of the civil work at that particular contract package.

Table 5.22: Implementation Schedule of NH-129A

	2017												2018												2019												2020					
	1Q			2Q			3Q			4Q			1Q			2Q			3Q			4Q			1Q			2Q			3Q			4Q			1Q			2Q		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
Project Preparation Stage																																										
Scree project impact																																										
Public Consultation on alignment																																										
Prepare Land Acquisition Plan																																										
Carry out Census Survey																																										
Prepare Resettlement Plan (RP)																																										
RP Implementation Stage																																										
Obtaing RP approval from NHIDCL																																										
Disclosure of RP																																										
Formation of GRC (Grievance Mechanism)																																										
Implementation of GRC																																										
Public Consultation																																										
Co-ordination with district authority for LA																																										
Submission of LA proposals to DC																																										
Declaration of cut-off date (LA notification)																																										
Payment of compensation																																										
Taking proceession of acquired land																																										
Handling over the acquired land to contractor																																										
Rehabilitation of DPs																																										
Monitoring and Reporting Period																																										
Internal monitoring and reporting																																										
Hiring Construction Supervision Consultant																																										
External monitoring and reporting																																										

5.18 MONITORING AND EVALUATION

5.18.1 INTRODUCTION

Monitoring is a periodic assessment of planned activities providing midway inputs, facilitates changes and gives necessary feedback of activities and the directions on which they are going, whereas Evaluation is a summing up activity at the end of the project, assessing whether the activities have actually achieved their intended goals and purposes. In absence of an effective monitoring strategy it would be impossible to ensure that all anticipated benefits and entitlements reach DPs in time and in an efficient grievance free manner. It will be a systematic and continuous process of collecting and analysing information about the progress of the project and a tool for identifying strengths and weaknesses within a project. Resettlement monitoring will include the collection, analysis, reporting and use of information about the progress of resettlement, based on the RP. Monitoring in resettlement will focus on restoration of income and standard of living of the affected persons as the primary focus. Several key activities such as delivery of entitlements will also be monitored. EA will have two tiers (Internal and External) monitoring system.

5.18.2 THE INTERNAL MONITORING

The internal monitoring will be handled by PIU. A monitoring cell will be established in PIU with individuals having appropriate skills and capacity. A comprehensive and relevant database and management 'information system (MIS) will be established and updated periodically for monitoring various activities of the project. The RP information generated through various surveys like census, baseline socio-economic, land and structures will become important input of the information system. Effective Monitoring will help accomplish this task and facilitate appropriate changes in resettlement implementation based on the information obtained, through routine collection of data. Therefore, EA will develop a monitoring plan that covers all essential stages of resettlement i.e. preparatory stage, relocation stage & rehabilitation stage.

PIU, EA will form independent monitoring cell which will work at the time of Project Implementation.

5.18.3 KEY INDICATORS OF MONITORING

EA, considering the importance of the various stage of project cycle, will handle the monitoring at each stage as stated below:

5.18.4 PREPARATORY STAGE

During the pre-relocation phase of resettlement operation, monitoring is concerned with administrative issues such as, establishment of resettlement unit, budget, land acquisition, consultation with DPs in the preparation of resettlement plan, payments of entitlements due, grievance redressal, and so on.

❖ The key indicators for monitoring at this stage will be:

- ❖ Conduct of baseline survey
- ❖ Consultations
- ❖ Identification of DP and the numbers
- ❖ Identification of different categories of DPs and their entitlements
- ❖ Collection of gender disaggregated data
- ❖ Inventory & losses survey
- ❖ Asset inventory Entitlements
- ❖ Valuation of different assets
- ❖ Budgeting
- ❖ Information dissemination
- ❖ Institutional arrangements
- ❖ Implementation schedule review, budgets and line items expenditure

5.18.5 RELOCATION STAGE

Monitoring during the relocation phase covers such issues as site selection in consultation with DPs, development of relocation sites, assistance to DPs (especially to vulnerable groups) in physically moving to the new site. Likewise, aspects such as adjustment of DPs in the new surroundings, attitude of the host population towards the new-comers and development of community life are also considered at this stage. The key indicators for monitoring will be:

- ❖ Payment of compensation
- ❖ Delivery of entitlement
- ❖ Grievance handling
- ❖ Land acquisition
- ❖ Preparation of resettlement site, including civic amenities '(water, sanitation, drainage, paved streets, electricity)
- ❖ Consultations
- ❖ Relocation
- ❖ DPs who do not relocate
- ❖ Payment of compensation
- ❖ Livelihood restoration assistance.

5.18.6 REHABILITATION STAGE

Once DPs have settled down at the new sites, the focus of monitoring will be on issues of economic recovery programmes including income generating schemes (IGSs), acceptance of these schemes by

DPs, impact of IGSs on living standards, and the ability of the new livelihood patterns. The key indicators for monitoring will be:

- ❖ Initiation of income generation activities
- ❖ Provision of basic civic amenities and essential facilities in the relocated area
- ❖ Consultations
- ❖ Assistance to enhance livelihood and quality of life

The most crucial components/indicators to be monitored are specific contents of the activities and entitlement matrix.

- ❖ Input and output indicators related to physical progress of the work will include items as:
- ❖ Training of PIU, ROs and other staff completed
- ❖ Public meetings held
- ❖ Census, assets inventories, assessments and socio-economic studies completed.
- ❖ Meeting of DLCs
- ❖ Meeting of GRCs
- ❖ Grievance redresses procedures in-place and functioning.
- ❖ Compensation payments disbursed.
- ❖ Shops space allotted.
- ❖ Relocation of DPs completed.
- ❖ Employment provided to DPs.
- ❖ Community development activities completed.
- ❖ Infrastructure repaired, bus stands, water and sanitation facilities provided.
- ❖ Village roads repaired.
- ❖ Training of DPs initiated.
- ❖ Income restoration activities initiated.
- ❖ Number of families displaced and resettled.
- ❖ Extent of government land identified and allotted to the DPs.
- ❖ Monitoring and evaluation reports submitted.

5.18.7 REPORTING MECHANISM

As stated earlier one of the main roles of PIU will be to oversee proper and timely implementation of all activities in RP. Internal Monitoring will be a regular activity for PIU and Rehabilitation Manager will oversee the timely implementation of R&R activities. Internal Monitoring will be carried out by the PIU (through the R&R Cell) and its agents, PIU will prepare monthly/quarterly reports on the

progress of RP Implementation. PIU will collect information from the project site and assimilate in the form of monthly progress to access the progress and results of RP implementation and adjust work programme where necessary, in case of delays or problems. Both monitoring and evaluation will form parts of regular activities and reporting on this will be extremely important in order to undertake mid-way corrective DPs. The reports can broadly be classified as:

- ❖ Progress reports during Implementation of the RP
- ❖ Qualitative reports highlighting the qualitative aspects
- ❖ Financial reports
- ❖ Evaluation reports based on benefits and impact of assistance provided.

5.18.8 RESOURCES REQUIREMENT AND DATABASE MANAGEMENT

For the PIU to function, EA will allocate adequate financial resource towards office space, computers, transport and staff budget. The following essential requirements will be planned:

- ❖ Annual budget for Monitoring
- ❖ Office space
- ❖ Tables, chairs and furniture.
- ❖ Computer dedicated to the monitoring unit
- ❖ Transport
- ❖ Administrative support staff
- ❖ Appropriate technical staff
- ❖ Add on database management

5.18.9 EXTERNAL OR INDEPENDENT MONITORING

External (or Independent) monitoring will be hired to provide an independent periodic assessment of resettlement implementation and impacts to verify internal monitoring, and to suggest adjustment of delivery mechanisms and procedures as required. A social and economic assessment of the results of delivered entitlements and measurement of the income and standards of living of the DPs before and after resettlement will be integral components of this monitoring activity.

To function effectively, the organization responsible for external monitoring will be independent of the governmental agencies involved in resettlement implementation. The agency will submit monthly and quarterly monitoring reports. Mid-term and final evaluation will be done by the agency to find out if the R&R objectives have been achieved as against the performance impact indicators.

5.18.10 SCOPE OF WORK OF EXTERNAL MONITOR:

- ❖ Examine and verify internal monitoring system and suggest changes.
- ❖ Prepare independent reports based on monitoring visits.

- ❖ Major recommendations for remedial actions.
- ❖ Major recommendations for policy changes.
- ❖ Maintenance of database.

5.18.11 DETAIL ACTIVITIES TO BE UNDERTAKEN BY EXTERNAL MONITOR:

The scope of activities will include but not be limited to:

- ❖ Verification of internal reports, by field check of delivery of the following:
- ❖ Payment of compensation including its levels and timing.
- ❖ Land readjustment.
- ❖ Preparation and adequacy of resettlement sites.
- ❖ House construction.
- ❖ Provision of employment, its adequacy and income levels.
- ❖ Training.
- ❖ Rehabilitation of vulnerable groups.
- ❖ Infrastructure repair, relocation or replacement.
- ❖ Enterprise relocation, compensation and its adequacy.
- ❖ Transition allowances.

5.18.12 PROPERTY AND DEMOGRAPHIC SURVEY OF THE FOLLOWING AFFECTED PERSONS:

- ❖ 100% census survey of persons who were severely affected by Project works and have relocated either to group resettlement sites or preferred to self-relocate.
- ❖ 20% sample survey of persons who had property, assets, incomes and activities marginally affected by Project works and did not relocate.
- ❖ 20% sample survey of those affected by off-site project activities by contractors' subcontractors, including employment, use of land for contractor's camps, pollution, public health etc.
- ❖ Generate gender disaggregated socio-economic data, socio-economic condition, needs and priorities of women etc.

5.18.13 EVALUATION OF DELIVERY AND IMPACTS OF ENTITLEMENTS

- ❖ Identify the categories of impacts and evaluate the quality and timeliness of delivery of entitlements (compensation and rehabilitation measures) for each category of impact. He/she will ensure that how the entitlements were used and examine impact and adequacy to meet the specified objectives of the RP.

- ❖ Ensure the quality, sufficiency of funds and on-time delivery of entitlements according to RP. Also verify other monitoring reports prepared during implementation by an independent source.
- ❖ Establish by appropriate investigative and analytical techniques, the pre-and post- Project socio-economic conditions of the affected people. In the absence of baseline socio-economic data on income and living standards, and given the difficulty of DPs having accurate recollection of their pre-Project income and living standards, develop some quality checks on the information to be obtained from the DPs. Such quality checks could include verification by neighbours and local village leaders. The methodology for assessment should be very explicit.

5.18.14 EVALUATION OF CONSULTATION AND GRIEVANCE PROCEDURES

Identify, quantify and qualify the types of conflicts and grievances reported and resolved and the consultation and participation procedures.

5.18.15 DECLARATION OF SUCCESSFUL IMPLEMENTATION

Provide a summation of whether involuntary resettlement was implemented (a) in accordance with the RP, and (b) in accordance with Policy on Involuntary Resettlement.

5.18.16 ACTIONS REQUIRED

Describe any outstanding actions that are required to bring the resettlement into compliance with Policy on Involuntary Resettlement. Describe further mitigation measures needed to meet the needs of any affected person or families judged and/or perceiving themselves to be worse off as a result of the Project.

Provide a timetable and define budget requirements for these supplementary mitigation measures and detail the process of compliance monitoring and final "signing off" for these DPs.

5.18.17 REPORTING CYCLE/FREQUENCY

PIU is responsible for supervision and implementation of the RP & will prepare monthly progress reports on resettlement activities. The external M&E expert will submit bi-annual review directly to EA and determine whether resettlement goals have been achieved, more importantly whether livelihoods and living standards have been restored/enhanced and suggest suitable recommendations for improvement.

5.18.18 PARTICIPATION OF AFFECTED PEOPLE IN M&E

The general approach to be used is to monitor activities and evaluate impacts ensuring participation of all stakeholders especially women and vulnerable groups. Monitoring tools would include both quantitative and qualitative methods:

- ❖ Baseline household survey of a representative sample, disaggregated by gender and vulnerable groups to obtain information on the key indicators of entitlement delivery.

efficiency, effectiveness, impact and sustainability. 20% percent random sample of DPs will be covered.

- ❖ Focused Group Discussions (FGD) that would allow the monitors to consult with a range of stakeholders (local government, resettlement field staff, PIU, community leaders and DPs).
- ❖ Key informant interviews: select local leaders, village workers or persons with special knowledge or experience about resettlement activities and implementation.
- ❖ Community public meetings: open public meetings at resettlement sites to elicit: -
- ❖ Information about performance of various resettlement activities.
- ❖ Structured direct observations: field observations on status of resettlement
- ❖ Implementation, plus individual or group interviews for crosschecking purposes.
- ❖ Informal surveys/interviews: informal surveys of DPs, host village, workers, resettlement staff, and implementing agency personnel using non-sampled methods. In the case of special issues, in-depth case studies of DPs and host populations from various social classes will be undertaken to assess impact of resettlement.

5.18.19 IMPACT ON WOMEN

The project will have both positive and negative impact on the women of the region. The women, by virtue of their biological difference, enjoy a low privilege status in the society as compared to their male counterpart. Any negative impact of the project would have greater magnitude on this less privileged class of the society. It is imperative to have a continuous monitoring and evaluation of implication of RP implementation on the women.

5.19 CONCLUSION

The Government of Manipur has taken up the initiative to develop, maintain the highways and other district roads of the State of Manipur under the big push of agricultural as well as tourist growth and increase of trade with outer world where the intensity of traffic has increased considerably and there is necessity for augmentation of capacity for safe and efficient movement of traffic. One such project is the development for 2-laning of NH-129A starts from Maram village (NH-39), and ends at Dzuko bridge (near Peren Town) in the Senapati district of Manipur for a length of 109.494 km (as per Design).

The project road lies in Manipur. Most part of the District is in Hilly Terrain. This Road is passing through Maram village, Kabanam, Bungram, Magaimai, Duigam center village, Sankumai, Willong, Kamlung, Paukilwa, Yangkhullen, Bendramai, Bakie, Ziumi center village and Tampung. The Design road length is 109.494 km. The road starts Maram and end at Peren. The project road has distributed in three packages.

The Existing RoW varies from 7m to 16.4m (avg. ROW 10m) throughout the project road. However, the existing ROW is not sufficient to accommodate proposed 2 laning proposal and hence additional land is to be acquired to implement the proposal.

As discussed the scope of land acquisition is quite significant in the project but due to some restrictions/constraints of land acquisition is kept within low degree to minimize the Impact of Resettlement and Rehabilitation. A project census survey was carried out to identify the persons both private owners and customary right holders who would be displaced by the project and to make an inventory of their assets that would be lost to the project, which would be the basis of calculation of compensation. The cut-off date is finalized as 13th November, 2018.

The public consultation on the focus groups and the stakeholders give the opportunity to address issues, which were already resolved after making appropriate changes in design and alternative finalisation. The stakeholders become aware of the development schemes and at the same time influence and share to control over these initiatives, decisions and resources. Community consultations also help to avoid opposition to the project, which is otherwise likely to occur.

Decisions regarding providence of the resettlement and rehabilitation entitlement would be done as per the guidelines of EA and Government of India. The DPs may go to the Grievance Redressed Cell and to the Arbitrator as per the provision laid in the Guidelines. It may be noted that the redress to the grievances of the DPs may be done with consideration.

In the total SIA, there is very little impact of resettlement and rehabilitation programmes as there is no major impact in their livelihood and their socio economic as well as cultural way of life of the people of these areas.

Out of the 106 DHs (Private Structure owner, Tenent & Employee of commercial Structure), there would be only major impact on 11 DHs, who are both residential and commercial have to be shifted for Package-I.

Out of the 31 DHs (Private Structure owner, Tenent & Employee of commercial Structure), there would be only major impact on 1 DH, who is both residential and commercial have to be shifted for Package-II.

Out of the 7 DHs (Private Structure owner, Tenent & Employee of commercial Structure), there would be only major impact on 1 DH, who is both residential and commercial have to be shifted for Package-III.

According to the proposed alignment of the Project Road the estimated cost for the various categories of Affected Persons for different purpose and objective of Resettlement and Rehabilitation based on rates vide Entitlement Matrix (June-July 2018) followed for EA road development works with an escalation of 12% on the said matrix. The estimated cost of Resettlement and Rehabilitation is not the total socio – economic cost of the project. The PIU should look into the income restoration of the Affected Families with the objective that the families are ‘as well off as before’.

The Resettlement Budget is Rs 3.17 Cr as per Minimum Guidance Value and Rs. 33.59 Cr as per as per Average Market Rate for Package-III.

Table: 1.23: Minimum Guidance Value & Average Market Rate of Package-III

	Package-III
Minimum Guidance Value	3.17 Cr
Average Market Rate	33.59 Cr

The Resettlement Impact is summarized in Tabular format in **Table 5.24**

Table 5.24: Resettlement Impacts for Package-I to Package-III

Sl.	Impacts	PKG. III
1	Total land acquisition requirements (in ha)	51.2168
2	Total no. of private Residential structures (Nos.)	7
3	Total no. of private Commercial structures (Nos.)	0
4	Total number of Residential cum Commercial structures (Nos.)	1
5	Total number of other private structure (Nos.)	1
6	Total No. of Affected Families by affected structure (Nos.)	7
7	Total Number of Vulnerable households affected of Affected structure (Nos.)	7
8	Total number of displaced persons (DPs) (Nos.)	41
9	Total number of CPRs affected Community and Religious (Nos.)	6

Source: Census Survey on November, 2018

The widening of the NH gives an immense scope of development of the region in regards of easy accessibility. Other than the development of the agricultural sector there would be easy accessibility of the other industrial and consumerable products to the region and the finished Handicrafts and cottage industrial products with the rest the country as well as for International Market. The socio – economic status of the region is being changing drastically with inflow venture and human capital. The changing climate of the socio – economic and political scenario of the state of Manipur with the

working culture of the people with a huge supply of local skilled and unskilled labourers would increase the scope of developments by manifolds. Infrastructural investment such as the NH 129A would remove the bottle neckness of development and help in taking a huge positive leap of sustainable socio- economic growth of the region.



ACRONYMS

AROA	:	Assistant Resettlement Officer
AWC	:	Anganwadi Centre
BDO	:	Block Development Officer
BPL	:	Below Poverty Line
BSR	:	Basic Schedule Rates
CPR	:	Common Property Resource
DC	:	District Commissioner
DGM	:	Deputy General Manager
DPR	:	Detailed Project Report
EA	:	Executing Agency
EPC	:	Engineering, Procurement and Construction
FGD	:	Focus group discussions
GoI	:	Government of India
GP	:	Gram Panchayat
GRC	:	Grievance Redressal Committee
GSB	:	Paved sub base
HIV/AIDS	:	Human Immunodeficiency virus / Acquired immunodeficiency syndrome
IA	:	Implementing Agency
ICDS	:	Intregreted Child Development Service
ICDS	:	Integrated Child Development Services
KII	:	Key Informant Interview
MT	:	Motorized traffic
NGO	:	Non-Government Organization
NH	:	National Highway
NHAI	:	National Highway Authority of India
NHIDCL	:	National Highway Infrastructural Development Corporation Limited
NMT	:	Non-motorized traffic
NRRP	:	National Rehabilitation and Resettlement Policy
OBC	:	Other Backward Castes
PHC	:	Primary health centre
PMU	:	Project Monitoring Unit
PIU	:	Project Implementation Unit
PT	:	Pedestrian traffic
R&R	:	Resettlement and Rehabilitation
RCD	:	Road Construction Department
SC	:	Scheduled Castes
SH	:	State Highway
ST	:	Scheduled Tribes
WHH	:	Women Headed Household

CHAPTER - 6

TRAFFIC SURVEYS AND ANALYSIS

6.1 OBJECTIVE OF TRAFFIC SURVEY

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

6.2 SCOPE OF TRAFFIC SURVEY

The detailed scope of services includes the following:

- To carry out 7 days continuous 24 hrs. Classified Traffic Volume Count Survey (by ATCC method) at locations informed to Client
- To analyze the data collected through possible leakage points and study of travel pattern to determine through traffic for important segments of the route
- Determination of possible leakage points and alternative diversion routes by detailed network study
- To carry out Intersection count survey (1day x 12 hour) at Major intersections along the project road
- To carry out OD and Axle Load survey
- Calculation of MSA values based on Traffic volume for use in the pavement design.

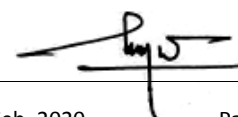
The details of the data collection, primary as well as secondary, results from its analysis are presented in the following sections.

6.3 TRAFFIC SURVEYS

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

6.3.1 SURVEY LOCATIONS

At the beginning of the study, a detailed reconnaissance survey has been carried out to identify traffic homogeneous sections so that each homogeneous section will have similar traffic volume and composition. Based on the above, the length of total project road has been considered as three homogeneous sections.



Homogeneous Section I : Km 0.000 to Km 115.280 (Maram to Peren)

Homogeneous Section II : Km 115.280 to Km 141.690 (Peren to Jalukie)

Homogeneous Section III : Km 141.690 to Km 177.482 (Jalukie to Dimapur)

6.3.2 CLASSIFIED TRAFFIC VOLUME COUNT LOCATIONS

Five Locations have been considered for Classified Traffic Volume Counts (7days x 24hrs). The locations are:

- ✓ CTVC-1: At Ch- 0.700 km near Maram village
- ✓ CTVC-2: At Ch-36.000 km near Willong village
- ✓ CTVC-3: At Ch-76.800 km near Ziumi village
- ✓ CTVC-4: At Ch-120.000 km near Peren town
- ✓ CTVC-5: At Ch- 142.500 km near Jalukie town

6.3.3 TURNING MOVEMENT SURVEY LOCATIONS

A total of seven major intersections were identified on the project road corridor. 1 day x 12 hour Intersection turning movements were carried out at all these identified major junctions on the project road. The intersection points taken into consideration are as follows:

- ✓ TMC-1: At Ch-0.000 km (Maram Junction)
- ✓ TMC-2: At Ch-115.280 km (Kiepeuzang Junction)
- ✓ TMC-3: At Ch-115.833 km (Peren Town Junction)
- ✓ TMC-4: At Ch-121.500 km (Pelekie Junction)
- ✓ TMC-5: At Ch-137.513 km (Sugar Mill Junction, Jalukie B)
- ✓ TMC-6: At Ch-141.690 km (High School Junction, Jalukie Town)
- ✓ TMC-7: At Ch-177.482 km (7th Mile Junction)

6.3.4 AXLE LOAD SURVEY LOCATION

Axle Load survey (2 days x 24hrs) has been conducted at two locations which are as follows:

- ✓ AXLE-1: On NH-39 near Maram Village
- ✓ AXLE-2: At Ch-120.000 km near Peren Town

6.3.5 ORIGIN DESTINATION SURVEY LOCATION

Origin Destination survey (1day x 24hrs) has been conducted at two locations which are as follows:

- ✓ OD-1: On NH-39 near Maram Village
- ✓ OD-2: At Ch-120.000 km near Peren Town



6.3.6 PEDESTRIAN SURVEY LOCATION

Pedestrian survey has been conducted at three points along the road stretch which are as follows:

- ✓ PEDESTRIAN-1: At Ch-0.700 km Near Maram Village
- ✓ PEDESTRIAN-2: At Ch-116.000 km Near Peren Town
- ✓ PEDESTRIAN-3: At Ch-142.000 km Near Jalukie Town

Detailed Traffic Survey Schedule is mentioned in **Table- 6.1**.

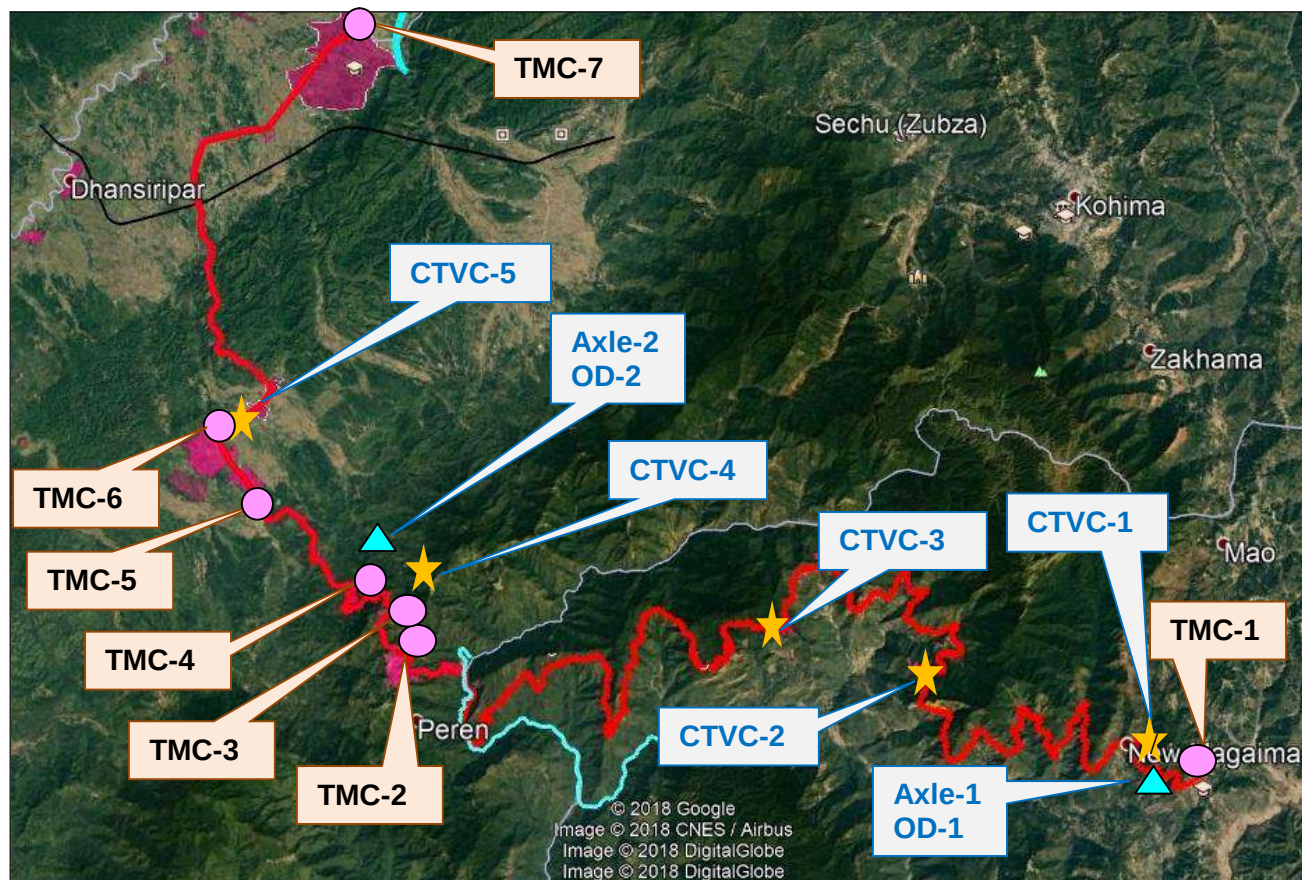
TABLE- 6.1: TRAFFIC SURVEY SCHEDULE

Sl.	Type of Survey	Nos. Proposed	Locations
1	Classified Traffic Volume Count Survey (7 days x 24 hrs)	5	✓ <u>CTVC-1</u>: At Ch- 0.700 km near Maram village ✓ <u>CTVC-2</u>: At Ch-36.000 km near Willong village ✓ <u>CTVC-3</u>: At Ch-76.800 km near Ziumi Village ✓ <u>CTVC-4</u>: At Ch-120.000 km near Peren town ✓ <u>CTVC-5</u>: At Ch- 142.500 km near Jalukie town
2	Origin-Destination and Commodity Movement Characteristics (1 day x 24 hrs)	2	✓ <u>OD-1</u>: On NH-39 near Maram Village ✓ <u>OD-2</u>: At Ch-120.000 km near Peren Town
3	Axle Loading Characteristics (2daysx 24 hrs)	2	✓ <u>AXLE-1</u>: On NH-39 near Maram Village ✓ <u>AXLE-2</u>: At Ch-120.000 km near Peren Town
4	Intersection Volume Count (1 day x 12 hour)	7	✓ <u>TMC-1</u>: At Ch-0.000 km (Maram Junction) ✓ <u>TMC-2</u>: At Ch-115.280 km (Kiepeuzang Junction) ✓ <u>TMC-3</u>: At Ch-115.833 km (Peren Town Junction) ✓ <u>TMC-4</u>: At Ch-121.500 km (Pelekie Junction) ✓ <u>TMC-5</u>: At Ch-137.513 km (Sugar Mill Junction, Jalukie B) ✓ <u>TMC-6</u>: At Ch-141.690 km (High School Junction, Jalukie Town) ✓ <u>TMC-7</u>: At Ch-177.482 km (7th Mile Junction)
5	Speed-Delay Characteristics	177.482 km	✓ Total Project Stretch
6	Pedestrian/ animal cross traffic count (1 day x 12 hour)	3	✓ <u>PEDESTRIAN-1</u>: At Ch-0.700 km Near Maram Village ✓ <u>PEDESTRIAN-2</u>: At Ch-116.000 km Near Peren Town ✓ <u>PEDESTRIAN-3</u>: At Ch-142.000 km Near Jalukie Town

Trained enumerators were used for counting traffic under the supervision of qualified and experienced transport planners/supervisors. The data collected from the traffic surveys was coded and entered into

the computer for its analysis and interpretation of results with respect to existing traffic, travel pattern and for forecasting purposes. The details from the analysis of survey data are presented in the following sections. A traffic survey location map is given in **Figure- 6.1**.

FIG 6.1: TRAFFIC SURVEY LOCATION MAP



6.4 CLASSIFIED TRAFFIC VOLUME COUNTS

Classified directional traffic count surveys with ATCC for 7 days 24 hours at each of the five identified locations on the project road, to obtain the following.

- Average Daily Traffic (ADT)
- Temporal Variation
 - ✓ Daily Variation
 - ✓ Hourly Variation
 - ✓ Peak Factor
- Directional Distribution
- Traffic Composition
- Seasonal Variation
 - ✓ Annual Average Daily Traffic (AADT)
 - ✓ Peak Season AADT

Five locations have been considered for Classified Traffic Volume Counts Survey (7 days x 24 hrs). The locations are:

- ✓ CTVC-1: At Ch- 0.700 km near Maram village.
- ✓ CTVC-2: At Ch-36.000 km near Willong village.
- ✓ CTVC-3: At Ch-76.800 km near Ziumi village.
- ✓ CTVC-4: At Ch-120.000 km near Peren town.
- ✓ CTVC-5: At Ch- 142.500 km near Jalukie town.

The details of the above are presented in the following sections.

6.4.1 AVERAGE DAILY TRAFFIC (ADT)

The traffic volumes counted in 15 minute intervals have been aggregated to one-hour volumes. These are presented in Appendix to Main Report. The hourly volumes have been aggregated into daily volumes for the entire survey period (7-days). The daily volumes are then averaged for ADT. To express the classified vehicular count in terms of PCUs, the PCU factors as given in IRC-108: 1996 have been considered. For ready reference, the PCU Factors considered in the analysis are given in **Table- 6.2**.

TABLE- 6.2: PCU FACTORS CONSIDERED FOR THE STUDY

Sl. No.	Vehicle Type		PCU Factor
1	Two Wheeler		0.50
2	Car/Jeep/ Van/Taxi/ Auto		1.00
3	BUS	Mini	1.50
4		Standard	3.00
5	LCV		1.50
6	Truck	2-Axle	3.00
7		3 -Axle	3.00
8		Multi-Axle	4.50
9	Agricultural	With Trailer	4.50
10	Tractor	Without Trailer	1.50



Sl. No.	Vehicle Type		PCU Factor
11	Cycle		0.50
12	Cycle Rickshaw		2.00
13	Hand Cart		3.00
14	Animal Drawn	Bullock Cart	8.00
15		Horse	4.00

The summary of ADT, as observed on the Project Road, in terms of vehicles and PCUs at different survey locations is given in **Table- 6.3**.

TABLE- 6.3: ADT (JANUARY 2018) AS OBSERVED ON THE PROJECT ROAD

Vehicle Type	On NH-129A near Maram village (At Ch-0.700 km)	On NH-129A near Willong village (At Ch-36.000km)	On NH-129A near Ziumi village (At Ch-76.800km)	On NH-129A near Peren town (At Ch-120.000km)	On NH-129A near Jalukie town (At Ch-142.500km)
Two Wheeler	47	0	1	101	838
Car/Jeep/Van/Taxi/Auto	443	37	16	246	1957
Mini Bus	1	0	0	6	5
Standard Bus	0	1	0	1	10
LCV	88	5	2	44	163
2-Axle	52	7	3	39	37
3-Axle	59	1	0	0	1
Multi-Axle	0	0	0	0	0
Tractor With Trailer	2	0	0	0	0
Tractor Without Trailer	4	1	0	0	0
Cycle	2	0	0	3	140
Cycle Rickshaw	0	0	0	0	0
Hand Cart	0	0	0	1	4
Bullock Cart	0	0	0	0	0
Horse Cart	0	0	0	0	0
Total Motorized Vehicles (In Number)	696	52	22	438	3011
Total Non Motorized Vehicles (In Number)	2	0	0	4	144
Total Vehicles(In Number)	698	52	22	442	3155
Total Motorized Vehicles (In PCU)	948	73	29	494	2772
Total Non Motorized Vehicles (In PCU)	1	0	0	5	81
Total Vehicles (In PCU)	949	73	29	500	2853
Total Commercial Vehicle per day (In Number)	202	14	5	91	216



6.4.2 TEMPORAL VARIATION

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

- o Daily Variation of Traffic
- o Hourly variation of traffic
- o Peak Hour Factor

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

Daily Variation

Figure-6.2 to Figure-6.11 presents daily variations in traffic in terms of no. of vehicles per day and PCU per day at all the count locations.

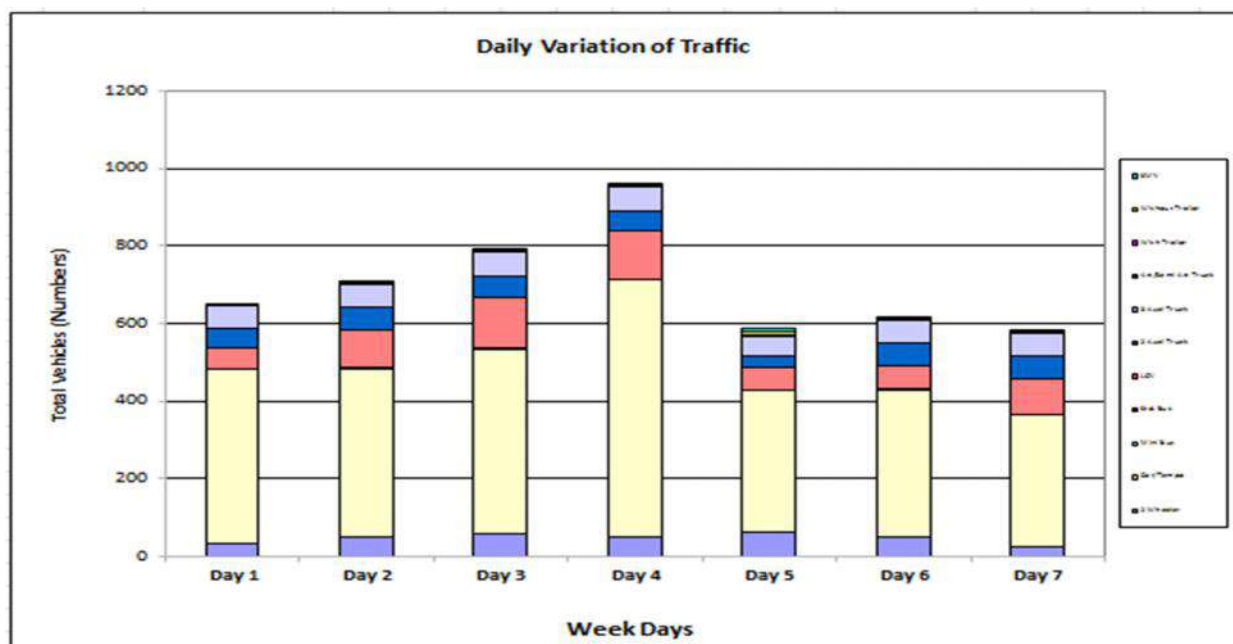


Figure 6.2: Daily Variation of Traffic at Ch- 0.700 Km in Vehicles per Day

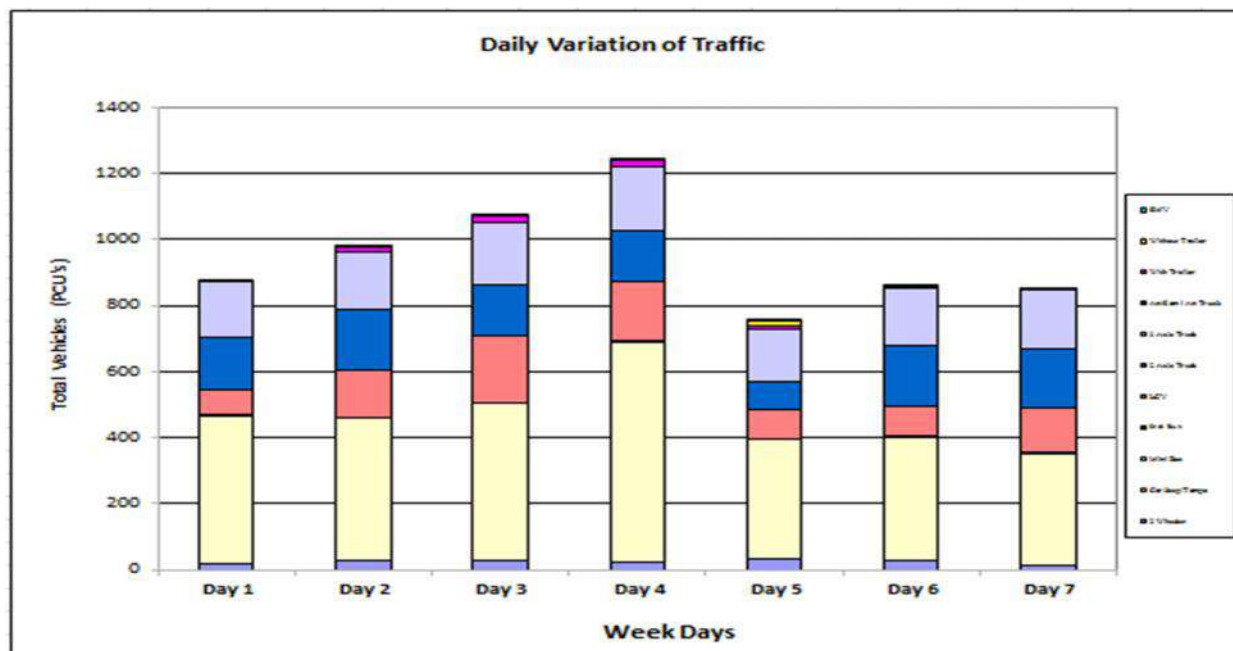


Figure 6.3: Daily Variation of Traffic at Ch- 0.700 Km in PCU per Day

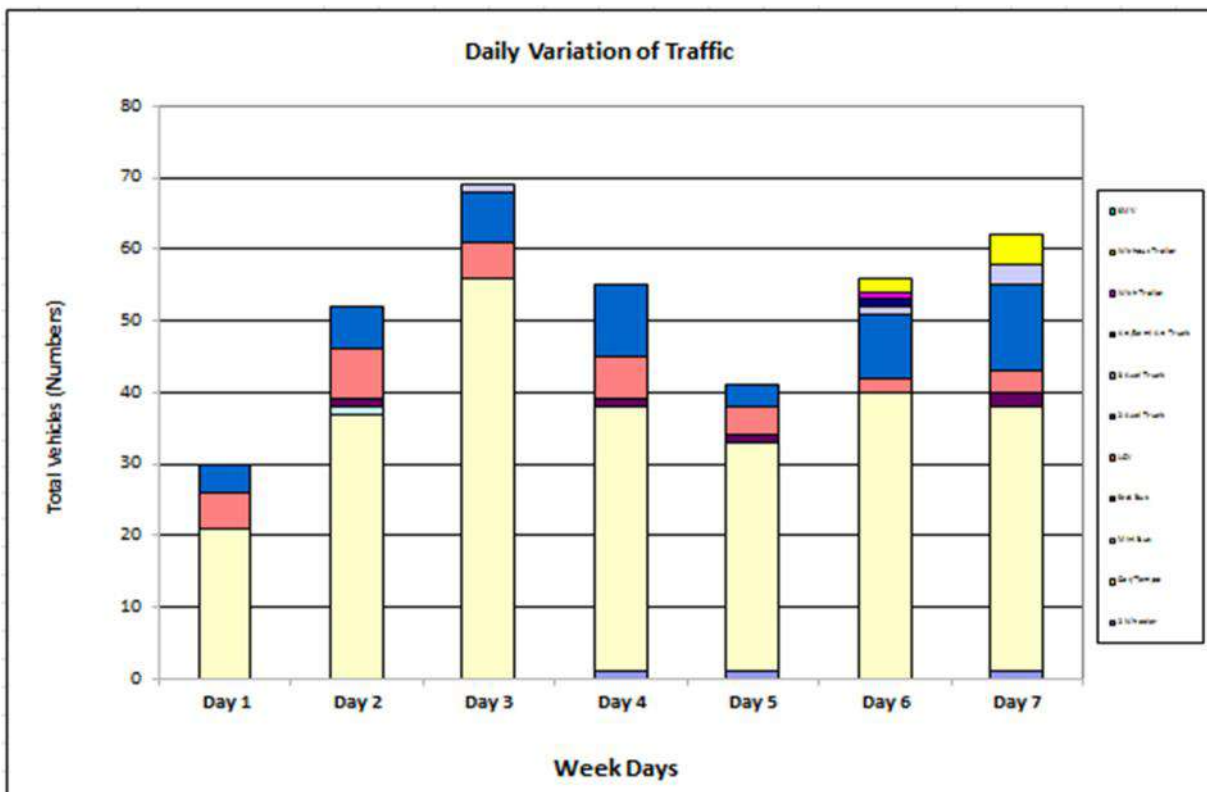


Figure 6.4: Daily Variation of Traffic at Ch- 36.000 Km in Vehicles per Day



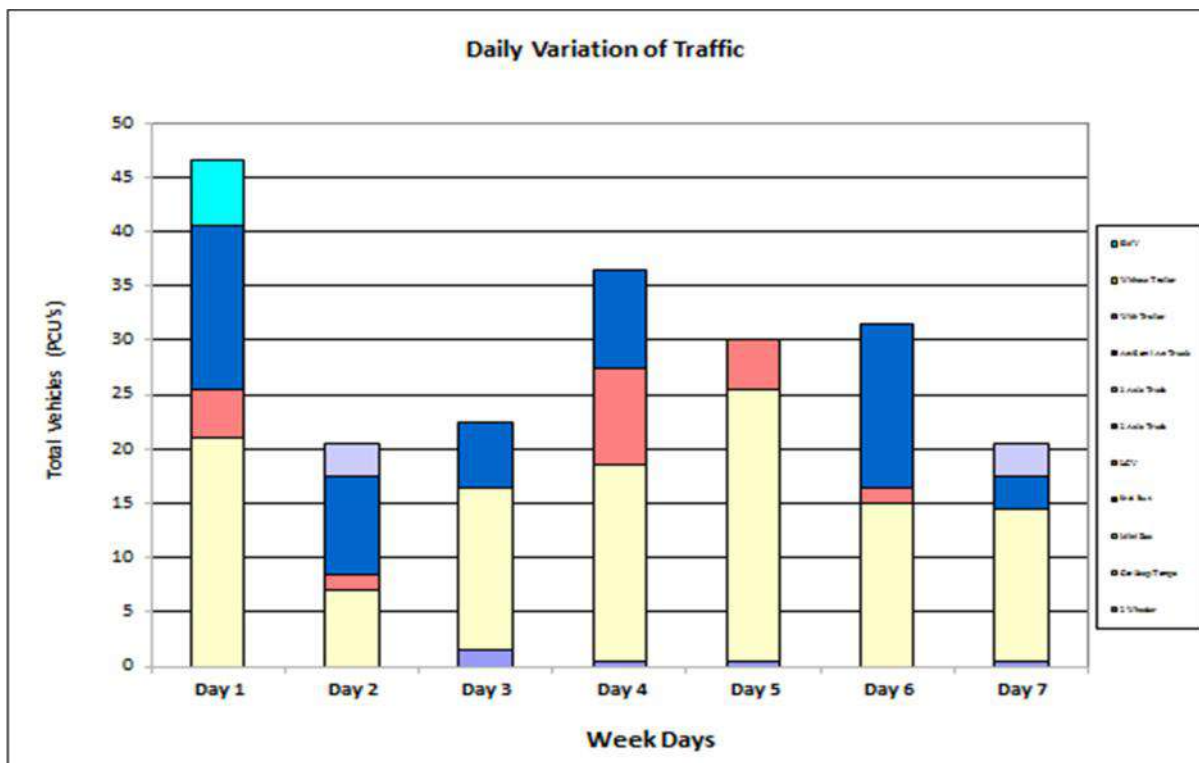


Figure 6.7: Daily Variation of Traffic at Ch- 76.800 Km in PCU per Day

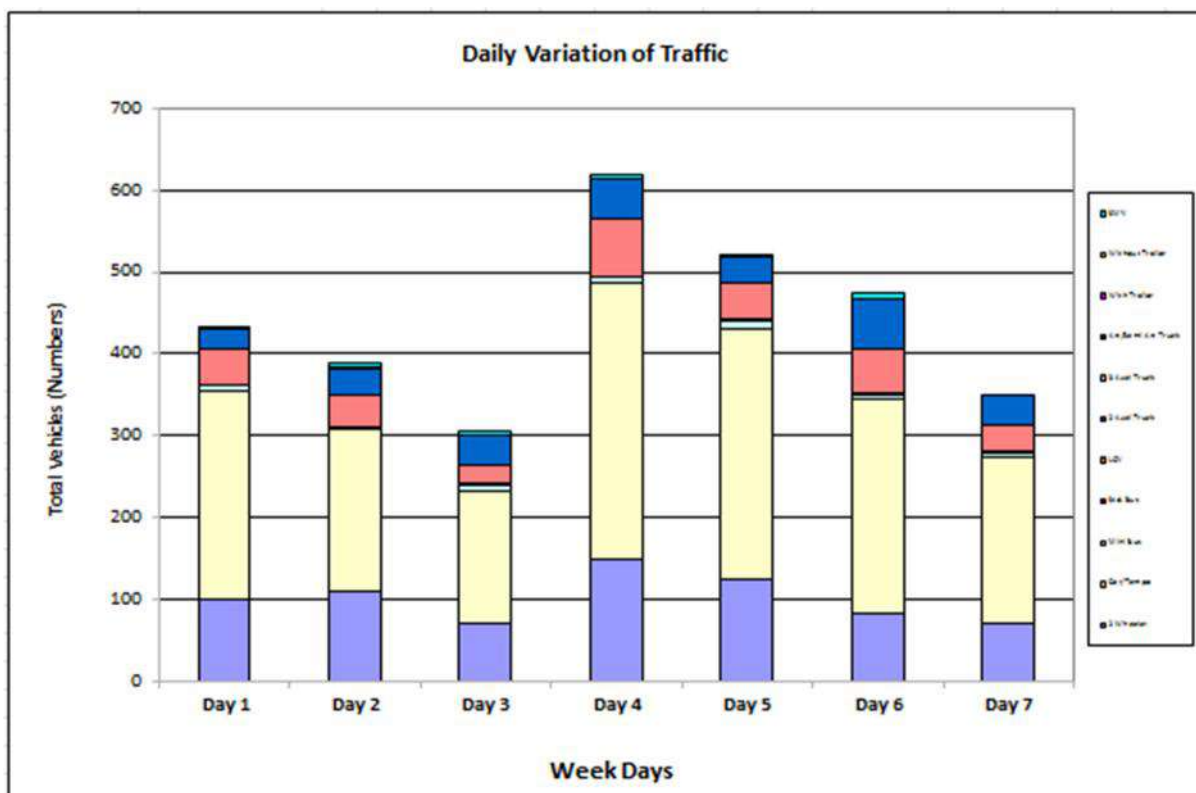


Figure 6.8: Daily Variation of Traffic at Ch- 120.000 Km in Vehicles per Day

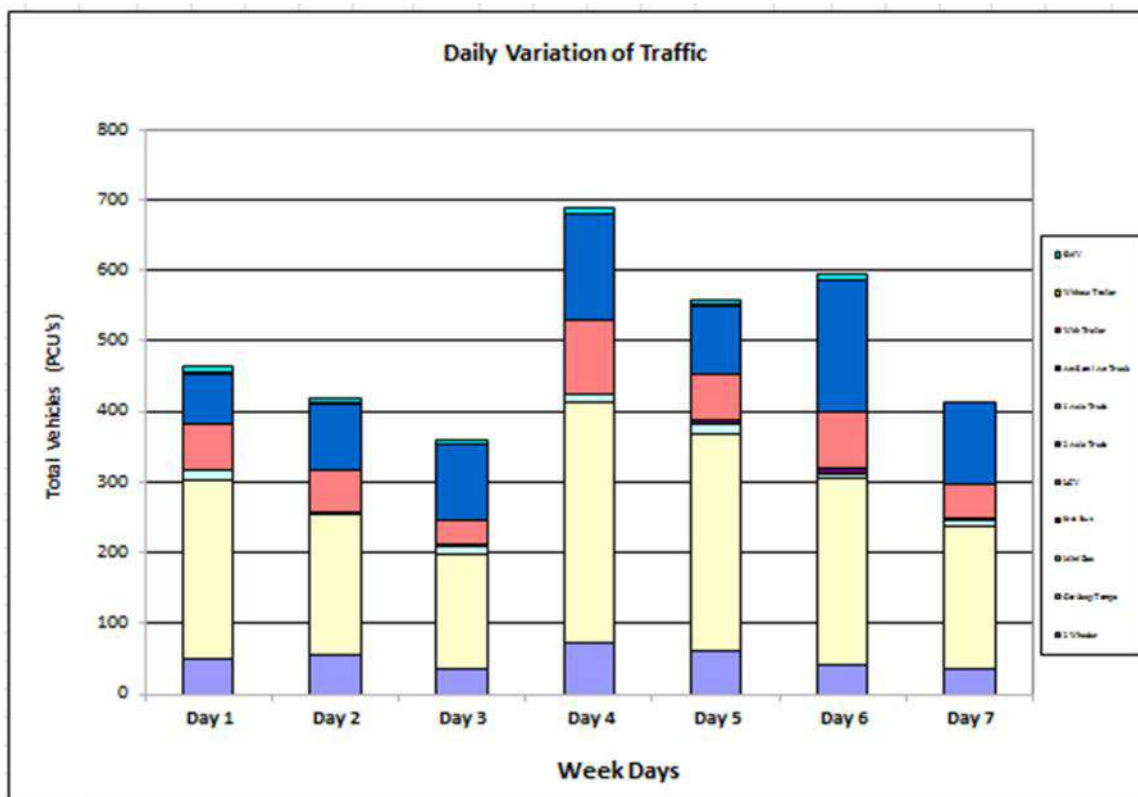


Figure 6.9: Daily Variation of Traffic at Ch- 120.000 Km in PCU per Day

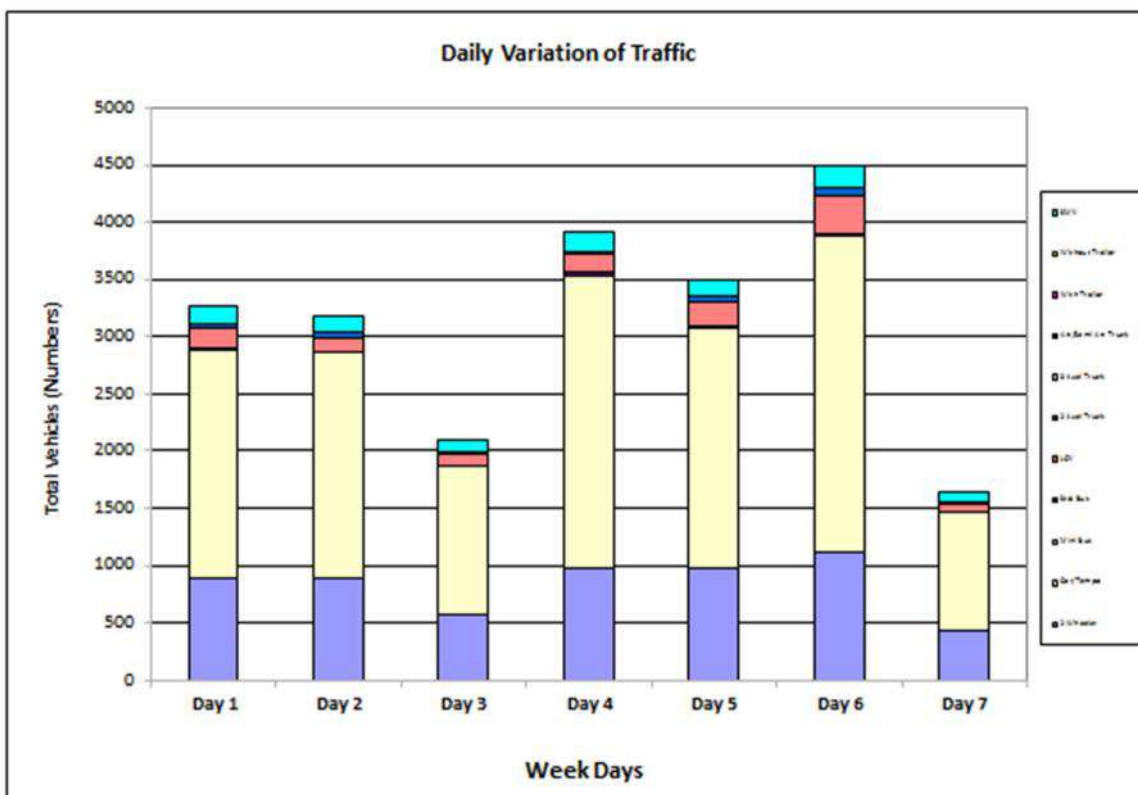


Figure 6.10: Daily Variation of Traffic at Ch-142.500 Km in Vehicles per Day

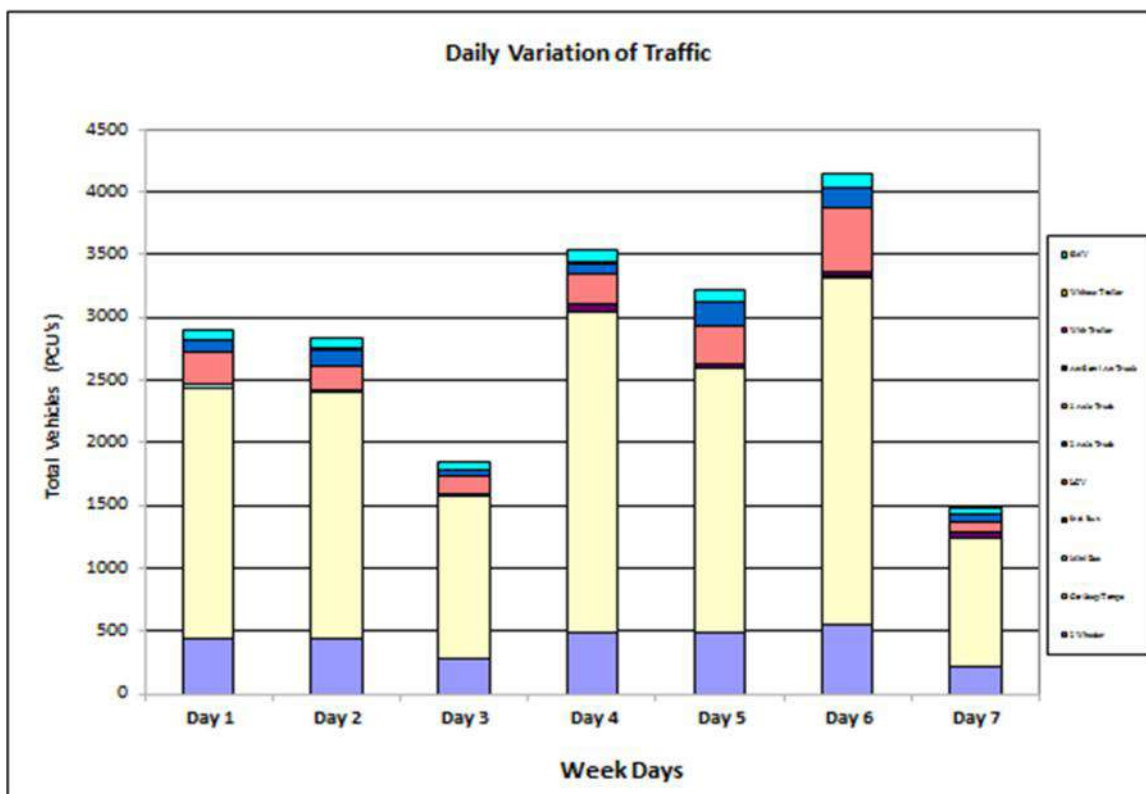


Figure 6.11: Daily Variation of Traffic at Ch- 142.500 Km in PCU per Day

From the above figures, the following conclusions are made:

- At Maram, the daily variation of traffic in number is +37.90% to -16.97% and in PCU is +31.33% to -20.59% with respect to average daily traffic.
- At Willong, the daily variation of traffic in number is +32.33% to -42.47% and in PCU is +35.35% to -44.63% with respect to average daily traffic.
- At Zumi, the daily variation of traffic in number is +30.13% to -46.15% and in PCU is +40.35% to -28.96% with respect to average daily traffic.
- At Peren, the daily variation of traffic in number is +40.37% to -31.53% and in PCU is +37.75% to -28.34% with respect to average daily traffic.
- At Jalukie, the daily variation of traffic in number is +42.57% to -48.52% and in PCU is +45.70% to -48.27% with respect to average daily traffic.

Hourly Variation

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

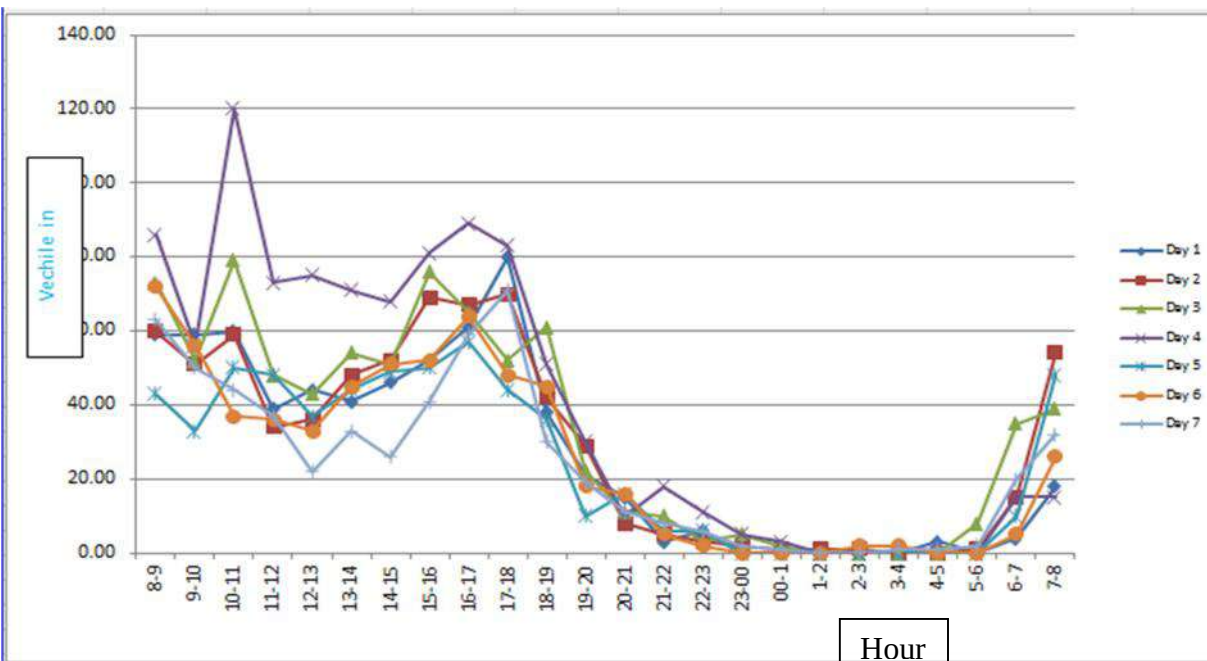


Figure 6.12: Hourly Variation of Traffic at Ch- 0.700 Km in Vehicles per Day

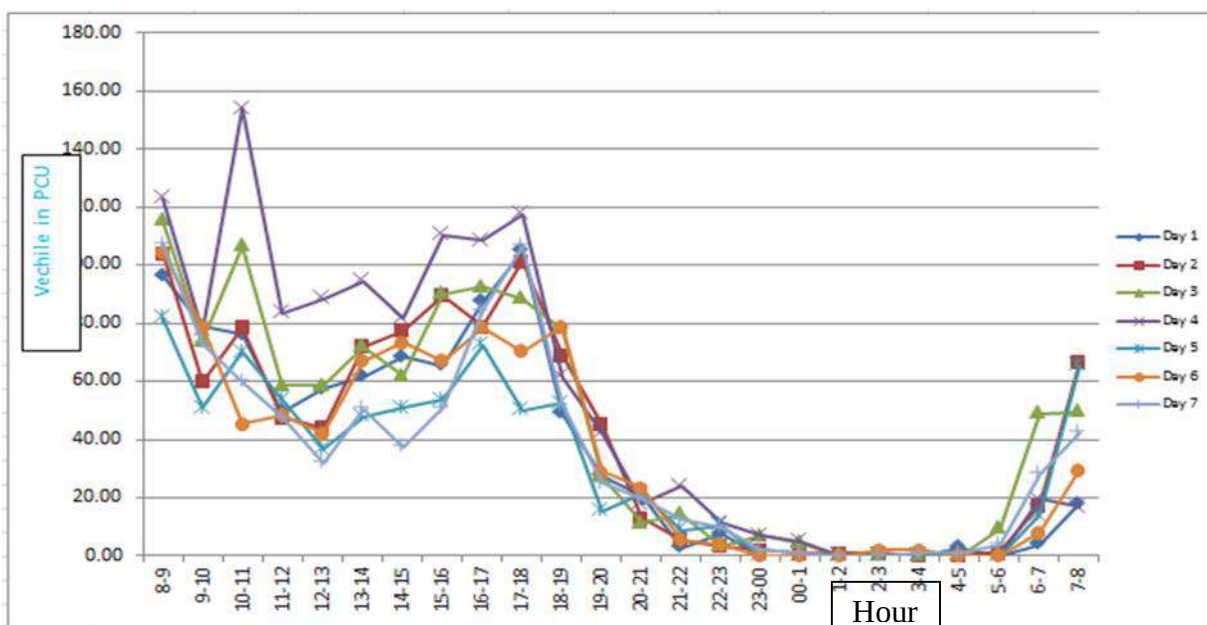


Figure 6.13: Hourly Variation of Traffic at Ch- 0.700 Km in PCU per Day

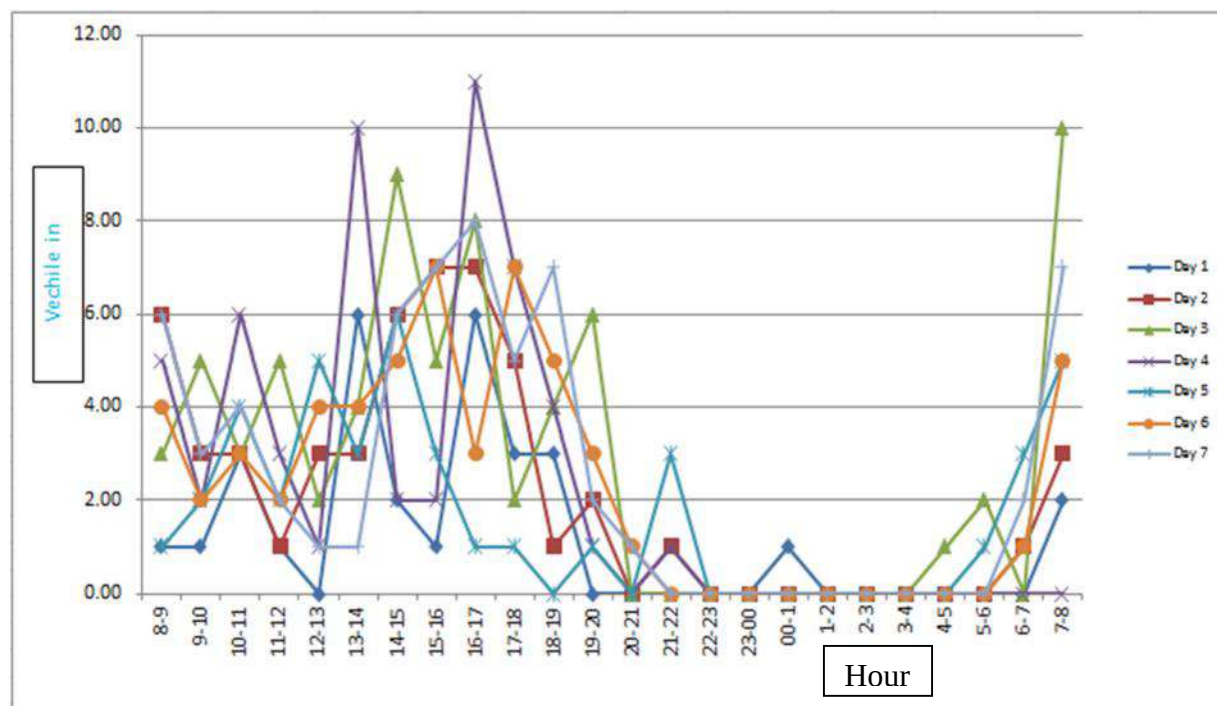


Figure 6.14: Hourly Variation of Traffic at Ch- 36.000 Km in Vehicles per Day

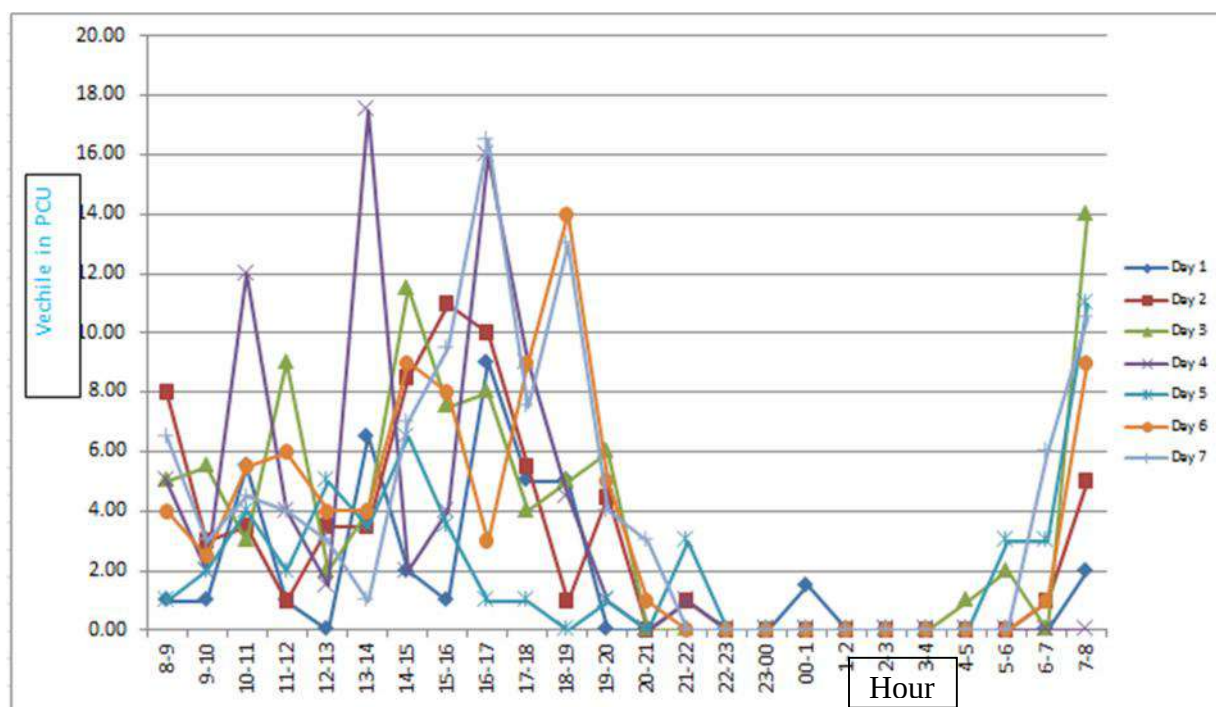


Figure 6.15: Hourly Variation of Traffic at Ch- 36.000 Km in PCU per Day

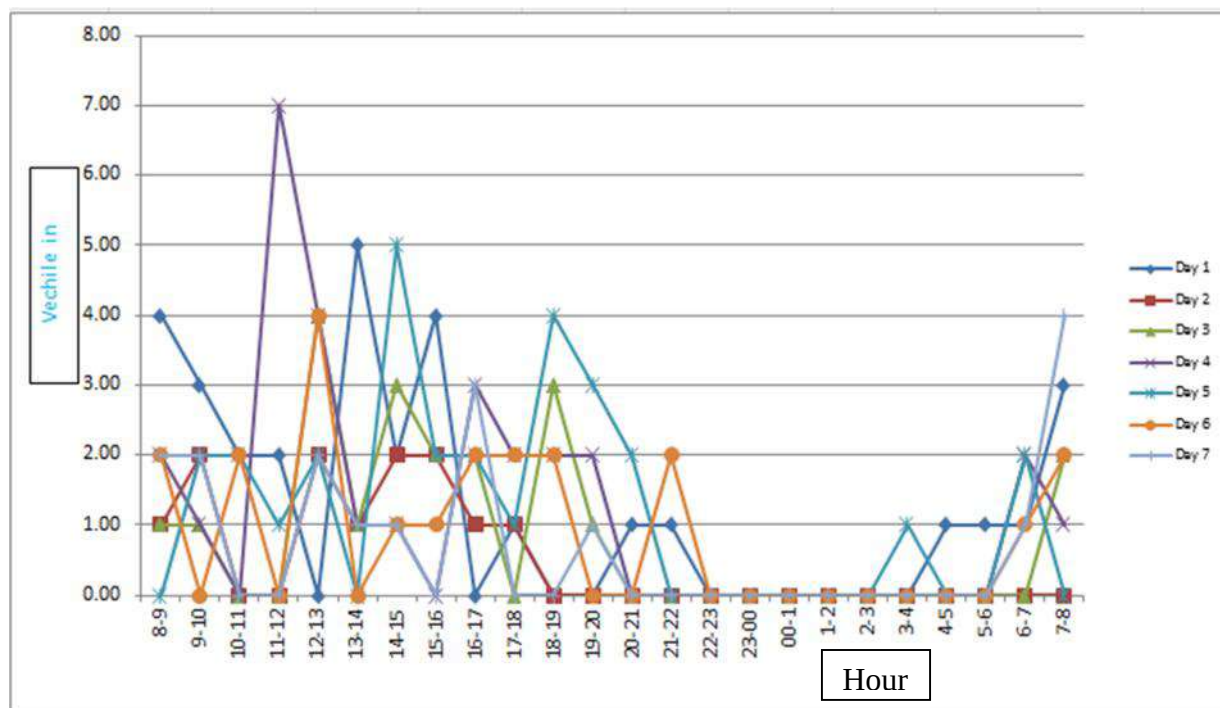


Figure 6.16: Hourly Variation of Traffic at Ch- 76.800 Km in Vehicles per Day

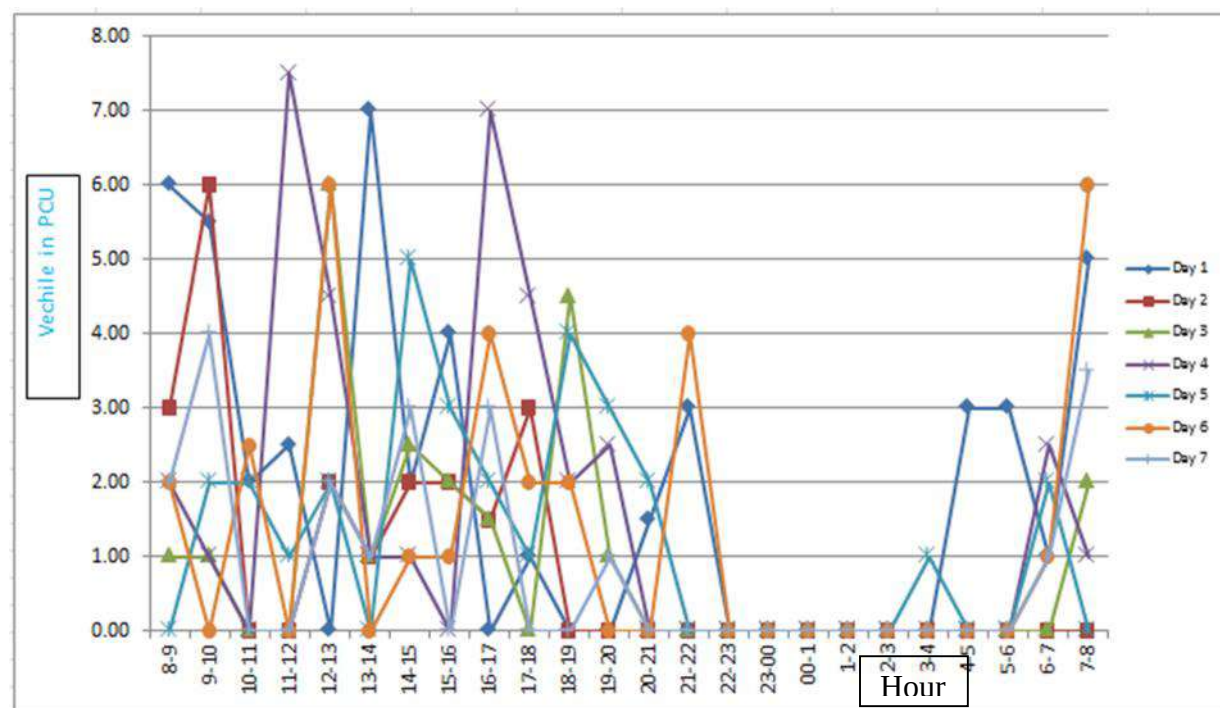


Figure 6.17: Hourly Variation of Traffic at Ch- 76.800 Km in PCU per Day

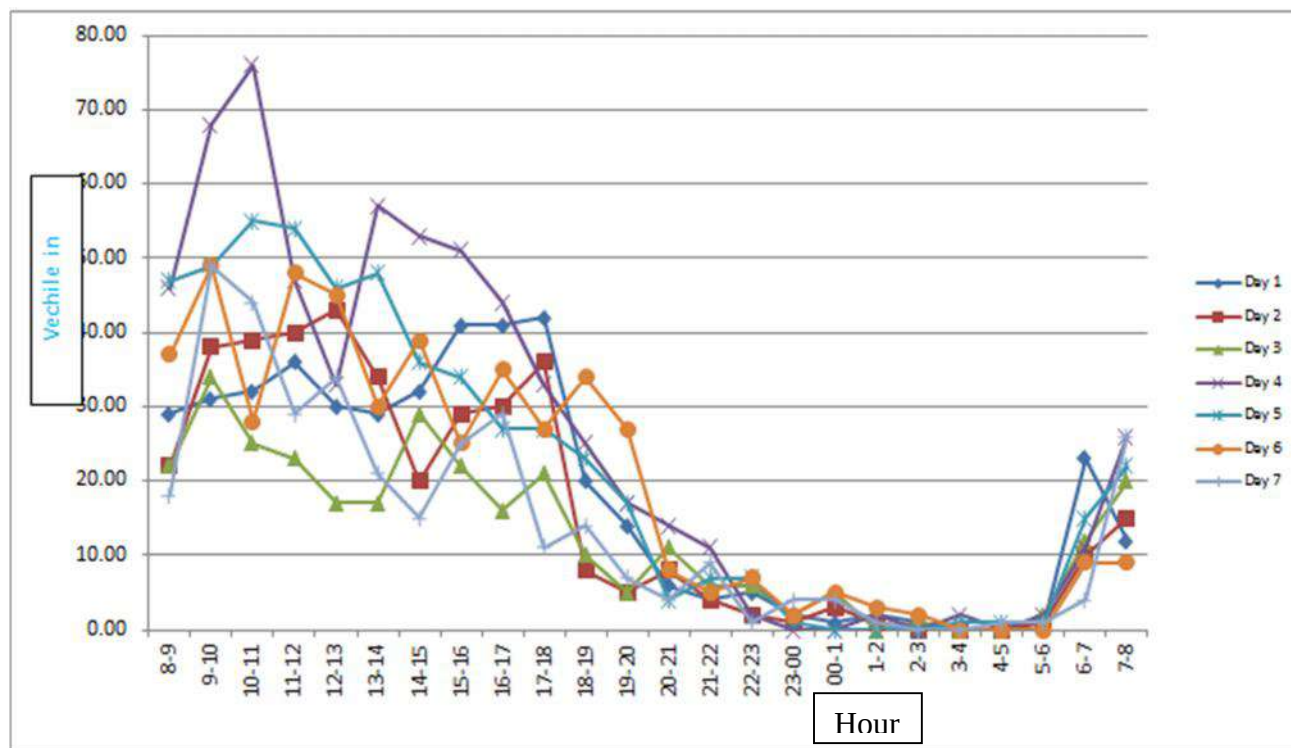


Figure 6.18: Hourly Variation of Traffic at Ch-120.000 Km in Vehicles per Day

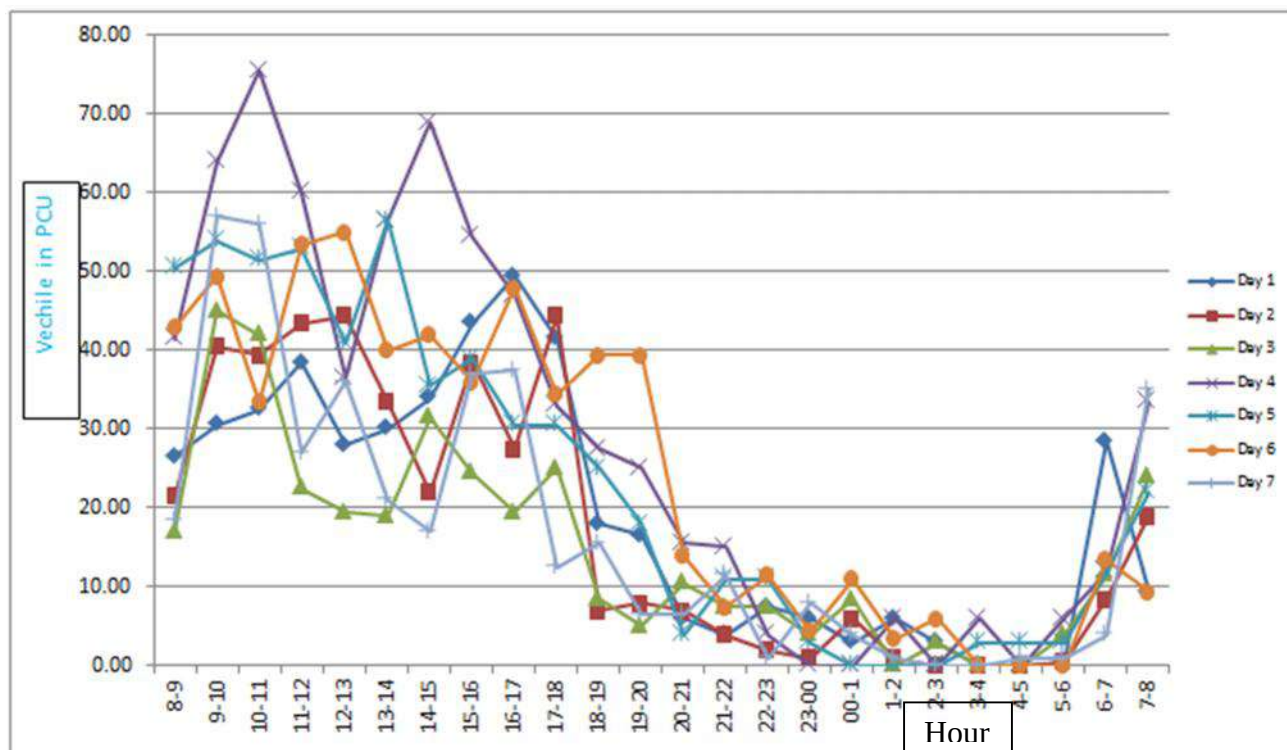


Figure 6.19: Hourly Variation of Traffic at Ch- 120.000 Km in PCU per Day

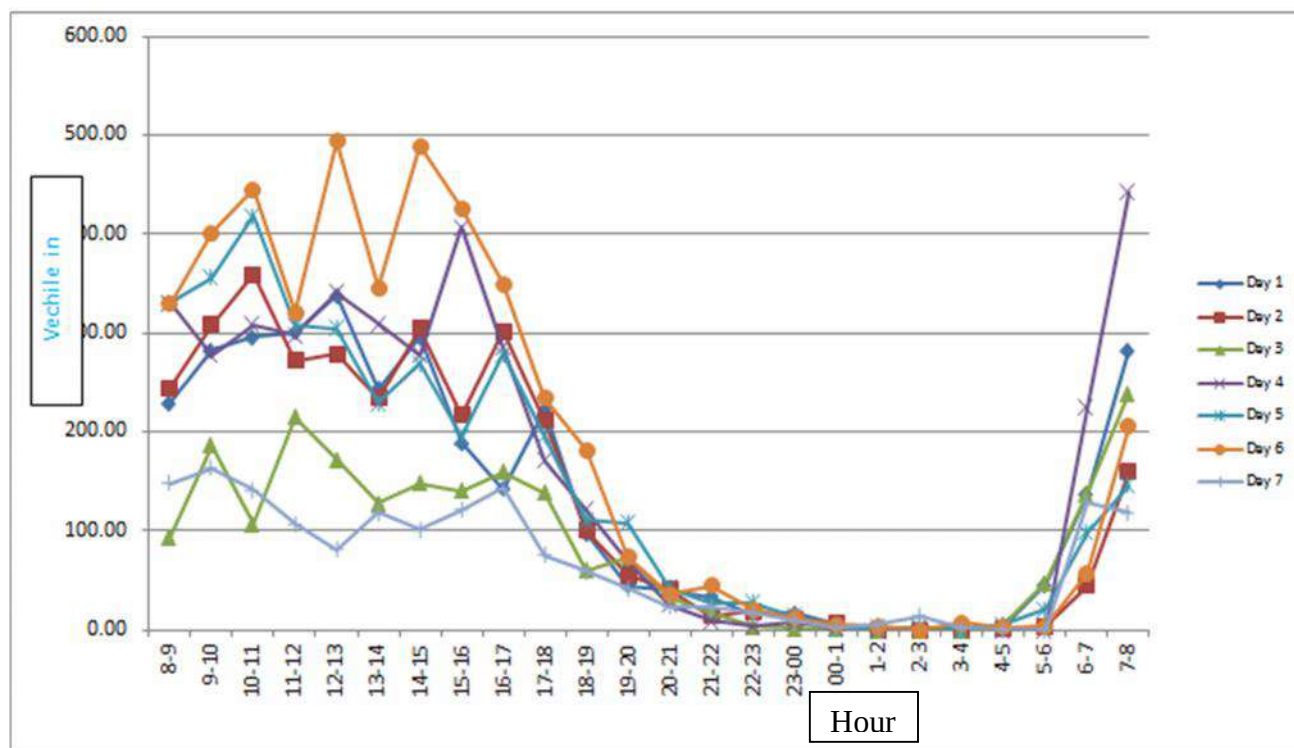


Figure 6.20: Hourly Variation of Traffic at Ch-142.500 Km in Vehicles per Day

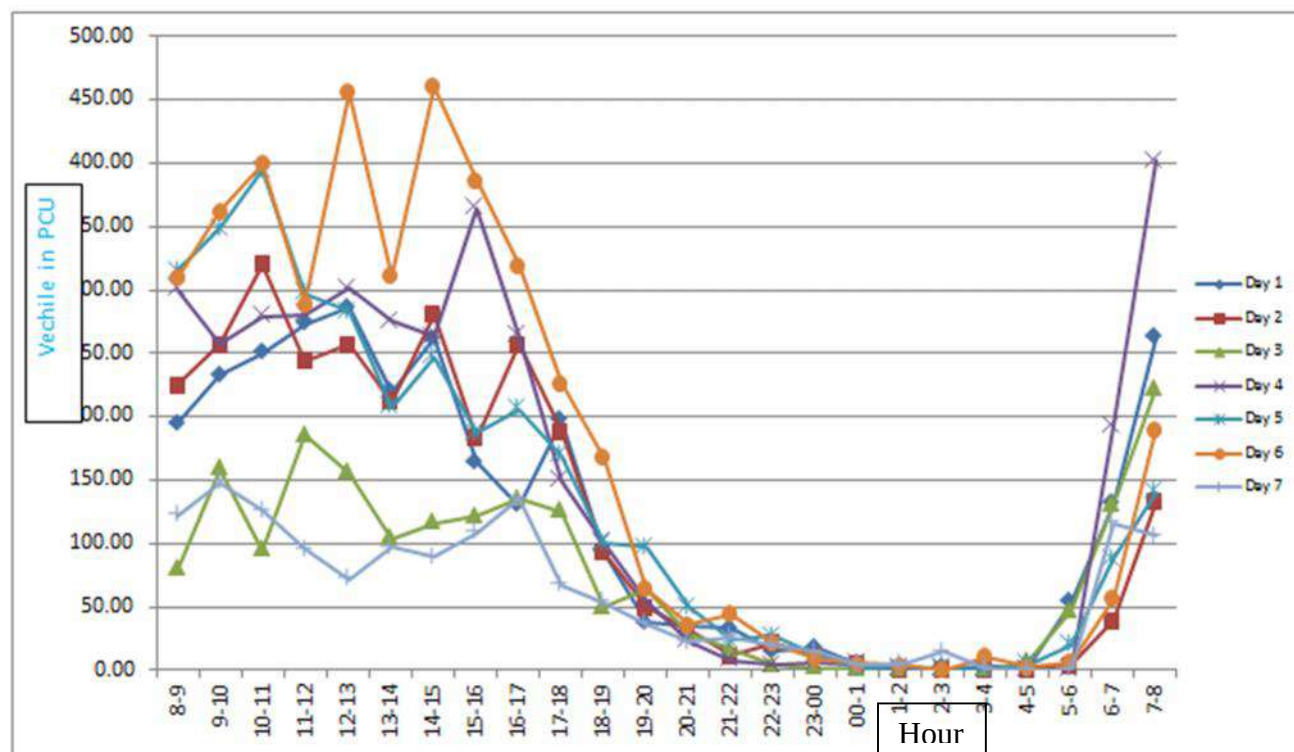


Figure 6.21: Hourly Variation of Traffic at Ch-142.500 Km in PCU per Day

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

- o The passenger traffic moves mostly during the day time and it is very low particularly between 20:00 hrs. to 06:00 hrs.
- o The slow moving traffic during night is negligible with most of the slow moving traffic moves during the day
- o Commercial traffic moves less in night compared to day time.

6.4.3 TRAFFIC COMPOSITION

While detailed traffic counts are presented in Appendix to Main Report, for ready reference and easier appreciation, the composition of traffic at CTVC count locations has been prescribed in **Figure-6.22** to **Figure- 6.26**.

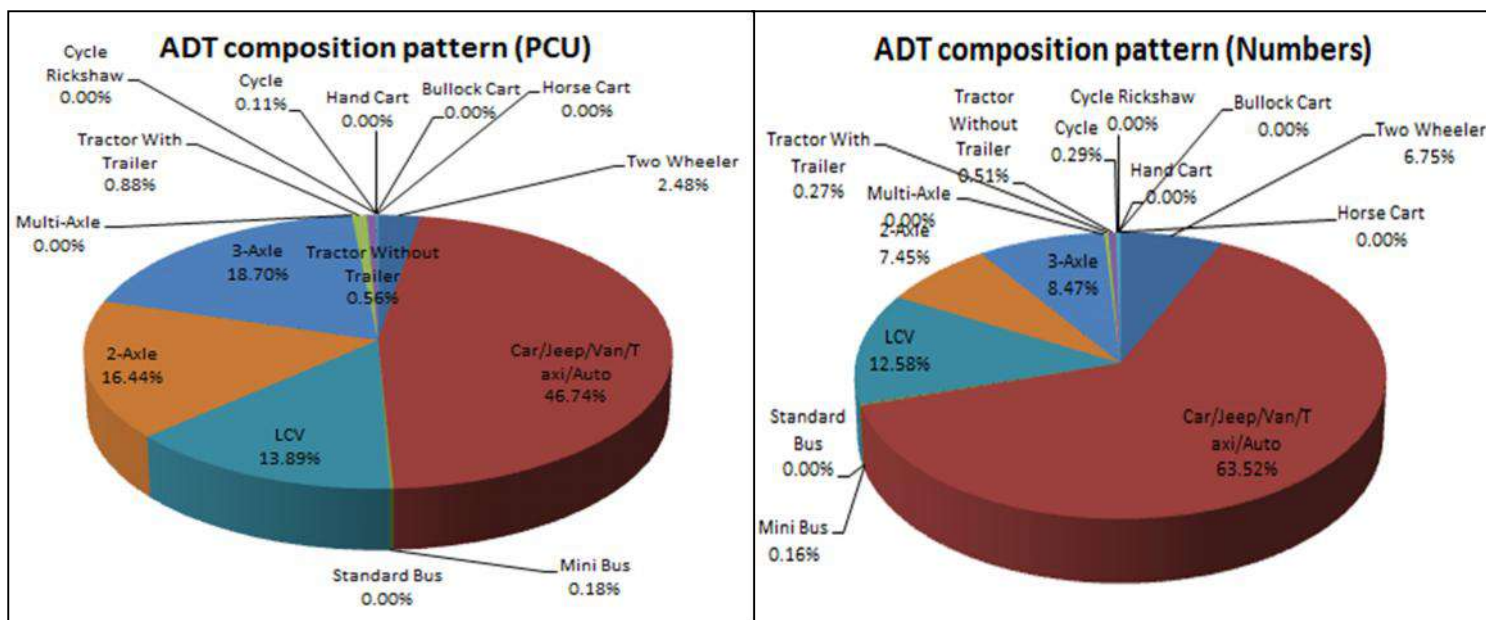


Figure 6.22: Traffic Composition at km 0+700 of NH-129A

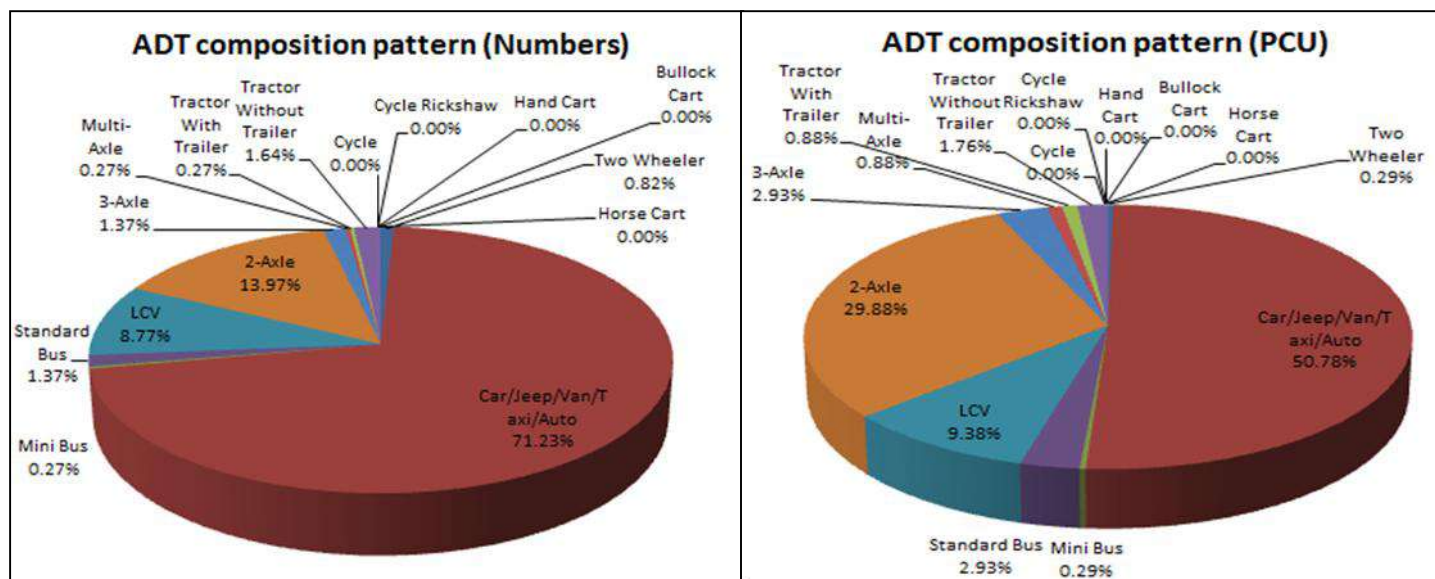


Figure 6.23: Traffic Composition at km 36+000 of NH-129A

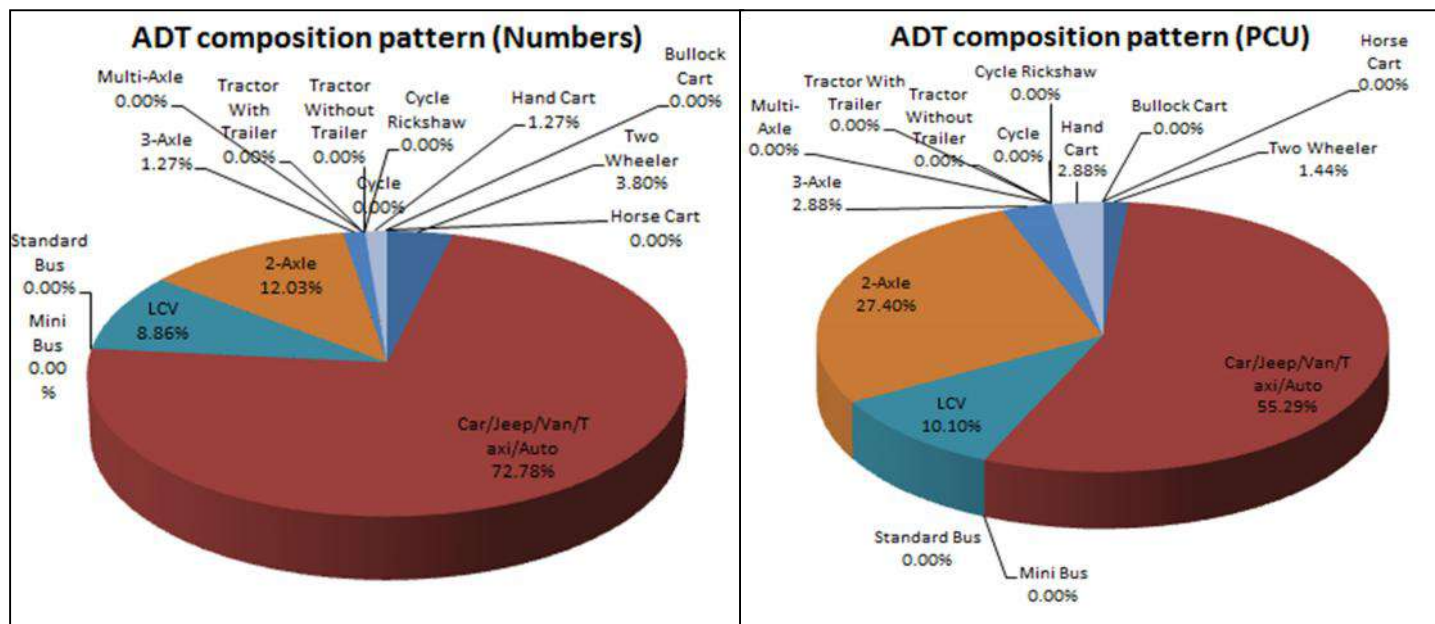


Figure 6.24: Traffic Composition at km 76+800 of NH-129A

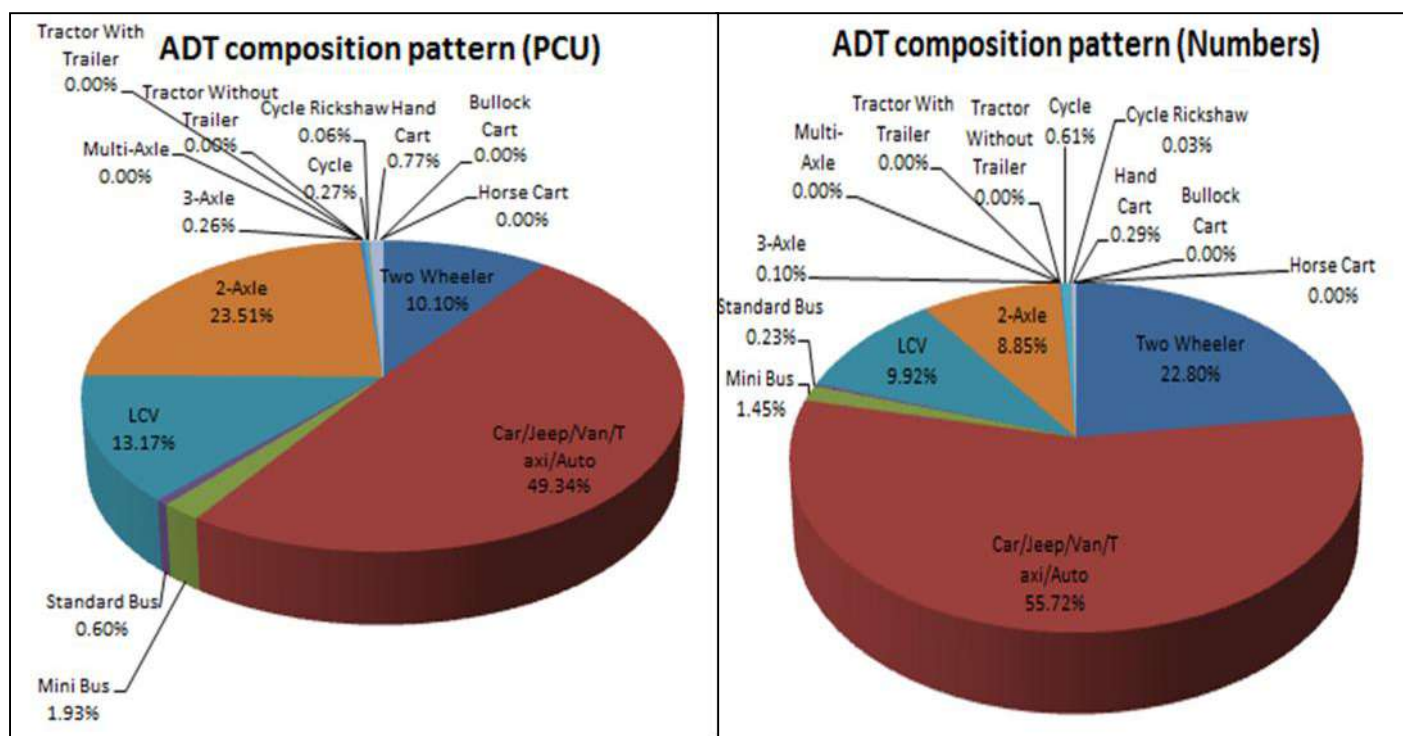


Figure 6.25: Traffic Composition at km 120+000 of NH-129A

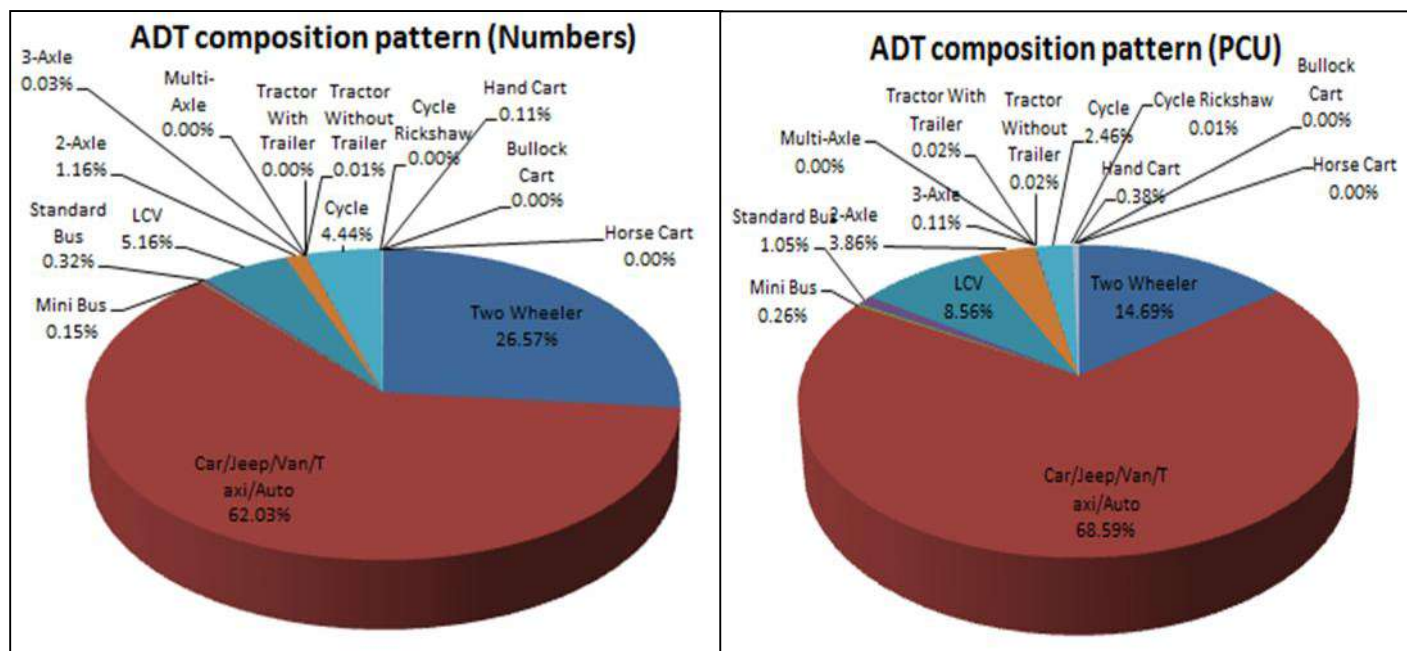


Figure 6.26: Traffic Composition at km 142+500 of NH-129A

The traffic composition shown in the above figures has been summarized in **Table- 6.4** to **Table- 6.8**.

TABLE 6.4: TRAFFIC COMPOSITION AT KM 0+700 OF NH-129A NEAR MARAM VILLAGE

Type of Vehicle	% of Total	ADT (Number)
Two Wheeler	6.75	47
Car/Jeep/Van/Taxi/Auto	63.52	443
Mini Bus	0.16	1
Standard Bus	0.00	0
LCV	12.58	88
2-Axle	7.45	52
3-Axle	8.47	59
Multi-Axle	0.00	0
Tractor With Trailer	0.27	2
Tractor Without Trailer	0.51	4
Cycle	0.29	2
Cycle Rickshaw	0.00	0
Hand Cart	0.00	0
Bullock Cart	0.00	0
Horse Cart	0.00	0

TABLE 6.5: TRAFFIC COMPOSITION AT KM 36+000 OF NH-129A NEAR WILLONG VILLAGE

Type of Vehicle	% of Total	ADT (Number)
Two Wheeler	0.82	0
Car/Jeep/Van/Taxi/Auto	71.23	37
Mini Bus	0.27	0
Standard Bus	1.37	1
LCV	8.77	5
2-Axle	13.97	7
3-Axle	1.37	1
Multi-Axle	0.27	0
Tractor With Trailer	0.27	0
Tractor Without Trailer	1.64	1
Cycle	0.00	0
Cycle Rickshaw	0.00	0
Hand Cart	0.00	0
Bullock Cart	0.00	0
Horse Cart	0.00	0



TABLE 6.6: TRAFFIC COMPOSITION AT KM 76+800 OF NH-129A NEAR ZIUMI VILLAGE

Type of Vehicle	% of Total	ADT (Number)
Two Wheeler	3.80	1
Car/Jeep/Van/Taxi/Auto	72.78	16
Mini Bus	0.00	0
Standard Bus	0.00	0
LCV	8.86	2
2-Axle	12.03	3
3-Axle	1.27	0
Multi-Axle	0.00	0
Tractor With Trailer	0.00	0
Tractor Without Trailer	0.00	0
Cycle	0.00	0
Cycle Rickshaw	0.00	0
Hand Cart	1.27	0
Bullock Cart	0.00	0
Horse Cart	0.00	0

TABLE 6.7: TRAFFIC COMPOSITION AT KM 120+000 OF NH-129A NEAR PEREN TOWN

Type of Vehicle	% of Total	ADT (Number)
Two Wheeler	22.80	101
Car/Jeep/Van/Taxi/Auto	55.72	246
Mini Bus	1.45	6
Standard Bus	0.23	1
LCV	9.92	44
2-Axle	8.85	39
3-Axle	0.10	0
Multi-Axle	0.00	0
Tractor With Trailer	0.00	0
Tractor Without Trailer	0.00	0
Cycle	0.61	3
Cycle Rickshaw	0.03	0
Hand Cart	0.29	1
Bullock Cart	0.00	0
Horse Cart	0.00	0



TABLE 6.8: TRAFFIC COMPOSITION AT KM 142+500 OF NH-129A NEAR JALUKIE TOWN

Type of Vehicle	% of Total	ADT (Number)
Two Wheeler	26.57	838
Car/Jeep/Van/Taxi/Auto	62.03	1957
Mini Bus	0.15	5
Standard Bus	0.32	10
LCV	5.16	163
2-Axle	1.16	37
3-Axle	0.03	1
Multi-Axle	0.00	0
Tractor With Trailer	0.00	0
Tractor Without Trailer	0.01	0
Cycle	4.44	140
Cycle Rickshaw	0.00	0
Hand Cart	0.11	4
Bullock Cart	0.00	0
Horse Cart	0.00	0

6.4.4 SEASONAL CORRECTION

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

SEASONAL CORRECTION FACTOR

The petrol and diesel fuel sale data for the years 2015-2018 have been collected and analyzed for estimation of Average Seasonal Correction Factor (ASCF) and Peak Seasonal Correction Factor (PSCF). As the traffic surveys were conducted in the month of January, the above factors for the month of January is considered. The fuel sales figures at the filling station in the region are presented month wise in **Table- 6.9 & Table-6.10.**



TABLE 6.9: SUMMARY OF PETROL AND DIESEL SALES DATA AT FUEL STATION

Petrol Sales Data (in Litre)				
Year	Month	Fuel Stations		
		M/s Rangkau Service Station, Jalukie Town	Avg. Sales Per Station (Lt.)	Avg. Sales Per Station (Lt.)
2015	APR	8405	8,405	8,405
2015	MAY	8405	8,405	8,405
2015	JUN	8405	8,405	8,405
2015	JUL	8405	8,405	8,405
2015	AUG	8405	8,405	8,405
2015	SEP	8405	8,405	8,405
2015	OCT	8405	8,405	8,405
2015	NOV	8405	8,405	8,405
2015	DEC	8405	8,405	8,405
2016	JAN	8405	8,405	8,405
2016	FEB	8405	8,405	8,405
2016	MAR	8405	8,405	8,405
2016	APR	27233	27,233	27,233
2016	MAY	27233	27,233	27,233
2016	JUN	27233	27,233	27,233
2016	JUL	27233	27,233	27,233
2016	AUG	27233	27,233	27,233
2016	SEP	27233	27,233	27,233
2016	OCT	27233	27,233	27,233
2016	NOV	27233	27,233	27,233
2016	DEC	27233	27,233	27,233
2017	JAN	27233	27,233	27,233
2017	FEB	27233	27,233	27,233
2017	MAR	27233	27,233	27,233
2017	APR	30642	30,642	30,642
2017	MAY	30642	30,642	30,642
2017	JUN	30642	30,642	30,642
2017	JUL	30642	30,642	30,642
2017	AUG	30642	30,642	30,642
2017	SEP	30642	30,642	30,642
2017	OCT	30642	30,642	30,642
2017	NOV	30642	30,642	30,642
2017	DEC	30642	30,642	30,642
2018	JAN	30642	30,642	30,642
2018	FEB	30642	30,642	30,642

Diesel Sales Data (in Litre)				
Year	Month	Fuel Stations		
		M/s Rangkau Service Station, Jalukie Town	Avg. Sales Per Station (Lt.)	Avg. Sales Per Station (Lt.)
2015	APR	11127	11,127	11,127
2015	MAY	11127	11,127	11,127
2015	JUN	11127	11,127	11,127
2015	JUL	11127	11,127	11,127
2015	AUG	11127	11,127	11,127
2015	SEP	11127	11,127	11,127
2015	OCT	11127	11,127	11,127
2015	NOV	11127	11,127	11,127
2015	DEC	11127	11,127	11,127
2016	JAN	11127	11,127	11,127
2016	FEB	11127	11,127	11,127
2016	MAR	11127	11,127	11,127
2016	APR	56025	56,025	56,025
2016	MAY	56025	56,025	56,025
2016	JUN	56025	56,025	56,025
2016	JUL	56025	56,025	56,025
2016	AUG	56025	56,025	56,025
2016	SEP	56025	56,025	56,025
2016	OCT	56025	56,025	56,025
2016	NOV	56025	56,025	56,025
2016	DEC	56025	56,025	56,025
2017	JAN	56025	56,025	56,025
2017	FEB	56025	56,025	56,025
2017	MAR	56025	56,025	56,025
2017	APR	49298	49,298	49,298
2017	MAY	49298	49,298	49,298
2017	JUN	49298	49,298	49,298
2017	JUL	49298	49,298	49,298
2017	AUG	49298	49,298	49,298
2017	SEP	49298	49,298	49,298
2017	OCT	49298	49,298	49,298
2017	NOV	49298	49,298	49,298
2017	DEC	49298	49,298	49,298
2018	JAN	49298	49,298	49,298
2018	FEB	49298	49,298	49,298



TABLE 6.10: SUMMARY OF SEASONAL VARIATION FACTOR (PETROL AND DIESEL)

Month	Avg. Sales (Lt.)		Avg. Seasonal Correction Factor		Peak Seasonal Correction Factor	
	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel
Jan	22,093	38,817	0.84	0.90	1.00	1.00
Feb	22,093	38,817	0.84	0.90	1.00	1.00
Mar	17,819	38,817	1.04	0.90	1.24	1.00
Apr	17,819	33,576	1.04	1.04	1.24	1.16
May	17,819	33,576	1.04	1.04	1.24	1.16
Jun	17,819	33,576	1.04	1.04	1.24	1.16
Jul	17,819	33,576	1.04	1.04	1.24	1.16
Aug	17,819	33,576	1.04	1.04	1.24	1.16
Sep	17,819	33,576	1.04	1.04	1.24	1.16
Oct	17,819	33,576	1.04	1.04	1.24	1.16
Nov	17,819	33,576	1.04	1.04	1.24	1.16
Dec	17,819	33,576	1.04	1.04	1.24	1.16
Avg. Sale per Month	18,532	34,886				

Average Seasonal Correction Factor for Petrol operated vehicles =	0.84
Average Seasonal Correction Factor for Diesel operated vehicles =	0.90
Average Seasonal Correction Factor to be considered for both type of vehicles =	0.92
Peak Seasonal Correction Factor for Petrol operated vehicles =	1.00
Peak Seasonal Correction Factor for Diesel operated vehicle =	1.00
Peak Seasonal Correction Factor to be considered for both type of vehicles =	1.01

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

6.4.5 ANNUAL AVERAGE DAILY TRAFFIC (AADT)

The Average seasonal correction factors for petrol and diesel driven vehicles, described in the previous sections have been applied to ADT to find out AADT.



TABLE 6.11: ESTIMATES OF AADT AS OBSERVED ON THE PROJECT ROAD (JANUARY 2018)

Vehicle Type	AADT				
	Maram (0.700 Km)	Willong (36.000 km)	Ziumi (76.800 km)	Peren Town (120.00 km)	Jalukie Town (142.500 km)
Two Wheeler	42	0	1	108	894
Car/Jeep/Van/Taxi/Auto	385	35	15	231	1834
Mini Bus	1	0	0	0	0
Standard Bus	0	1	0	0	0
LCV	71	4	2	2	2
2-Axle Truck	42	6	2	2	2
3-Axle Truck	48	1	0	0	0
Multi-Axle	0	0	0	0	0
Tractor With Trailer	2	0	0	0	0
Tractor Without Trailer	3	1	0	0	0
Cycle	2	0	0	3	140
Cycle Rickshaw	0	0	0	0	0
Hand Cart	0	0	0	1	4
Bullock Cart	0	0	0	0	0
Horse Cart	0	0	0	0	0
Total Motorized Vehicles (in Number)	594	47	20	343	2732
Total Non Motorized Vehicles (in Number)	2	0	0	4	144
Total Vehicles (in Number)	596	47	20	347	2876
Total Motorized Vehicles (in PCU)	795	64	26	294	2292
Total Non Motorized Vehicles (in PCU)	1	0	1	6	81
Total Vehicles (in PCU)	796	64	26	300	2373
Commercial Vehicle per day	163	11	4	4	4

6.4.6 TRAFFIC GROWTH RATES

As per IRC: SP 48:1998, Hill Road Manual, 7.5 % growth of traffic is considered for Hill road.



6.4.7 TRAFFIC PROJECTION FOR HOMOGENEOUS SECTION – I (KM 0+000 TO KM 115+280)

In Year 2019: 641 (in Numbers), 856 (in PCU)

In Year 2022: 796 (in Numbers), 1063 (in PCU)

In Year 2042: 3381 (in Numbers), 4517 (in PCU)

TABLE 6.12: TRAFFIC PROJECTION FOR HOMOGENEOUS SECTION - I

Year	Growth Factors	AADT															Total in Numbers	Total in PCU
		Two Wheeler	Car/Jeep/ Van/Taxi/ Auto	Mini / RTVs Bus	Stand. Bus	LCV	2-Axle	3 - Axle	Multi-Axle	Agri. Tract. With Trailer	Agri. Tract. Without Trailer	Cycle	Cycle Rickshaw	Hand Cart	Bullock Cart	Horse Cart		
2018	7.5%	42	385	1	0	71	42	48	0	2	3	2	0	0	0	0	596	796
2019	7.5%	46	414	1	0	76	45	51	0	2	3	2	0	0	0	0	641	856
2020	7.5%	49	445	1	0	82	49	55	0	2	3	2	0	0	0	0	689	920
2021	7.5%	53	479	1	0	88	52	59	0	2	4	2	0	0	0	0	740	989
2022	7.5%	57	514	1	0	95	56	64	0	2	4	3	0	0	0	0	796	1063
2023	7.5%	61	553	1	0	102	60	69	0	2	4	3	0	0	0	0	856	1143
2024	7.5%	65	595	1	0	110	65	74	0	2	5	3	0	0	0	0	920	1229
2025	7.5%	70	639	2	0	118	70	79	0	3	5	3	0	0	0	0	989	1321
2026	7.5%	76	687	2	0	127	75	85	0	3	5	4	0	0	0	0	1063	1420
2027	7.5%	81	739	2	0	136	81	92	0	3	6	4	0	0	0	0	1143	1527
2028	7.5%	87	794	2	0	146	87	99	0	3	6	4	0	0	0	0	1228	1641
2029	7.5%	94	854	2	0	157	93	106	0	3	7	4	0	0	0	0	1320	1764
2030	7.5%	101	918	2	0	169	100	114	0	4	7	5	0	0	0	0	1419	1897
2031	7.5%	108	986	2	0	182	108	122	0	4	8	5	0	0	0	0	1526	2039
2032	7.5%	117	1060	3	0	195	116	132	0	4	8	6	0	0	0	0	1640	2192
2033	7.5%	125	1140	3	0	210	124	141	0	5	9	6	0	0	0	0	1763	2356
2034	7.5%	135	1225	3	0	226	134	152	0	5	10	6	0	0	0	0	1895	2533
2035	7.5%	145	1317	3	0	243	144	163	0	5	10	7	0	0	0	0	2038	2723
2036	7.5%	156	1416	3	0	261	154	176	0	6	11	7	0	0	0	0	2190	2927
2037	7.5%	167	1522	4	0	281	166	189	0	6	12	8	0	0	0	0	2355	3147
2038	7.5%	180	1636	4	0	302	179	203	0	7	13	8	0	0	0	0	2531	3383
2039	7.5%	193	1759	4	0	324	192	218	0	7	14	9	0	0	0	0	2721	3636
2040	7.5%	208	1891	5	0	349	206	235	0	8	15	10	0	0	0	0	2925	3909
2041	7.5%	224	2033	5	0	375	222	252	0	8	16	11	0	0	0	0	3145	4202
2042	7.5%	240	2185	5	0	403	238	271	0	9	17	11	0	0	0	0	3381	4517
2043	7.5%	258	2349	6	0	433	256	292	0	9	18	12	0	0	0	0	3634	4856

6.4.8 TRAFFIC PROJECTION FOR HOMOGENEOUS SECTION – II (KM 115+280 TO 141+690 KM)

In Year 2019: 373 (in Numbers), 322 (in PCU)

In Year 2022: 463 (in Numbers), 401 (in PCU)

In Year 2042: 1966 (in Numbers), 1701 (in PCU)

TABLE 6.13: TRAFFIC PROJECTION OF HOMOGENEOUS SECTION-II

Year	Growth Factors	AADT															Total in Numbers	Total in PCU
		Two Wheeler	Car/Jeep/Van/Taxi/Auto	Mini / RTVs Bus	Stand. Bus	LCV	2-Axle	3 - Axle	Multi-Axle	Agri. Tract. With Trailer	Agri. Tract. Without Trailer	Cycle	Cycle Rickshaw	Hand Cart	Bullock Cart	Horse Cart		
2018	7.5%	108	231	0	0	2	2	0	0	0	0	3	0	1	0	0	347	300
2019	7.5%	116	248	0	0	2	2	0	0	0	0	3	0	1	0	0	373	322
2020	7.5%	124	267	0	0	2	3	0	0	0	0	3	0	1	0	0	401	347
2021	7.5%	134	287	0	0	2	3	0	0	0	0	3	0	2	0	0	431	373
2022	7.5%	144	308	0	0	2	3	0	0	0	0	4	0	2	0	0	463	401
2023	7.5%	154	332	0	0	2	3	0	0	0	0	4	0	2	0	0	498	431
2024	7.5%	166	356	0	0	2	3	0	0	0	0	4	0	2	0	0	535	463
2025	7.5%	178	383	0	0	3	4	0	0	0	0	5	0	2	0	0	575	498
2026	7.5%	192	412	0	0	3	4	0	0	0	0	5	0	2	0	0	618	535
2027	7.5%	206	443	0	0	3	4	0	0	0	0	5	0	2	0	0	665	575
2028	7.5%	222	476	0	0	3	5	0	0	0	0	6	0	3	0	0	714	618
2029	7.5%	238	512	0	0	4	5	1	0	0	0	6	0	3	0	0	768	664
2030	7.5%	256	550	0	0	4	5	1	0	0	0	6	0	3	0	0	826	714
2031	7.5%	275	591	0	0	4	6	1	0	0	0	7	0	3	0	0	888	768
2032	7.5%	296	636	0	0	4	6	1	0	0	0	7	0	4	0	0	954	825
2033	7.5%	318	683	0	0	5	6	1	0	0	0	8	0	4	0	0	1026	887
2034	7.5%	342	735	0	0	5	7	1	0	0	0	9	0	4	0	0	1103	954
2035	7.5%	368	790	0	0	6	8	1	0	0	0	9	0	4	0	0	1185	1025
2036	7.5%	395	849	0	0	6	8	1	0	0	0	10	1	5	0	0	1274	1102
2037	7.5%	425	913	0	0	6	9	1	0	0	0	11	1	5	0	0	1370	1185
2038	7.5%	457	981	0	0	7	9	1	0	0	0	12	1	5	0	0	1473	1274
2039	7.5%	491	1055	0	0	7	10	1	0	0	0	12	1	6	0	0	1583	1369
2040	7.5%	528	1134	0	0	8	11	1	0	0	0	13	1	6	0	0	1702	1472
2041	7.5%	567	1219	0	0	9	12	1	0	0	0	14	1	7	0	0	1829	1583
2042	7.5%	610	1310	0	0	9	12	1	0	0	0	15	1	7	0	0	1966	1701
2043	7.5%	656	1408	0	0	10	13	1	0	0	0	17	1	8	0	0	2114	1829

6.4.9 TRAFFIC PROJECTION FOR HOMOGENEOUS SECTION – III (KM 141+690 TO 177+482 KM)

In Year 2019: 3304 (in Numbers), 2938 (in PCU)

In Year 2022: 4105 (in Numbers), 3650 (in PCU)

In Year 2042: 17437 (in Numbers), 15504 (in PCU)

TABLE 6.14: TRAFFIC PROJECTION OF HOMOGENEOUS SECTION-III

Year	Growth Factors	AADT															Total in Numbers	Total in PCU
		Two Wheeler	Car/Jeep/Van/Taxi/Auto	Mini / RTVs Bus	Stand. Bus	LCV	2-Axle	3 - Axle	Multi-Axle	Agri. Tract. With Trailer	Agri. Tract. Without Trailer	Cycle	Cycle Rickshaw	Hand Cart	Bullock Cart	Horse Cart		
2018	7.5%	894	1834	5	9	153	34	1	0	0	0	140	0	4	0	0	3074	2733
2019	7.5%	961	1972	5	10	164	37	1	0	0	0	151	0	4	0	0	3304	2938
2020	7.5%	1033	2119	5	11	176	40	1	0	0	0	162	0	4	0	0	3552	3158
2021	7.5%	1110	2278	6	12	190	43	1	0	0	0	174	0	4	0	0	3819	3395
2022	7.5%	1193	2449	6	13	204	46	1	0	0	1	187	0	5	0	0	4105	3650
2023	7.5%	1283	2633	7	13	219	49	1	0	0	1	201	0	5	0	0	4413	3924
2024	7.5%	1379	2830	7	14	236	53	1	0	0	1	216	0	6	0	0	4744	4218
2025	7.5%	1482	3043	8	16	253	57	2	0	0	1	233	0	6	0	0	5100	4534
2026	7.5%	1594	3271	8	17	272	61	2	0	0	1	250	0	6	0	0	5482	4874
2027	7.5%	1713	3516	9	18	293	66	2	0	0	1	269	0	7	0	0	5893	5240
2028	7.5%	1842	3780	9	19	315	71	2	0	0	1	289	0	7	0	0	6335	5633
2029	7.5%	1980	4063	10	21	338	76	2	0	0	1	311	0	8	0	0	6810	6055
2030	7.5%	2128	4368	11	22	364	82	2	0	0	1	334	0	9	0	0	7321	6509
2031	7.5%	2288	4696	12	24	391	88	2	0	0	1	359	0	9	0	0	7870	6997
2032	7.5%	2459	5048	13	26	420	95	3	0	0	1	386	0	10	0	0	8460	7522
2033	7.5%	2644	5427	13	28	452	102	3	0	0	1	415	0	11	0	0	9095	8086
2034	7.5%	2842	5834	14	30	485	109	3	0	0	1	446	0	11	0	0	9777	8693
2035	7.5%	3055	6271	16	32	522	118	3	0	0	1	479	0	12	0	0	10510	9345
2036	7.5%	3284	6741	17	34	561	126	3	0	0	1	515	1	13	0	0	11299	10046
2037	7.5%	3531	7247	18	37	603	136	4	0	1	2	554	1	14	0	0	12146	10799
2038	7.5%	3796	7791	19	40	648	146	4	0	1	2	595	1	15	0	0	13057	11609
2039	7.5%	4080	8375	21	43	697	157	4	0	1	2	640	1	16	0	0	14036	12480
2040	7.5%	4386	9003	22	46	749	169	5	0	1	2	688	1	18	0	0	15089	13416
2041	7.5%	4715	9678	24	49	805	182	5	0	1	2	740	1	19	0	0	16221	14422
2042	7.5%	5069	10404	26	53	866	195	5	0	1	2	795	1	20	0	0	17437	15504
2043	7.5%	5449	11184	28	57	931	210	6	0	1	2	855	1	22	0	0	18745	16666

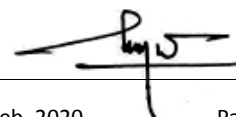
From tables 6.12, 6.13 & 6.14 it is found that if the project road is constructed with 2 lane then from initial opening year up to end of design life, it will operate with level of service B. Hence, 2 lane is recommended for Maram-Peren-Dimapur section.

6.5 INTERSECTION TURNING MOVEMENT COUNTS

Intersection turning movement surveys were carried out at the following identified seven major intersections on the project road:

- ✓ TMC-1: At Ch-0.000 km (Maram Junction)
- ✓ TMC-2: At Ch-115.280 km (Kiepeuzang Junction)
- ✓ TMC-3: At Ch-115.833 km (Peren Town Junction)
- ✓ TMC-4: At Ch-121.500 km (Pelekie Junction)
- ✓ TMC-5: At Ch-137.513 km (Sugar Mill Junction, Jalukie B)
- ✓ TMC-6: At Ch-141.690 km (High School Junction, Jalukie Town)
- ✓ TMC-7: At Ch-177.482 km (7th Mile Junction)

Classified directional turning movements were counted at each of the above seven intersections for working day from 08:00 a.m. to 8.00 p.m. Trained enumerators have carried out these surveys under close supervision of Traffic Expert. The details of the turning movement counts are given in Appendix to Main Report. The peak hour flows (in vehicles and PCUs) have been presented in **Figure- 6.27** to **Figure- 6.40**. The peak hour turning movements at various major junctions on the Project Road have been calculated and is given in **Table-6.15**. These forecasts consider the likely growth in the traffic at intersections. Forecasts of peak hour intersection turning movements are given in Appendix to Main Report.



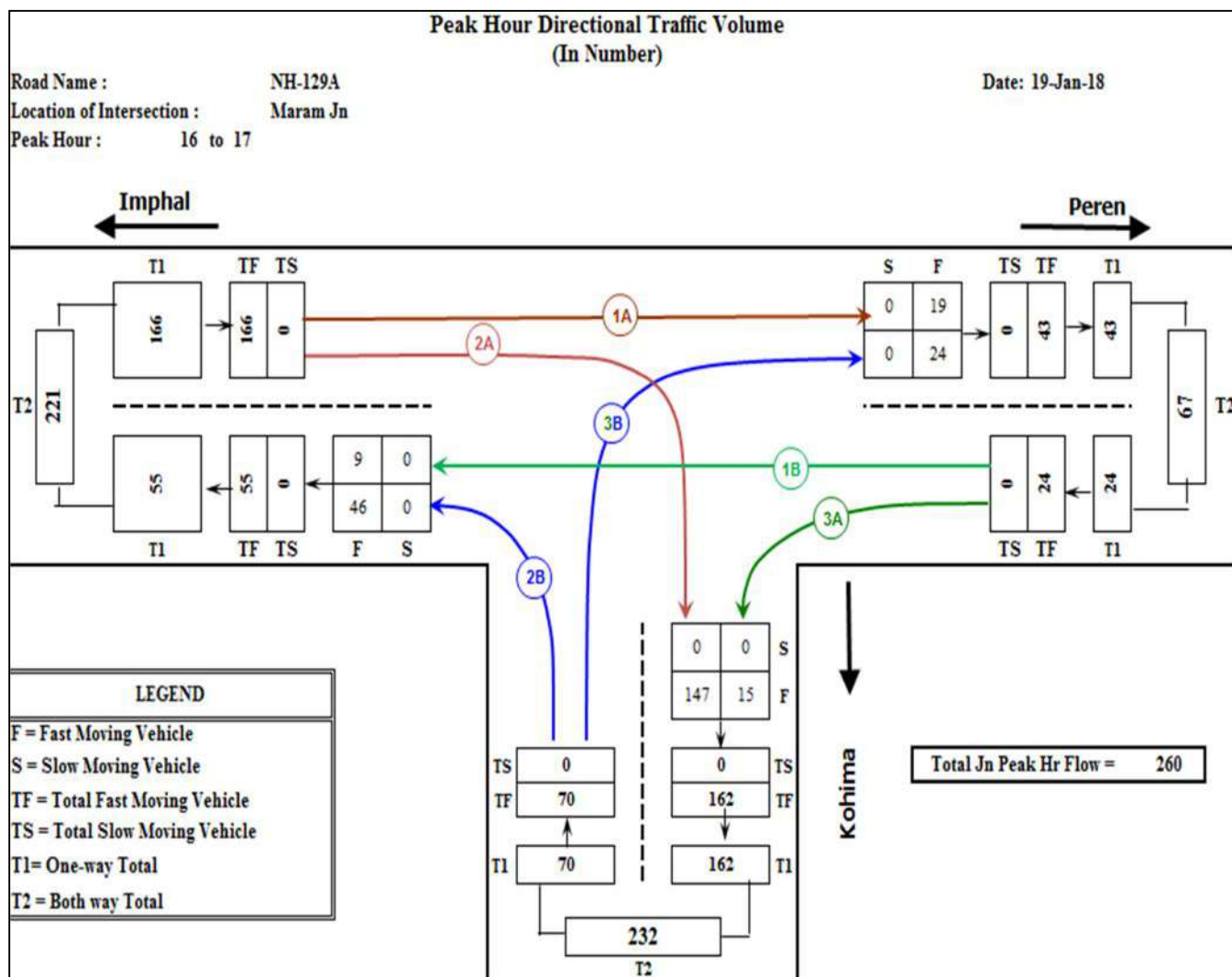


Fig 6.27: Peak hour traffic in Number at Ch- 0.000 Km (Maram Junction)

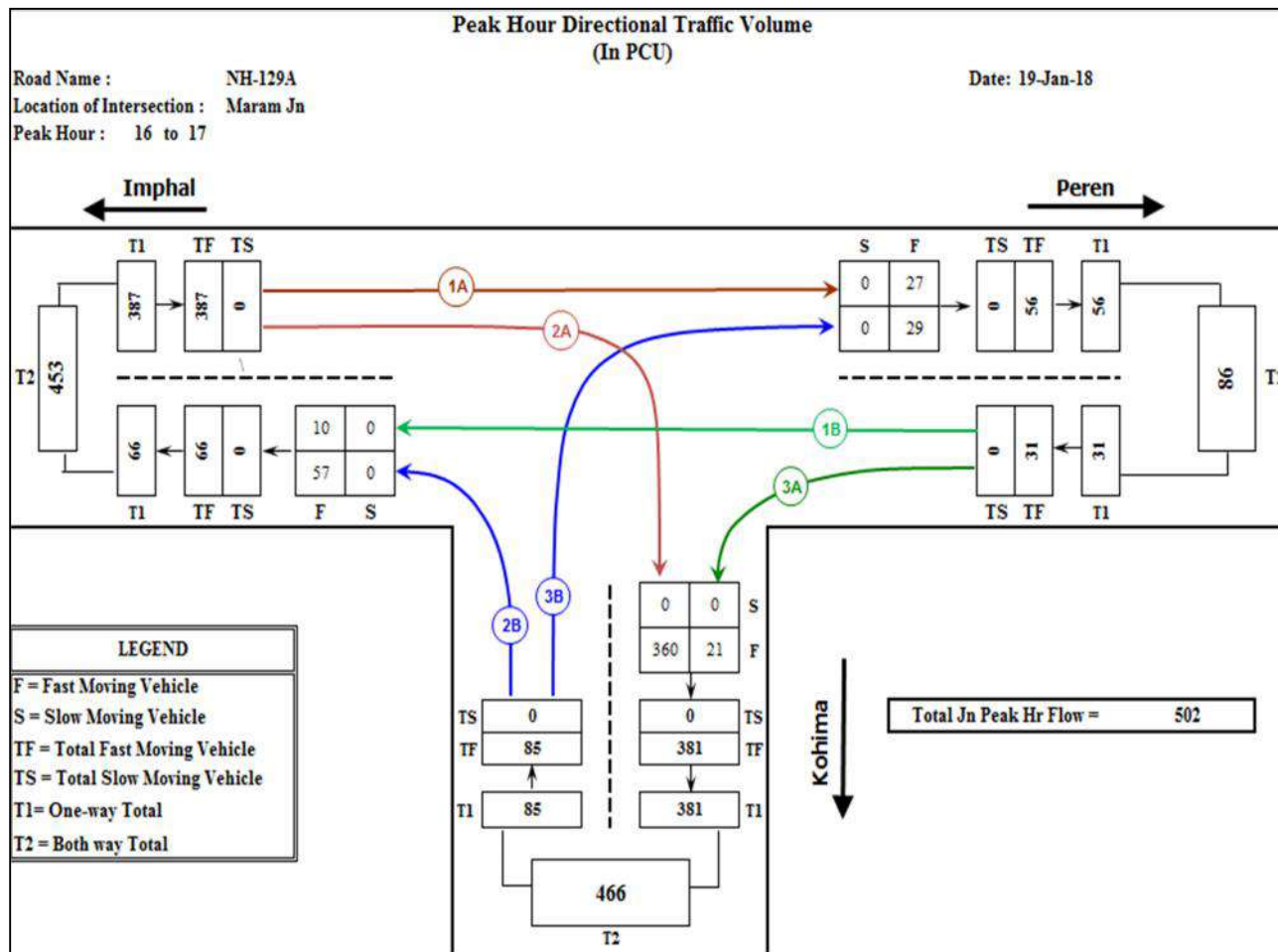


Fig 6.28: Peak hour traffic in PCU at Ch- 0.000 Km (Maram Junction)

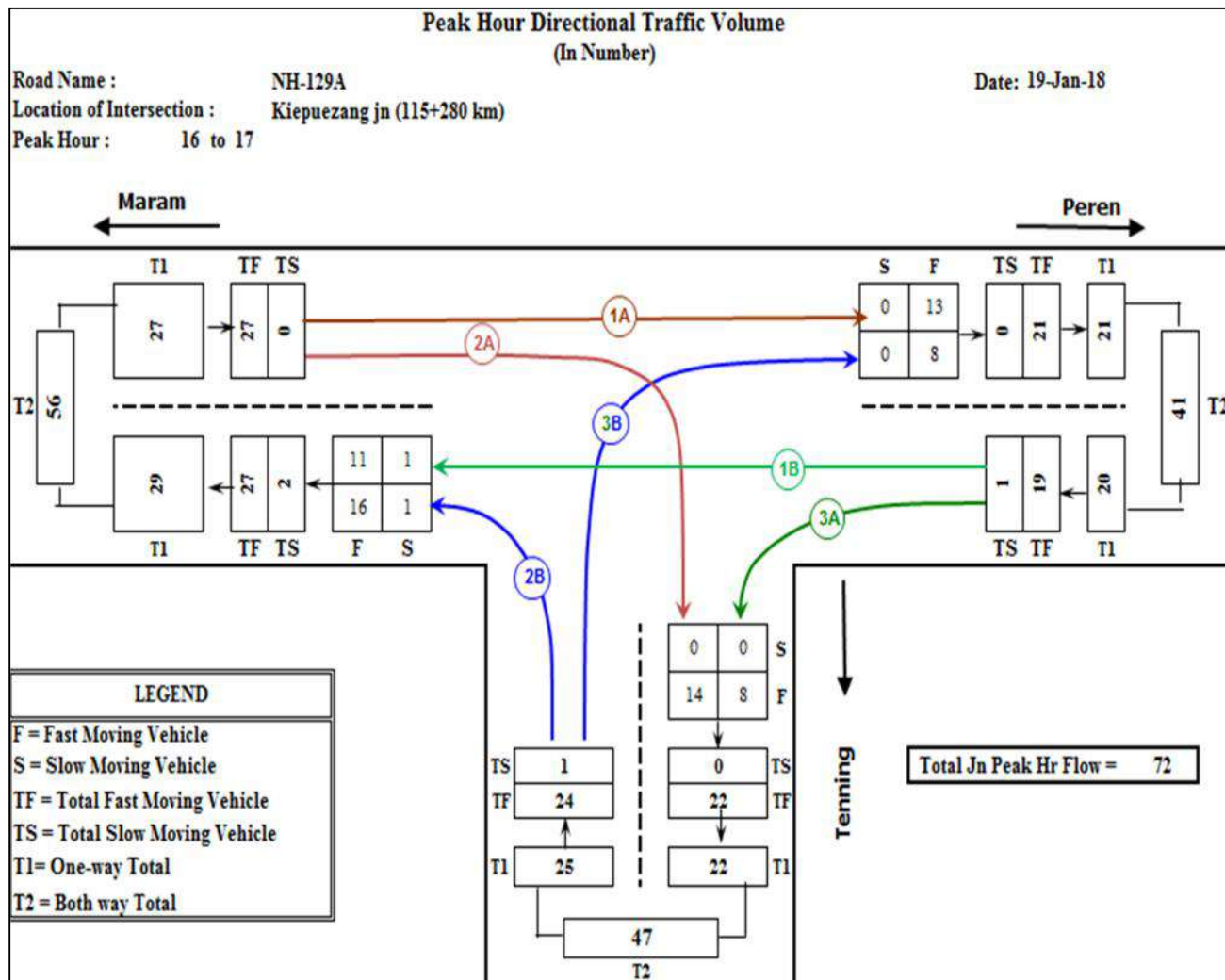


Fig 6.29: Peak hour traffic in Number at Ch-115.280 km (Kiepeuzang Junction)

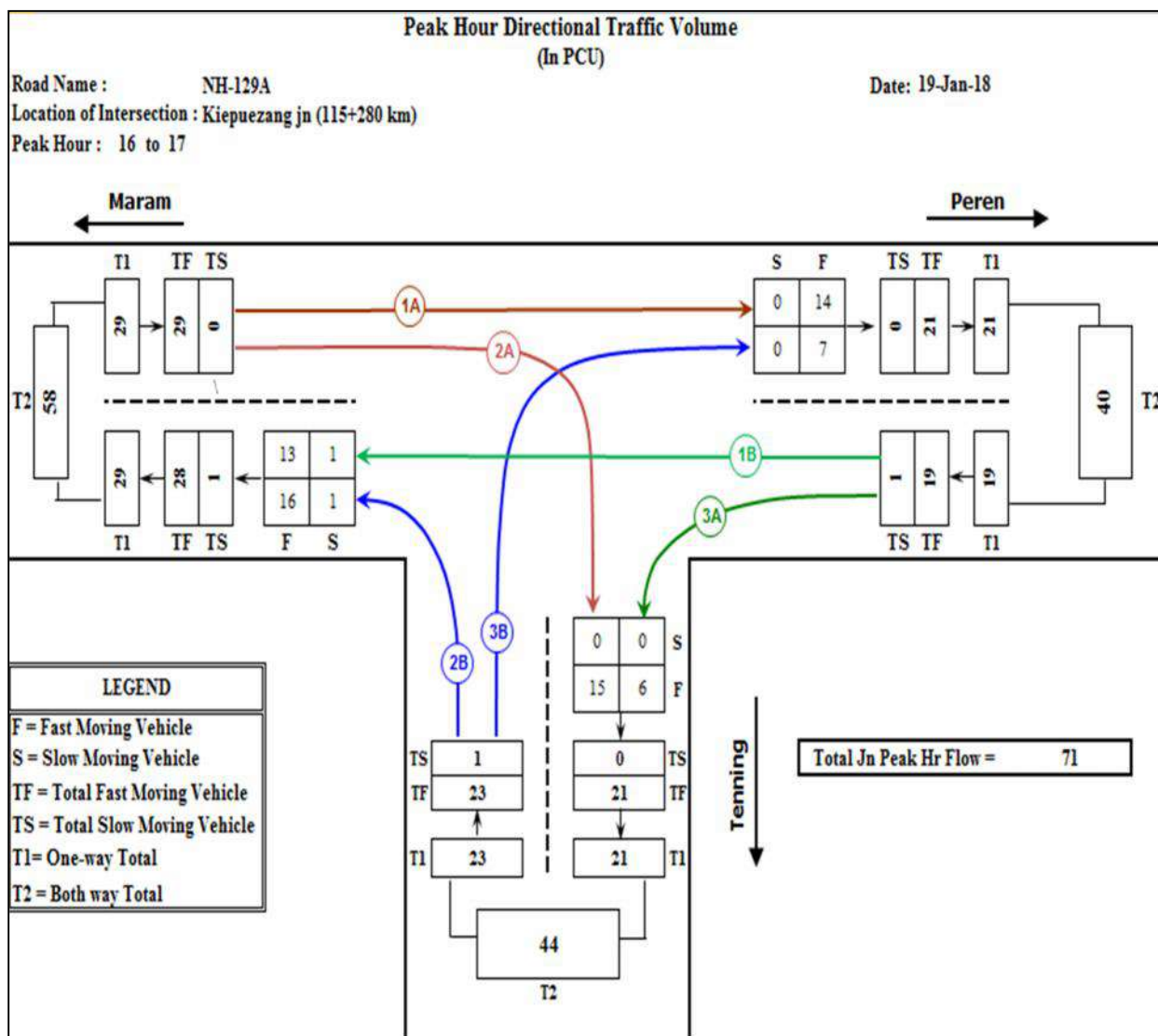


Fig 6.30: Peak hour traffic in PCU at Ch-115.280 km (Kiepeuzang Junction)

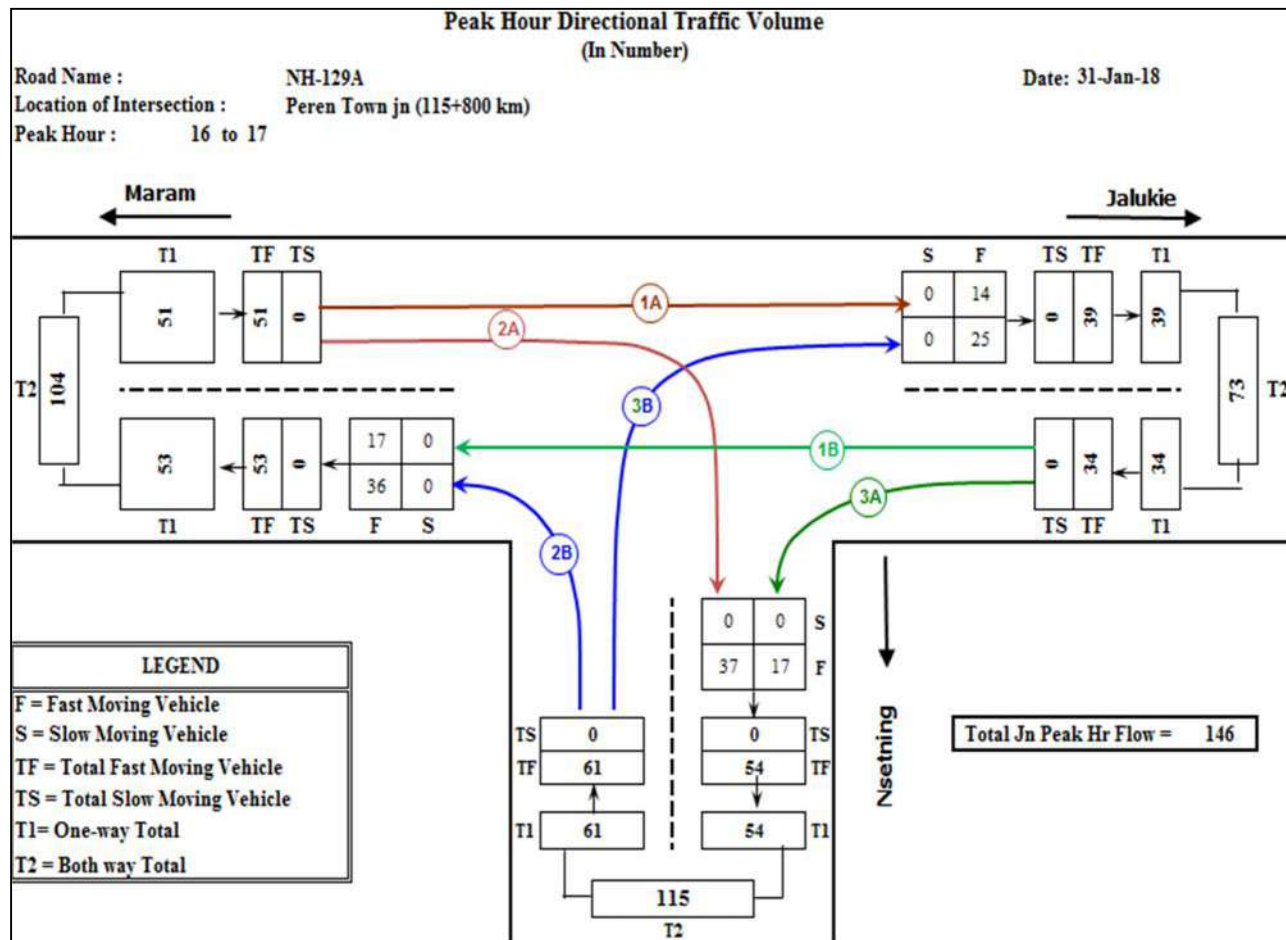


Fig 6.31: Peak hour traffic in Number at Ch-115.833 km (Peren Town Junction)

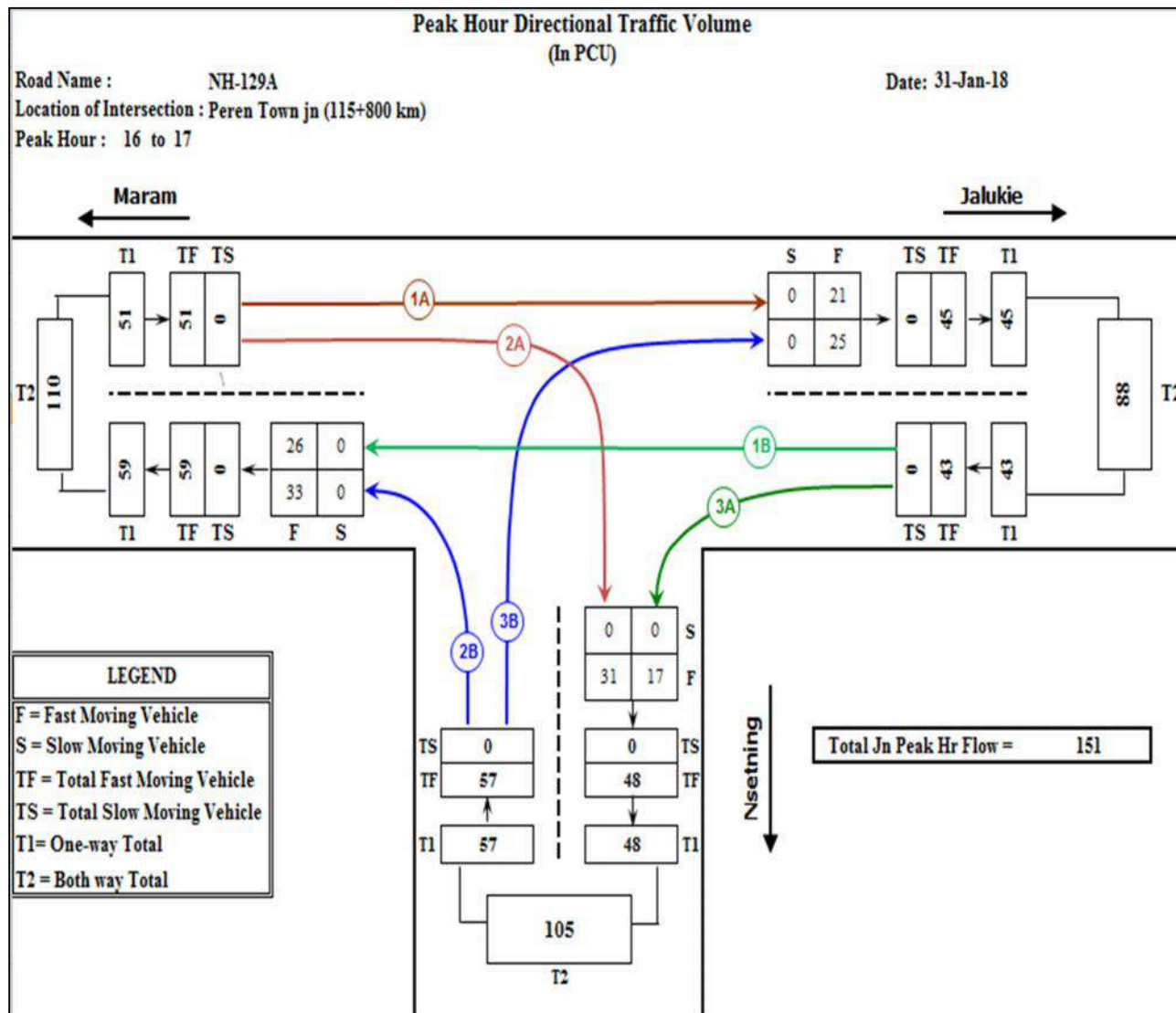


Fig 6.32: Peak hour traffic in PCU at Ch-115.833 km (Peren Town Junction)

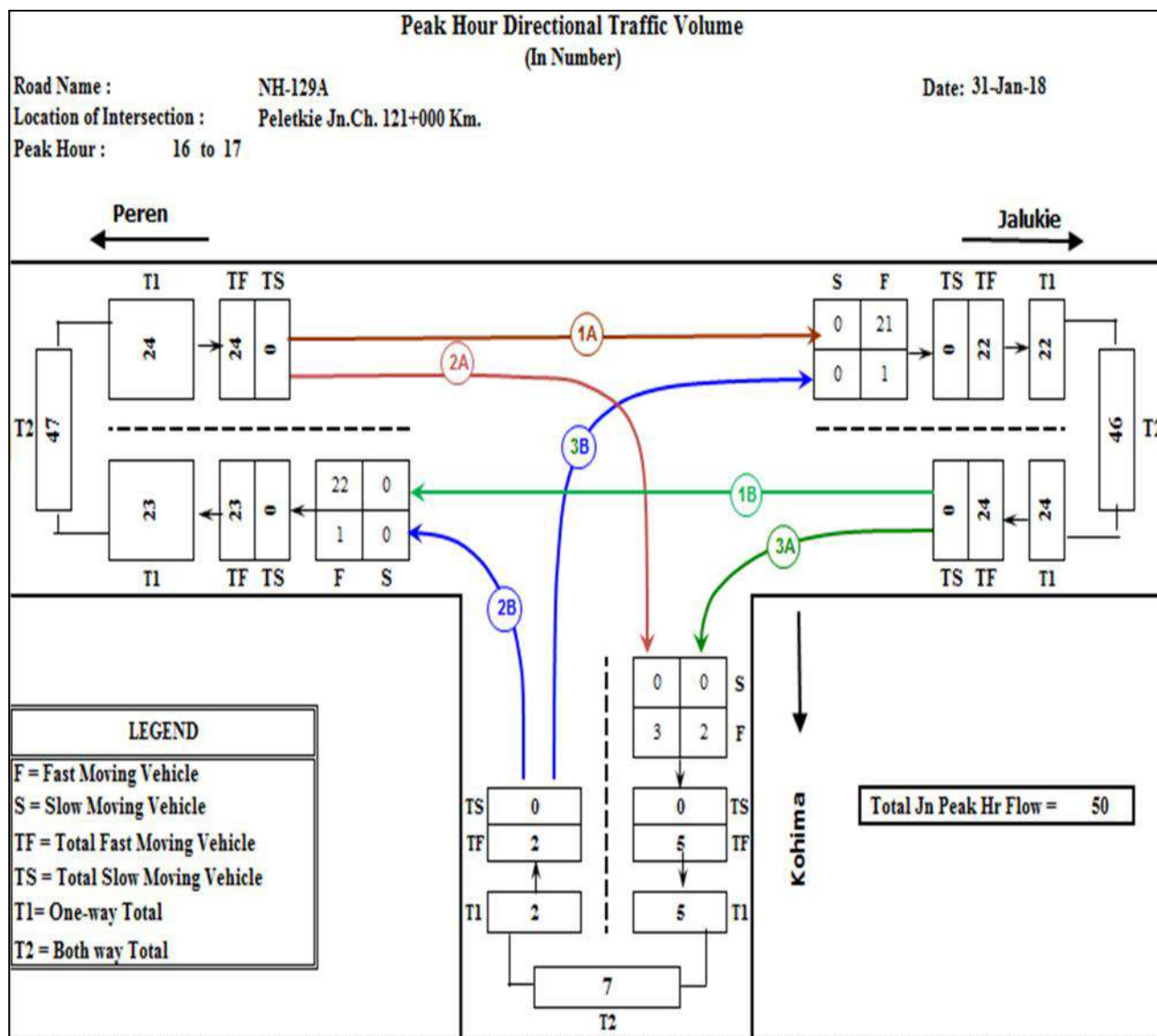


Fig 6.33: Peak hour traffic in Number at Ch-121.500 km (Peletkie Junction)

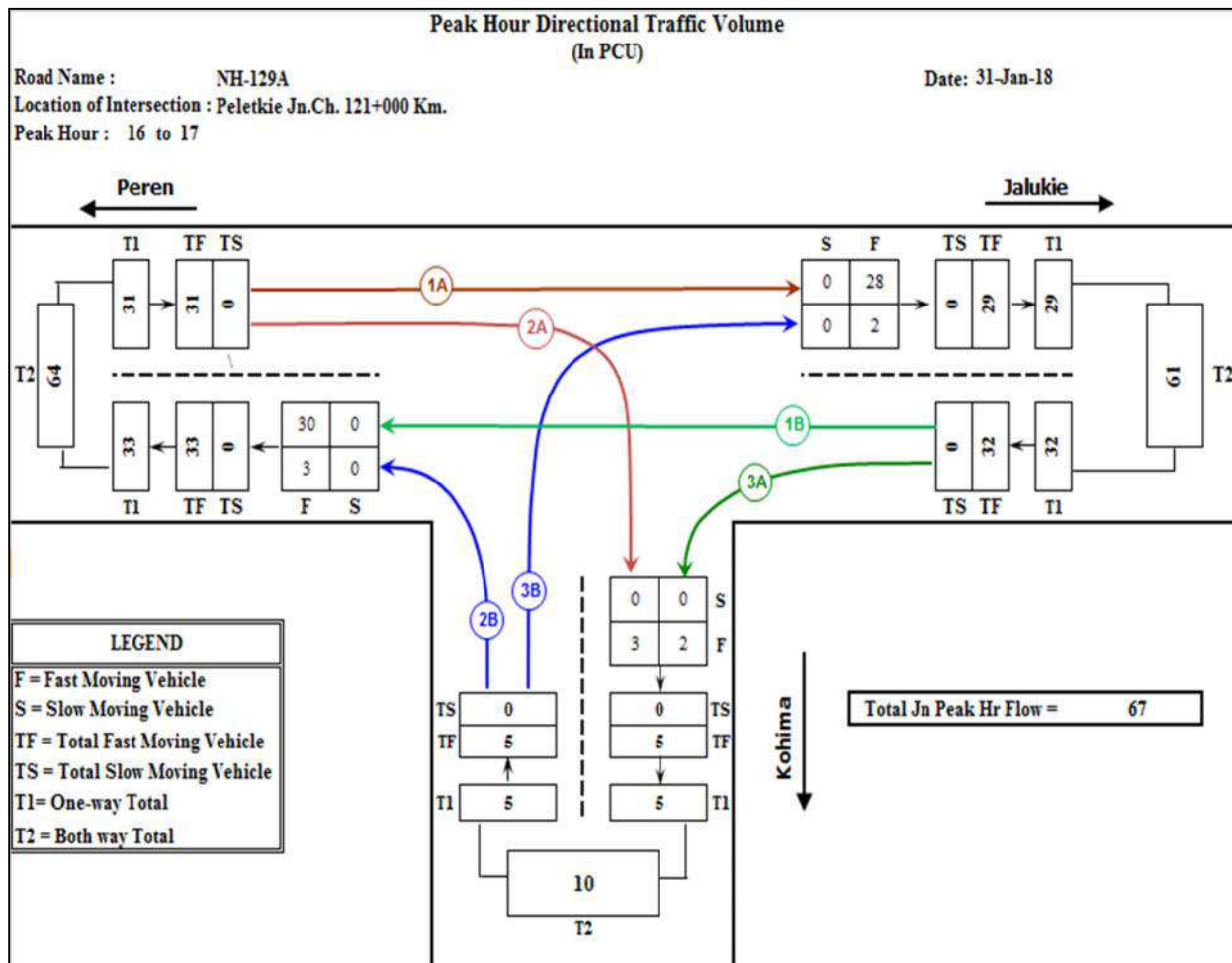


Fig 6.34: Peak hour traffic in PCU at Ch-121.500 km (Pelekie Junction)

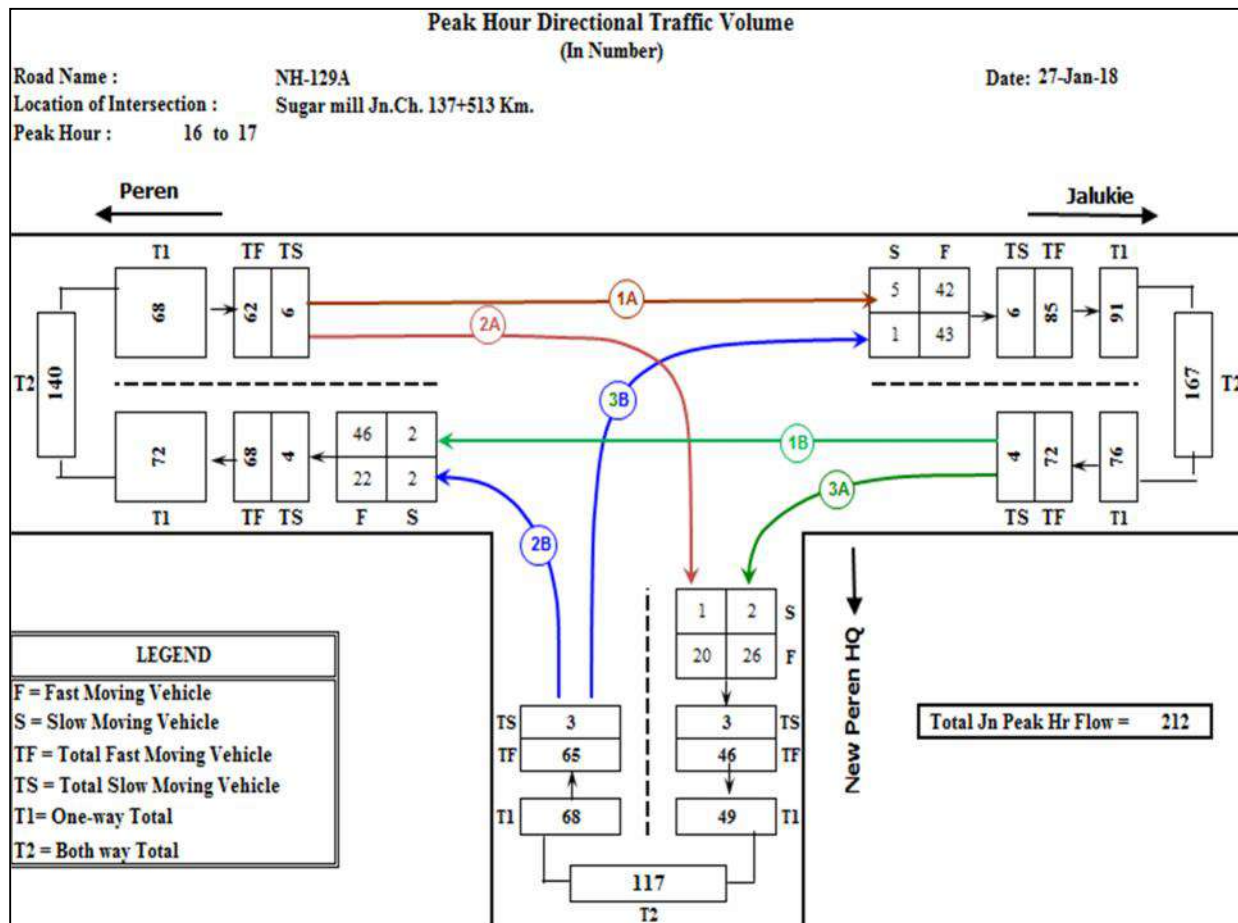


Fig 6.35: Peak hour traffic in Number at Ch-137.513 km (Sugar Mill Junction, Jalukie B)

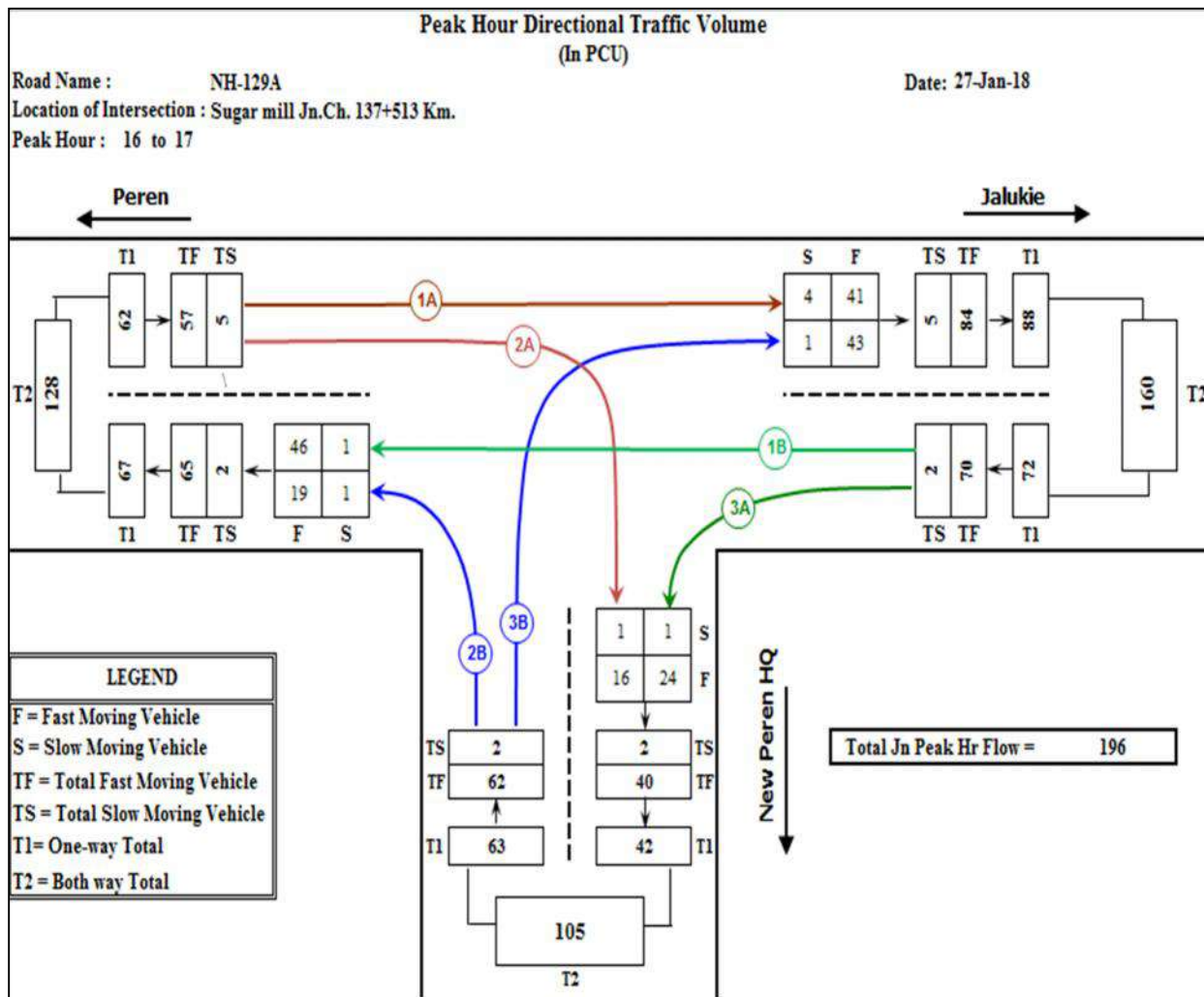


Fig 6.36: Peak hour traffic in PCU at Ch-137.513 km (Sugar Mill Junction, Jalukie B)

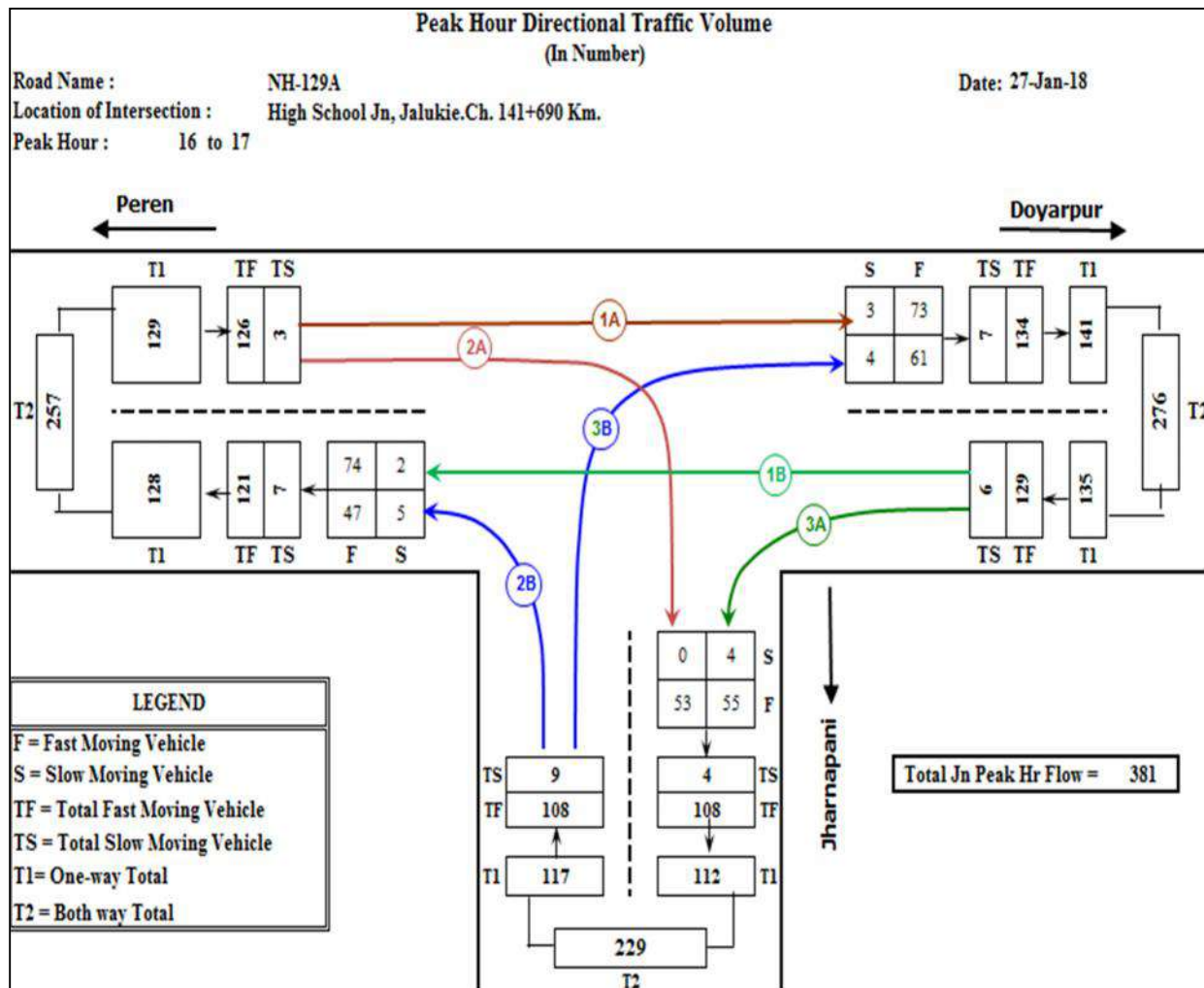


Fig 6.37: Peak hour traffic in Number at Ch-141.690 km (High School Junction, Jalukie Town)

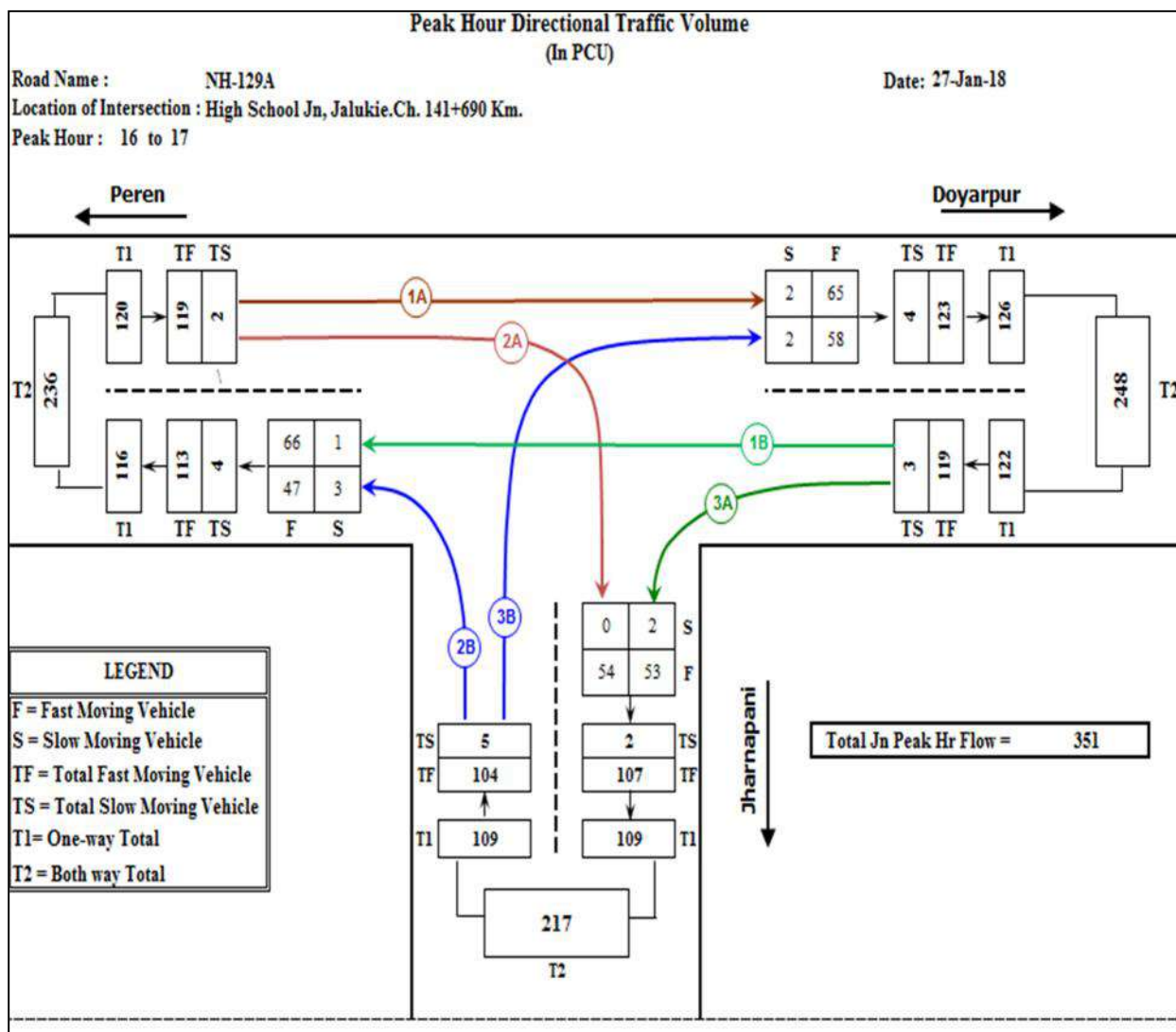


Fig 6.38: Peak hour traffic in PCU at Ch-141.690 km (High School Junction, Jalukie Town)

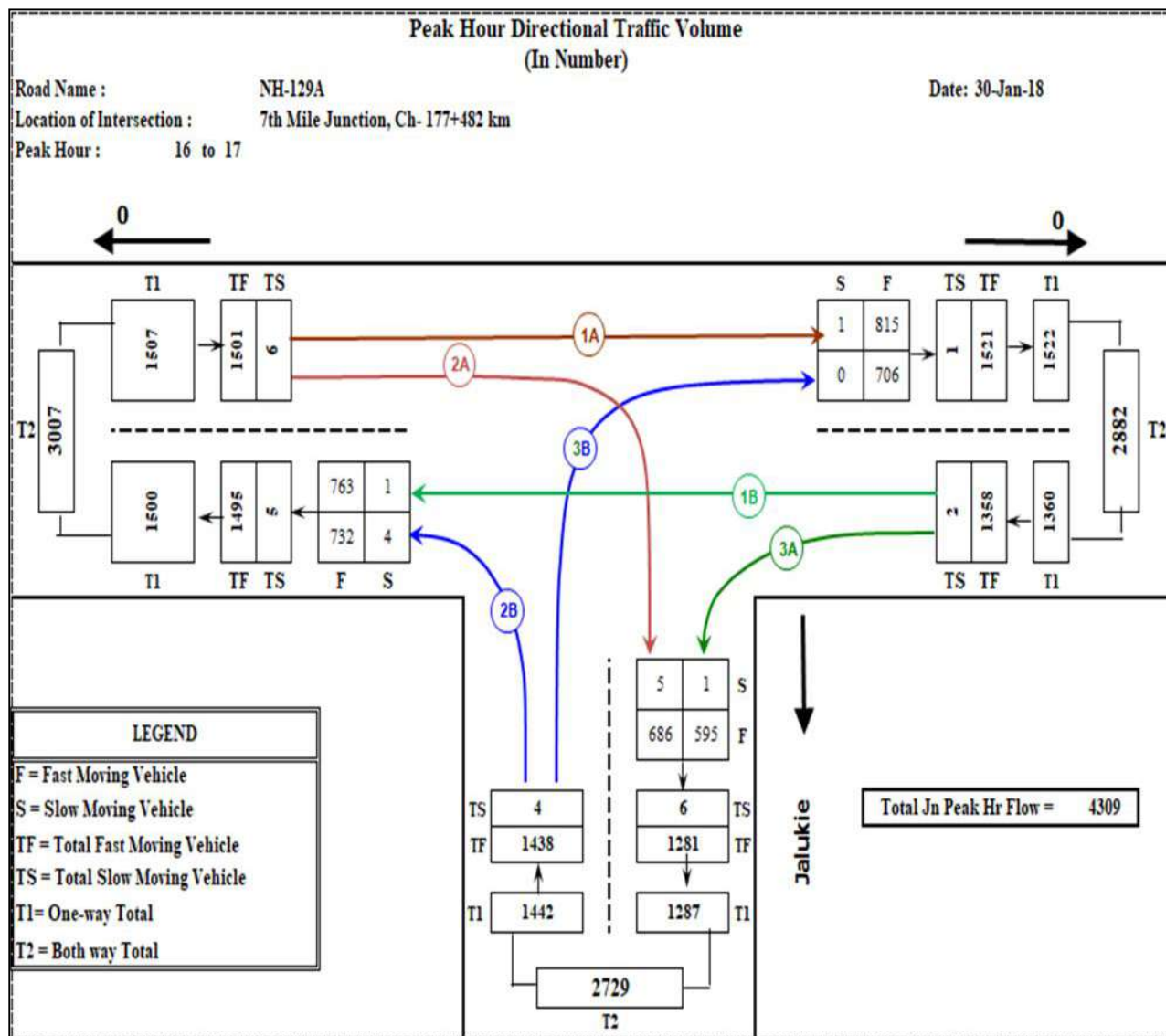


Fig 6.39: Peak hour traffic in Number at Ch-177.482 km (7th Mile Junction, Dimapur)

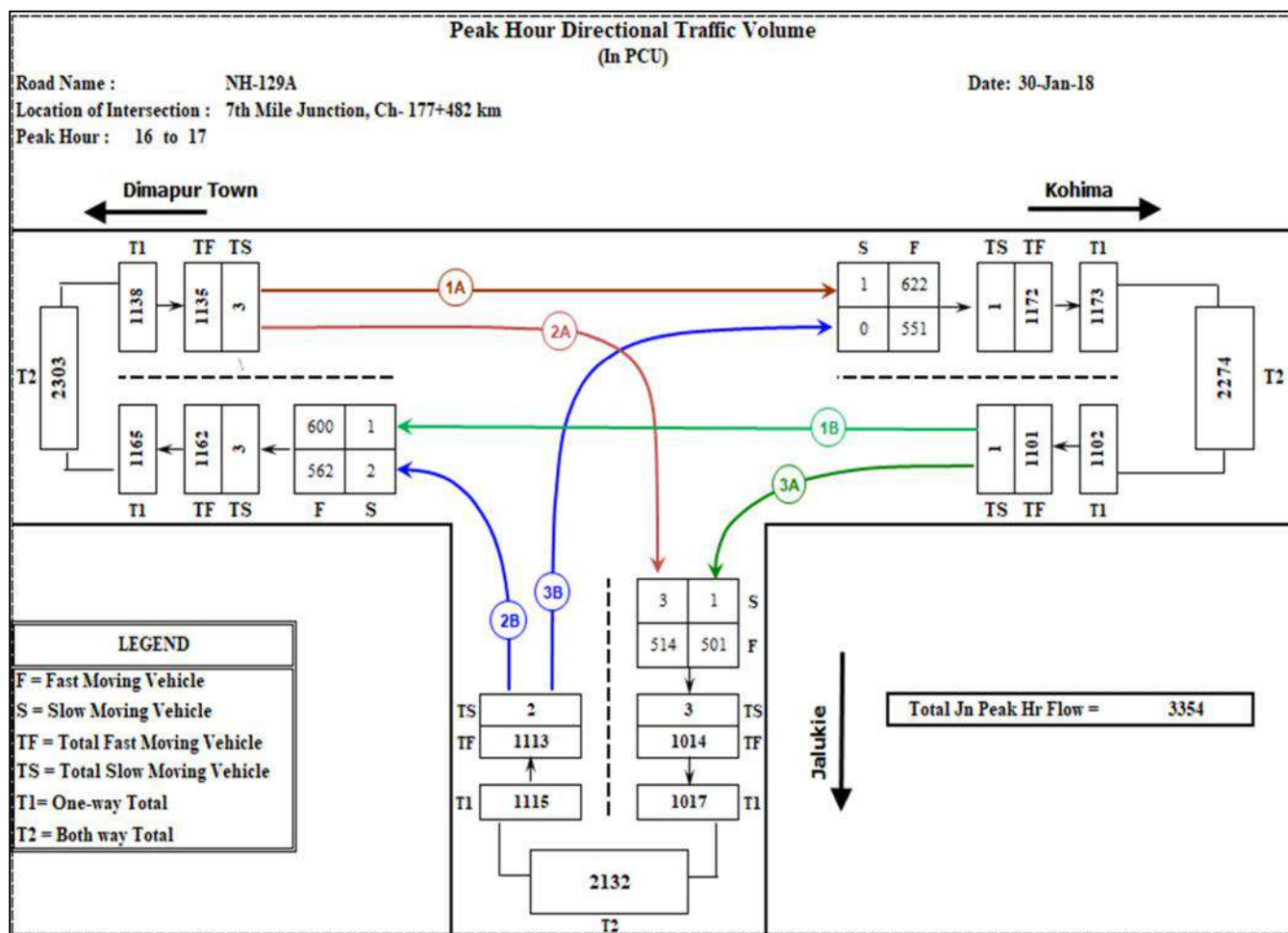


Fig 6.40: Peak hour traffic in PCU at Ch-177.482 km (7th Mile Junction, Dimapur)

TABLE 6.15: SUMMARY OF PEAK HOUR INTERSECTION FLOWS

Sl.No.	Name of Intersection	Total Junction Peak Hr. Flow	
		Number	PCU
1	Maram Junction	260	502
2	Kiepeuzang Junction	72	71
3	Peren Town Junction	146	151
4	Pelekie Junction	50	67
5	Sugar Mill Junction, Jalukie B	212	196
6	High School Junction, Jalukie Town	381	351
7	7th Mile Junction, Dimapur	4309	3354

As per IRC: 92-1985, Section 3, specifies warrants for providing grade separation. Since the Project Road will be developed to two laning with paved shoulder, grade separators are needed when the total peak hour traffic at a junction exceeds 10,000 PCUs/hr. However, the above table shows that the peak hour intersection flow doesn't reach 10,000 PCUs/hr. for any location. So, grade separator is not required.



Turning Movement Count at Maram Junction



Turning Movement Count at Kiepeuzang Junction



Fig 6.44: Photographs of Turning Movement Count Survey

6.6 ORIGIN DESTINATION SURVEY

6.6.1 ROAD SIDE INTERVIEWS FOR O-D

To understand the travel demand pattern in the region, Origin and Destination (O-D) Survey was carried out for 1 day x 24 hours at two locations. The locations are at Ch-0.700 km Near Maram and at Ch-120.000 km near Peren of NH 129A.

The O-D surveys were carried out based on the roadside interview method as per IRC: 102-1988. Both passenger and commercial vehicles plying on the project road were stopped on a random sampling basis and interviewed. Police assistance was arranged at the survey locations for successfully carrying out these surveys. The travel characteristics obtained by O-D survey facilitate the identification of the traffic characteristics based on its origin and destination.

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

Before presenting the travel pattern, the sample size considered for O-D surveys are presented first in the following section.

6.6.2 SAMPLE SIZE CONSIDERED FOR O-D SURVEYS

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

Table-6.16 and **Table-6.17** show the ADT and the sample size (both in absolute numbers and in percentage terms) captured during the survey on NH 129A at Ch- 0.700 km near Maram and Ch- 120.000 km near Peren.

TABLE -6.16: AT CH- 0.700 KM OF NH 129A NEAR MARAM

Location : NH 129A			22.01.2018
Vehicle Type	Sample Collected	Actual Volume	Sample Size %
LCV	38	61	62
Bus	2	2	100
2 - Axle	44	60	73
3-Axle	31	59	53
Bus	129	377	34
Total	244	559	44%



TABLE -6.17: AT CH- 120.000 KM OF NH 129A NEAR PEREN

Location : NH 129A			30.01.2018
Vehicle Type	Sample Collected	Actual Volume	Sample Size %
LCV	30	53	57
Bus	5	7	71
2 - Axle	23	62	37
Car	115	264	44
Total	173	386	45%

6.6.3 ZONING SYSTEM

For understanding the spatial dimensions of the trip characteristics of the vehicles interviewed during the O-D survey, a scientifically derived zoning system was adopted. The Zoning System considered in this study has been presented in **Table- 6.18 & Table- 6.19**.

TABLE- 6.18: ZONE CODE FOR OD NEAR MARAM ON NH 129A

Zone Code	Name of Zone
1	Near Project Road (Maram, Zuimui, Peren, Tepuiki, Jalukie, Dimapur, Magmai,
2	South- East of the project road (Kohima)
3	South-East of the project road (Imphal, Daili, kangpoki, karong, katomai, lenglei, saitu, senapoti, torbari etc.)

TABLE- 6.19: ZONE CODE FOR OD NEAR PEREN ON NH 129A

Zone Code	Name of Zone
1	Near Project Road (Maram, Zuimui, Peren, Tepuiki, Jalukie, Dimapur etc.)
2	East (Pelekie, Amaluma, Molvom, Pedi, Mahai, Kotlen, Nagma etc.)
3	West (Kendung, Tepun, Tamei, Songsang, Teson, Taspong etc.)

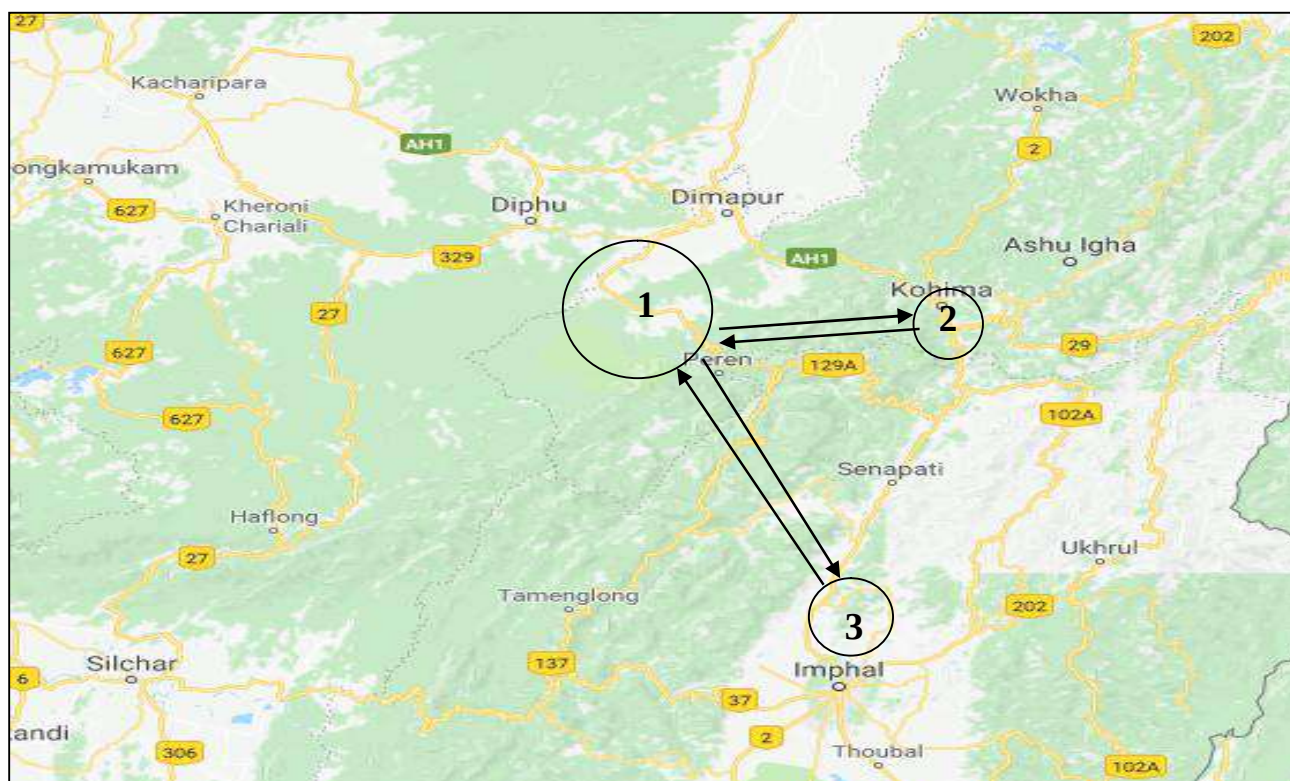
6.6.4 TRAVEL PATTERN

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



TABLE- 6.20: OD MATRIX FOR MARAM

Origin Zone ↓	Destination Zone →	1	2	3	Grand Total
1		139	42	9	190
2		45	3	0	48
3		6	0	0	6
Grand Total		190	45	9	244

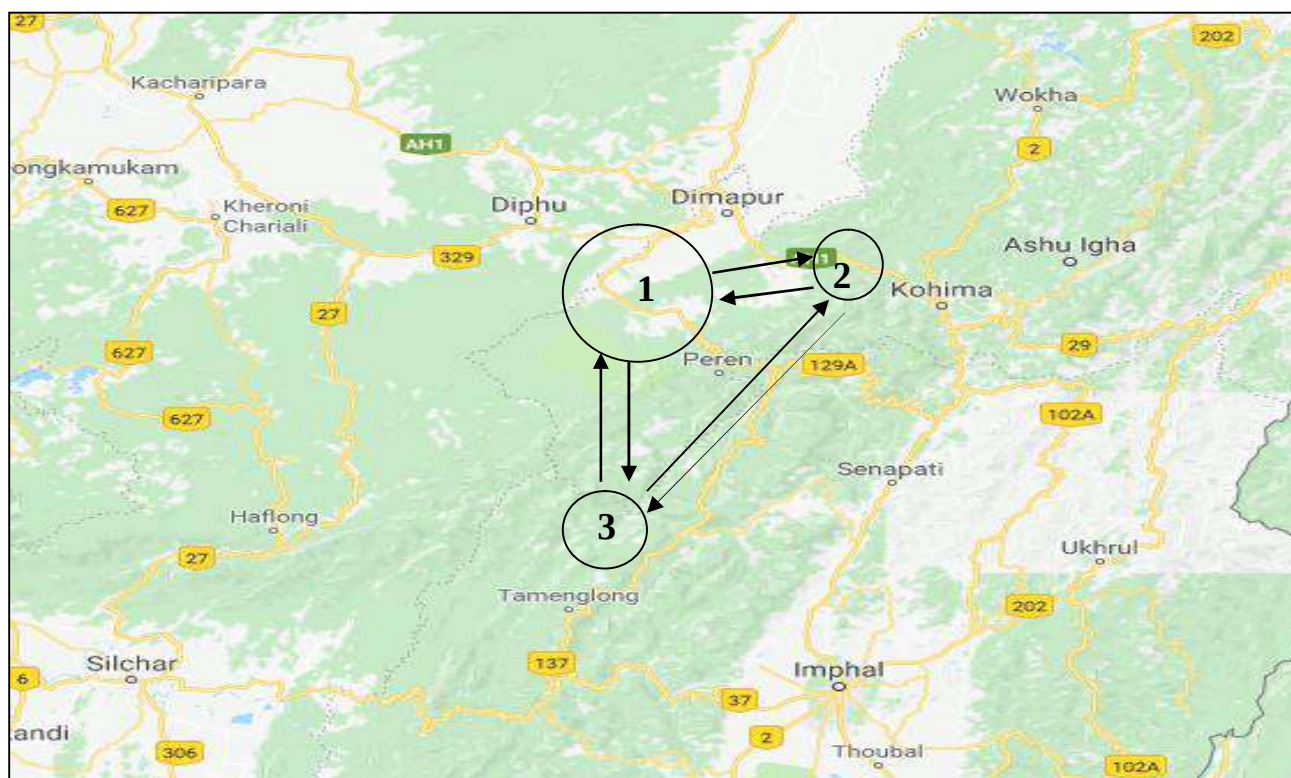


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TABLE- 6.21: OD MATRIX FOR PEREN

Origin Zone ↓	Destination Zone →	1	2	3	Grand Total
1		108	14	14	136
2		10	0	2	12
3		21	5	0	26
Grand Total		139	19	16	174



From the above two tables, the following travel pattern on the project road can be deduced:

- For OD on NH 129A at Maram, it has been seen that most of the traffic has been produced from Zone 1 and Zone 2.
- For OD on NH 129A near Peren, it has been seen that most of the traffic has been produced from Zone 1 and Zone 3.

6.7 PEDESTRIAN COUNT SURVEY

Pedestrian count survey was conducted at the following location to obtain the number of pedestrians crossing the Project road:

- ✓ PEDESTRIAN-1: At Ch-0.700 km Near Maram Village
- ✓ PEDESTRIAN-2: At Ch-116.000 km Near Peren Town
- ✓ PEDESTRIAN-3: At Ch-142.000 km Near Jalukie Town

Analysis of Pedestrian count survey data is presented below in **Table -6.22** to **Table -6.24** respectively.

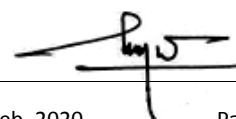


TABLE- 6.22: PEDESTRIAN COUNT SURVEY AT MARAM (CH-0.700 KM)

PEDESTRIAN COUNT SURVEY

LOCATION OF SURVEY STATION : Maram
DATE & DAY OF SURVEY : 20.01.18
ROAD NAME- NH-129A

PLACE	COUNT HOURS			Side of Carriageway		Across the Carriageway		Total		Total(in all direction)
				1	2	1A	2A	1+2	1A+2A	
MARAM	08:00	to	09:00	7	5	3	4	12	7	19
	09:00	to	10:00	11	8	8	9	19	17	36
	10:00	to	11:00	14	7	12	6	21	18	39
	11:00	to	12:00	18	5	18	8	23	26	49
	12:00	to	13:00	12	8	16	9	20	25	45
	13:00	to	14:00	13	5	23	4	18	27	45
	14:00	to	15:00	12	6	14	9	18	23	41
	15:00	to	16:00	12	6	17	8	18	25	43
	16:00	to	17:00	19	9	15	7	28	22	50
	17:00	to	18:00	7	5	5	4	12	9	21
	18:00	to	19:00	2	1	5	1	3	6	9
	19:00	to	20:00	0	0	1	0	0	1	1
TOTAL				127	65	137	69	192	206	398
HOURLY AVERAGE PEDESTRIAN				11	5	11	6	16	17	33
PEAK HOURLY PEDESTRIAN	13:00	to	14:00	18		27		45		50

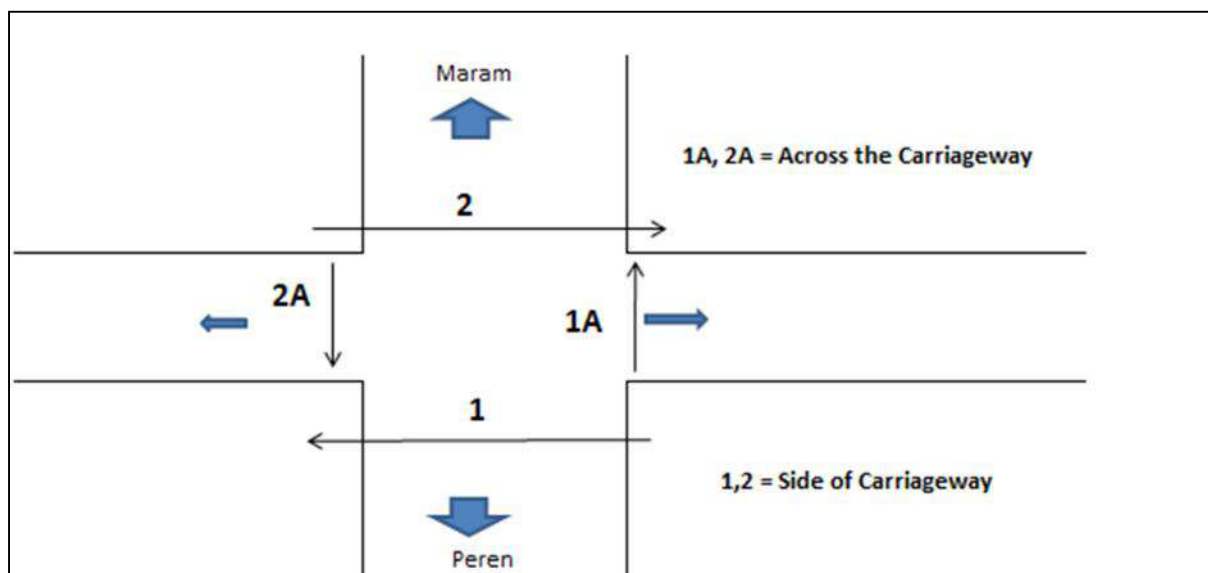


TABLE -6.23: PEDESTRIAN COUNT SURVEY AT PEREN (CH-116.000 KM)

PEDESTRIAN COUNT SURVEY

LOCATION OF SURVEY STATION : Peren Town

DATE & DAY OF SURVEY : 27.01.2018

ROAD NAME- NH-129A

PLACE	COUNT HOURS			Side of Carriageway		Across the Carriageway		Total		Total(in all direction)
				1	2	1A	2A	1+2	1A+2A	
PEREN TOWN	08:00	to	09:00	36	18	3	6	54	9	63
	09:00	to	10:00	20	20	11	10	40	21	61
	10:00	to	11:00	26	28	8	7	54	15	69
	11:00	to	12:00	21	42	3	5	63	8	71
	12:00	to	13:00	10	35	8	11	45	19	64
	13:00	to	14:00	16	14	5	6	30	11	41
	14:00	to	15:00	19	10	9	8	29	17	46
	15:00	to	16:00	22	9	3	6	31	9	40
	16:00	to	17:00	16	13	5	10	29	15	44
	17:00	to	18:00	4	10	2	5	14	7	21
	18:00	to	19:00	1	5	0	2	6	2	8
	19:00	to	20:00	2	1	1	1	3	2	5
TOTAL				193	205	58	77	398	135	533
HOURLY AVERAGE PEDESTRIAN				16	17	5	6	33	11	44
PEAK HOURLY PEDESTRIAN	09:00	to	10:00	40		21		61		71

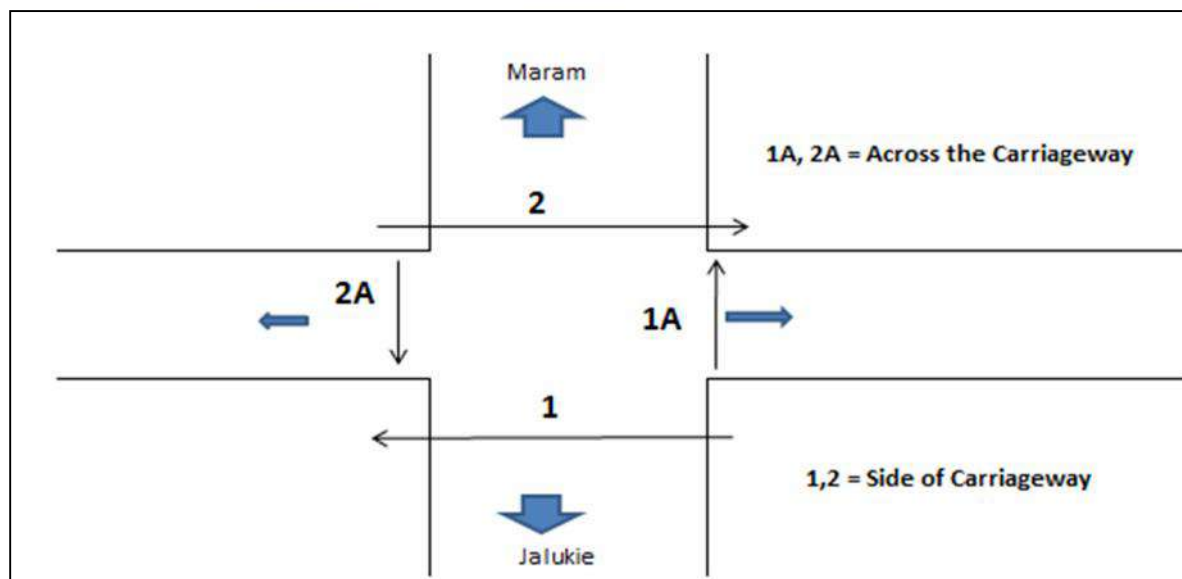
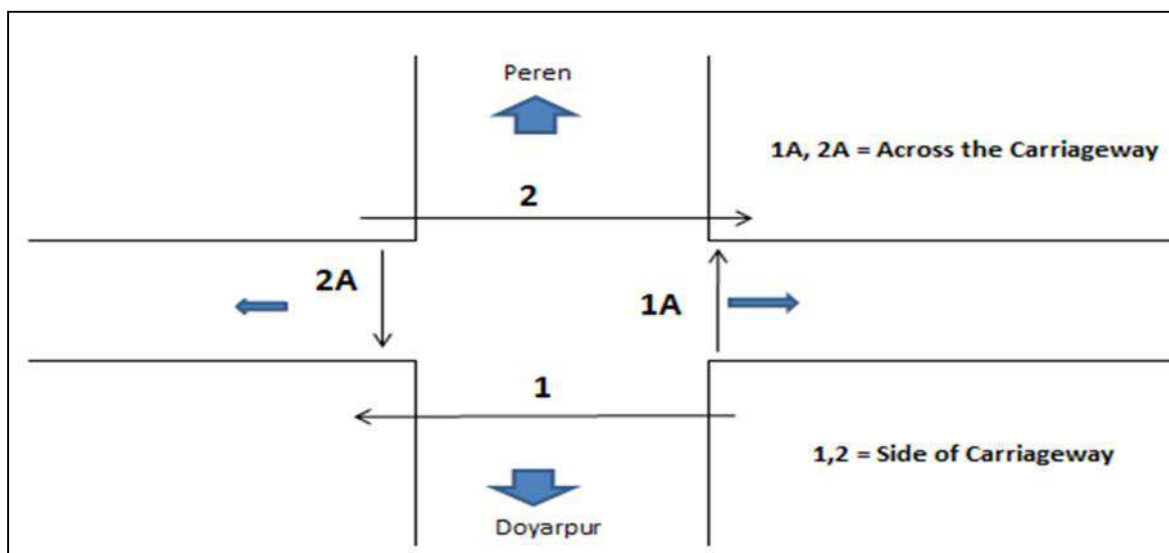


TABLE- 6.24: PEDESTRIAN COUNT SURVEY AT JALUKIE (CH-142.000 KM)

PEDESTRIAN COUNT SURVEY										
LOCATION OF SURVEY STATION : Jalukie Town										
DATE & DAY OF SURVEY : 27.01.2018										
ROAD NAME- NH-129A										
PLACE	COUNT HOURS			Side of Carriageway		Across the Carriageway		Total		Total(in all direction)
				1	2	1A	2A	1+2	1A+2A	
JALUKIE TOWN	08:00	to	09:00	18	12	18	13	30	31	61
	09:00	to	10:00	26	31	24	27	57	51	108
	10:00	to	11:00	37	31	19	21	68	40	108
	11:00	to	12:00	36	24	35	16	60	51	111
	12:00	to	13:00	39	37	14	11	76	25	101
	13:00	to	14:00	27	22	31	19	49	50	99
	14:00	to	15:00	30	20	18	26	50	44	94
	15:00	to	16:00	21	22	17	11	43	28	71
	16:00	to	17:00	9	15	9	6	24	15	39
	17:00	to	18:00	6	7	2	3	13	5	18
	18:00	to	19:00	4	7	0	1	11	1	12
	19:00	to	20:00	2	1	0	0	3	0	3
TOTAL				255	229	187	154	484	341	825
HOURLY AVERAGE PEDESTRIAN				21	19	16	13	40	28	69
PEAK HOURLY PEDESTRIAN	09:00	to	10:00	57		51		108		111

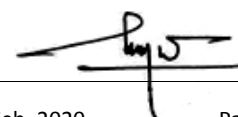


From the above three tables based on total cross pedestrian on the project road PV² value has been determined at each pedestrian count survey location and it has been prescribed in **Table-6.25**.

TABLE-6.25: TOTAL CROSS PEDESTRIAN AT PROJECT ROAD

LOCATION	TOTAL CROSS PEDESTRIAN (TCP)	PEAK HR. PEDESTRIAN (P)	TOTAL MOTORISED TRAFFIC DURING PEDESTRIAN PEAK HOUR (V)	P.V ²	LIMITING VALUE OF P.V ²
Ch-0.700 km	202	27	71	0.00136107	1X10 ⁸
Ch-116.000 km	135	21	38	0.00030324	1X10 ⁸
Ch-142.000 km	341	51	308	0.04838064	1X10 ⁸

From **Table-6.25** it is observed that PV² value of all the four locations are within the limiting value as mentioned in IRC: 103-1998. Therefore, there is no need of providing any pedestrian underpass. However, proper traffic safety measurement will be recommended at these locations.




6.8 AXLE LOAD SURVEYS AND VEHICLE DAMAGE FACTORS

For the purpose of preliminary pavement design required for the project, axle load surveys have been carried out (2 day x 24 hours) at the following location:

- ✓ **AXLE-1:** On NH-39 near Maram Village
- ✓ **AXLE-2:** At Ch-120 km near Peren Town

The axle load spectrum observed on the project road, along with the derivation of vehicle damage factors (VDFs) as per the relevant IRC Codes are given in **Table-6.26** & **Table-6.27** which summarizes the VDF. Axle load analysis is presented in Appendix to Main Report.

TABLE -6.26: VDF CALCULATION ON NH 39 NEAR MARAM VILLAGE

TYPE OF VEHICLES	VDF			
	UP		DOWN	
	VDF	Frequency	VDF	Frequency
3 Axle truck	2.44	29	0.54	31
2 Axle truck	2.22	32	2.00	41
LCV	0.00	43	0.00	47
Bus	0.36	1	0.38	1
TOTAL		105		120
WEIGHTED VDF IN EACH DIRECTION	1.36		0.83	
Max. WEIGHTED VDF	1.36			
WEIGHTED VDF OF COMMERCIAL VEHICLE				1.36

TABLE -6.27: VDF CALCULATION ON NH 129A NEAR PEREN TOWN

TYPE OF VEHICLES	VDF			
	UP		DOWN	
	VDF	Frequency	VDF	Frequency
3 Axle truck	1.98	1	0.00	0
2 Axle truck	3.40	32	3.09	27
LCV	0.005	32	0.001	31
Bus	0.19	4	0.18	4
TOTAL		69		62
WEIGHTED VDF IN EACH DIRECTION	1.62		1.36	
Max. WEIGHTED VDF	1.62			
WEIGHTED VDF OF COMMERCIAL VEHICLE				1.62

Hence, maximum VDF value 1.62 has been adopted for calculation of design msa of the project road.

[Handwritten Signature]





Figure 6.45: Photographs of Axle Load Survey

6.9 SPEED DELAY SURVEY

Speed delay survey has been carried out throughout the project stretch. Summary of this survey is prescribed in **Table- 6.28 & Table -6.29**.

TABLE- 6.28: AVERAGE JOURNEY SPEED OF SECTION MARAM-PEREN

SPEED DELAY SURVEY FOR DETERMINING AVERAGE TRAVEL & JOURNEY SPEED														
Section : One			From : Maram			To : Peren								
Direction	Journey Time		Stopped Delay		No. of Vehicles			Overtaking (-) Overtaken (ny)	Average journey Time in min. (tw)	Average Journey Time from opp. Stream (ta)	Average Volume $q = (na + ny) / (ta + tw)$	Average Journey Time $t = tw - (ny/q)$	Length of Travel in km (L)	Average Journey Speed = $L/t \times 60$ (km/hr)
	Min	Sec	Min	Sec	Over-taking	Over-taken	From opp. Direction (na)							
M-P	252	16	2	57	6	1	14	2.3	254.78	261.92	0.033	185	83	27
	259	52	2	30	4	2	15							
	252	14	1	47	-	-	17							
Total	764	22	7	14	10	3	46							
Mean	254	47	2	25	3.3	1	15	3	261.92	254.78	0.036	178.6	83	27.9
P-M	260	5	1	15	5	3	12							
	256	6	1	25	7	1	14							
	269	35	1	46	2	1	22							
Total	785	46	4	26	14	5	48							
Mean	261	55	1	29	4.7	1.7	16							

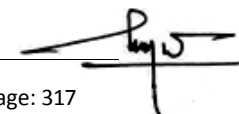


TABLE -6.29: AVERAGE JOURNEY SPEED OF SECTION PEREN- DIMAPUR

SPEED DELAY SURVEY FOR DETERMINING AVERAGE TRAVEL & JOURNEY SPEED														
Section : One			From : Peren		To : Dimapur									
Direction	Journey Time		Stopped Delay		No. of Vehicles			Overtaking (-) Overtaken (ny)	Average journey Time in min. (tw)	Average Journey Time from opp. Stream (ta)	Average Volume q= (na + ny) / (ta+tw)	Average Journey Time t = tw - (ny/q)	Length of Travel in km (L)	Average Journey Speed = L/t x 60 (km/hr)
	Min	Sec	Min	Sec	Over- taking	Over- taken	From opp. Direction (na)							
P-D	172	10	7	56	6	2	262	5.3	179	178	0.68	171.2	83	29
	178	26	9	12	4	-	234							
	186	20	6	52	10	3	214							
Total	536	56	24	-	20	5	710							
Mean	178	59	8	0	7	1.7	237							
D-P	171	10	8	38	7	1	232	3.33	178	179	0.63	171.7	83	28.8
	185	11	12	21	2	1	196							
	177	26	9	16	6	3	238							
Total	533	47	30	15	15	5	666							
Mean	177	56	10	5	5	1.66	2.22							



6.10 ESTIMATION OF DESIGN ESA

- a) Traffic growth rate (Both direction): 7.5 %
- b) Vehicle Damage Factors (F): 1.62
- c) Lane Distribution Factor (D): 0.5

(i) ESA COMPUTATION FOR HOMOGENEOUS SECTION-I (FROM KM 0+000 TO KM 115+280)

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

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day=218

D: Lane distribution factor (Refers IRC: 37-2012, Clause 4.5.1(ii), page-8) = 0.5

F: Vehicle Damage Factor (Refers IRC: 37-2012, Clause 4.4.6), page-8) =1.62

n: Design life in years =20

r: Annual growth rate of commercial vehicles in decimal =0.075

$$N = (365 * [(1+r)^n - 1] * A * D * F) / r = 3 \text{ msa}$$

ESA computations have been done on the basis of these growth rates, Vehicle Damage Factors and lane distribution factor and the ESA comes about 3.0 msa in 20 years for Homogeneous Section -I.

As per IRC: SP 73-2015 (Para-5.4.1, Page No-44), design traffic shall not be less than 20 msa for pavement design.

So, Pavement design has been done considering design traffic 20 msa.

(ii) ESA COMPUTATION FOR HOMOGENEOUS SECTION-II (FROM KM 115+280 TO KM 141+690)

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

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day=5

D: Lane distribution factor (Refers IRC: 37-2012, Clause 4.5.1(ii), page-8) = 0.5

F: Vehicle Damage Factor (Refers IRC: 37-2012, Clause 4.4.6), page-8) =1.62.

n: Design life in years =20

r: Annual growth rate of commercial vehicles in decimal =0.075



$$N = \frac{365 * [(1+r)^n - 1] * A * D * F}{r} = 0.06 \text{ msa}$$

ESA computations have been done on the basis of these growth rates, Vehicle Damage Factors and lane distribution factor and the ESA comes about 0.06 msa in 20 years for Homogeneous Section- II.

As per IRC: SP 73-2015(Para-5.4.1, Page No-44), design traffic shall not be less than 20 msa for pavement design.

So, Pavement design has been done considering design traffic 20 msa.

(iii) ESA COMPUTATION FOR HOMOGENEOUS SECTION-III (FROM KM 141+690 TO KM 177+482)

Traffic growth rate (Both direction): 5.0 %

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

A: Initial traffic in the year of completion of construction in terms of the number of commercial vehicle per day=270

D: Lane distribution factor (Refers IRC: 37-2012, Clause 4.5.1(ii), page-8) = 0.5

F: Vehicle Damage Factor (Refers IRC: 37-2012, Clause 4.4.6), page-8) =1.62

n: Design life in years =20

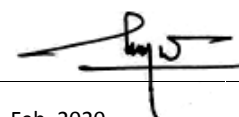
r: Annual growth rate of commercial vehicles in decimal =0.05

$$N = \frac{365 * [(1+r)^n - 1] * A * D * F}{r} = 3 \text{ msa}$$

ESA computations have been done on the basis of these growth rates, Vehicle Damage Factors and lane distribution factor and the ESA comes about 3.0 msa in 20 years for Homogeneous Section- III.

As per IRC: SP 73-2015(Para-5.4.1, Page No-44), design traffic shall not be less than 20 msa for pavement design.

So, Pavement design has been done considering design traffic 20 msa.



CHAPTER - 7

INDICATIVE DESIGN STANDARDS

7.1 GEOMETRIC DESIGN STANDARDS (FOR HIGHWAYS)

PROPOSED DESIGN BASIS

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

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

7.2 HORIZONTAL ALIGNMENT

7.2.1 TERRAIN CLASSIFICATION

The geometric design of a highway is influenced significantly by terrain conditions. Economy dictates a sensible choice of different standards for different types of terrain but the guiding principles above will always apply. Where it is necessary to change design standards, this will be done in discrete areas and with a careful eye to consistency and road safety.

The project road lies in mountainous terrain (i.e. cross slope of the ground more than 25 percent) and the geometric standards relevant to mountainous terrain as per IRC: SP 48-1998 & IRC: SP 73-2015 will be adopted.

7.2.2 DESIGN STANDARD

In general the design standard follows the provisions in the Hill Road Manual (IRC: SP 48-1998) and manual of specifications & standards for two laning of highways IRC: SP 73-2015.

7.2.3 DESIGN SPEED

The project is for up-gradation of existing road to 2- lane with hard shoulder having design speed of 40 kmph to 60 kmph in mountainous terrain follows the provisions of Hill Road Manual (IRC: SP 48-1998) & Two Lane Manual (IRC: SP 73-2015). However the design speed can be reduced upto 20 kmph in Hair Pin bend locations.

Nature of Terrain	Design Speed (km/h)	
	Ruling	Minimum
Mountainous	60	40

7.2.4 SIGHT DISTANCE

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

Design values for stopping sight distance and intermediate sight distance for various speeds:

Design Values (metres)		
Speed (km/h)	Stopping sight distance	Intermediate sight distance
60	90	180
50	60	120
40	45	90
30	30	60
20	20	40

Criteria for measuring sight distance:

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

7.2.5 RIGHT OF WAY (ROW)

Desirable target width of road land (ROW) is as follows:

For Mountainous Terrain:

Open Area	Built up Area
18 m - 24 m	14 m

7.2.6 CROSS SECTIONAL PARAMETERS

- **Open area with one side hill and opposite side valley**
 - a) Carriageway Width = 7.0 m
 - b) Hard Shoulder Width = 2 x 1.5 m
 - c) Earthen Shoulder Width on Valley Side = 1.0 m
 - d) Roadway Width = 11.0 m
- **Open area with both side hill**
 - a) Carriageway Width = 7.0 m
 - b) Hard Shoulder Width = 2 x 1.5 m
 - c) Roadway Width = 10.0 m
- **Built Up Area**
 - a) Carriageway Width = 7.0 m
 - b) Hard Shoulder Width = 2 x 1.5 m
 - c) Footpath cum Drain Width = 2 x 1.0 m
 - d) Road way Width = 12.0 m

7.2.7 WIDENING OF CARRIAGEWAY AT CURVE

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

Radius of Curve	Extra Width for two lane
Upto 20 m	1.5
21 – 40 m	1.5
41 – 60 m	1.2
61 – 100 m	0.9 m
101-300 m	0.6 m

7.2.8 CROSS-SLOPE/CAMBER

Bituminous surfacing has been proposed. The pavement in the straight reaches is to be provided with a crown in middle and surface on either side is to have slope of 2.5% towards edge. In reaches with winding alignment where straight sections are few and far between, the carriage way is to be given a unidirectional cross fall of 2.5% having regard to super elevation at the flanking horizontal curves and ease of drainage.

The cross fall of hard shoulders is to be at least 0.5% more than that of carriage way subject to a minimum of 3.0% and cross slope of earthen shoulder shall be of 3.5 % for proper surface runoff. Shoulders on super-elevated sections are to have the same cross fall as the pavement.

7.2.9 MINIMUM RADIUS OF HORIZONTAL CURVES

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

The desirable minimum and absolute minimum radii of horizontal curves for various classes of

terrain are given in the table below:

Name of the terrain	Desirable minimum radius	Absolute minimum radius
Mountainous & Steep	150 m	75 m

7.2.10 TRANSITION CURVES

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

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

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

Where, L_s = Length of the transition curve in metres

V = Speed in km/hr

R = Radius of circular curve in metres

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

Subject to a maximum of 0.8 and minimum of 0.5.

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

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

7.2.11 SUPERELEVATION

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

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

Where,

e = Super elevation (metre/metre)

V = Speed (km/hr)

R = Radius (metres)

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

7.2.12 RADIUS OF HORIZONTAL CURVES

The radius of horizontal curve is obtained from following formula:

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

Where,

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

7.2.13 SET-BACK DISTANCE AT HORIZONTAL CURVES

Set-back distance from the centreline of the carriageway for obtaining requisite sight distance across the inside of horizontal curves is calculated from following equation (vide **Figure-7.1** for definitions):

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

Where,

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

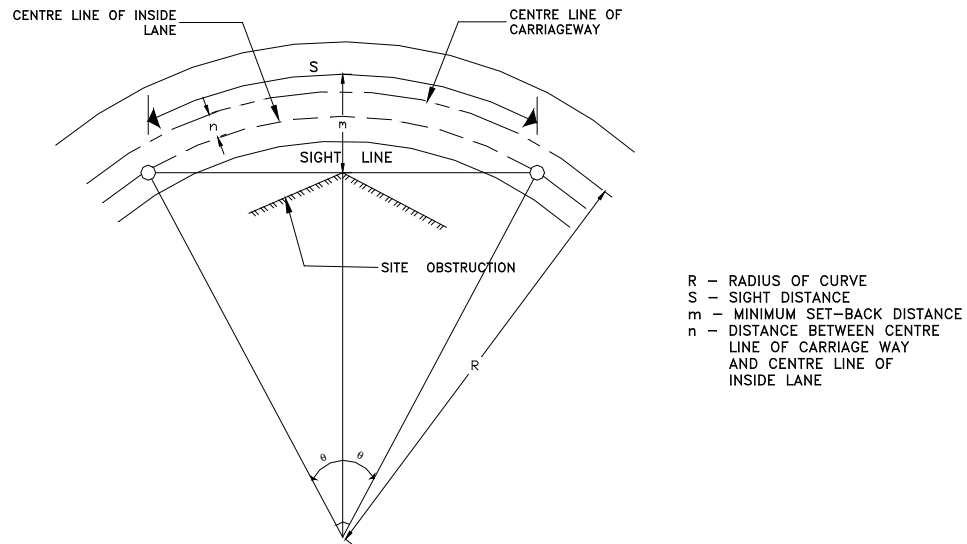


FIG. 7.1: VISIBILITY AT HORIZONTAL CURVES

Provision of lateral clearance with intermediate sight distance is often not economically feasible in hill roads. However, vision berms, as shown in **Figure-7.2**, may be provided by benching on hill sides in curves to provide better sighting of vehicles wherever considered necessary.

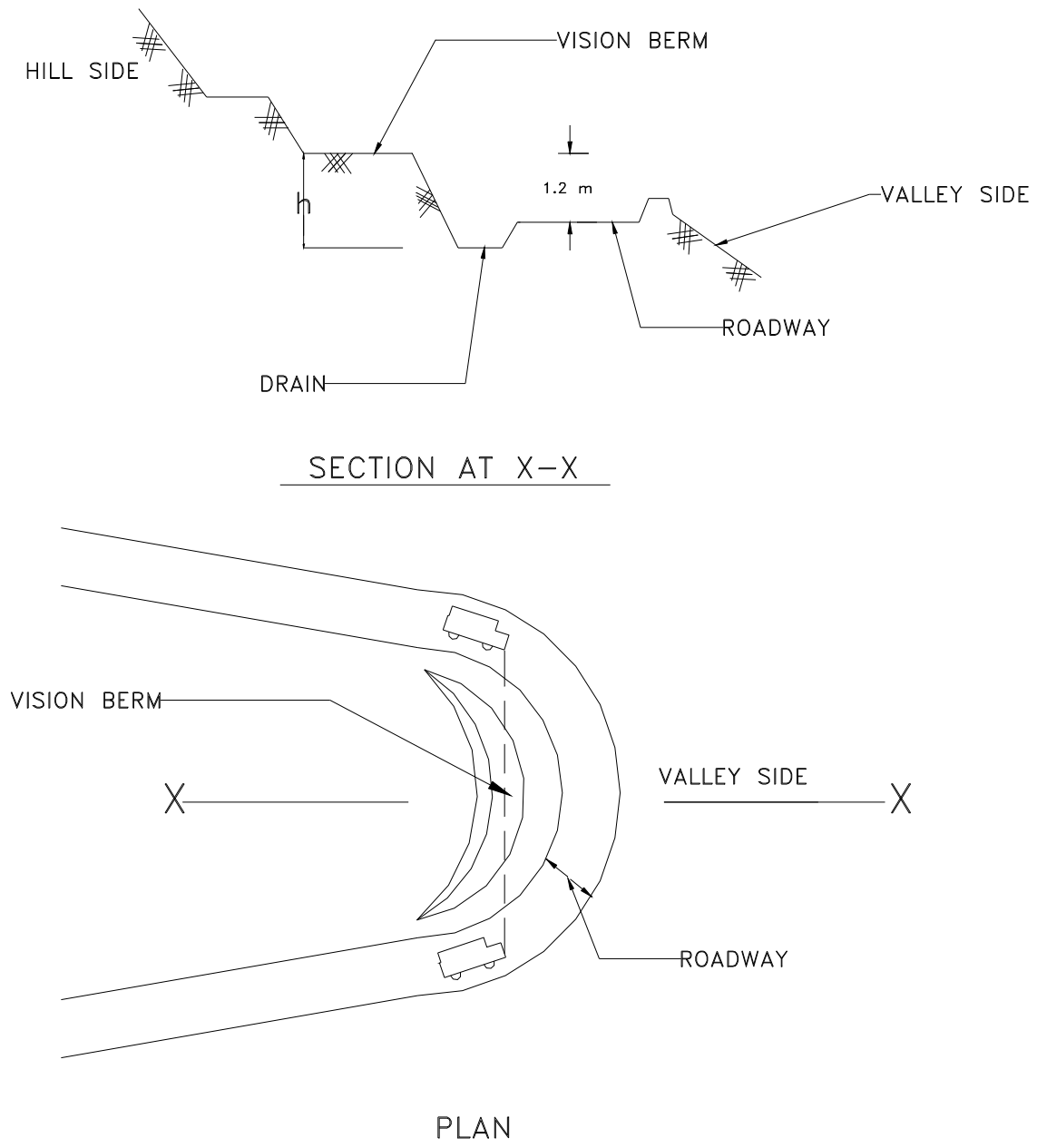


FIG: 7.2

VISION BERMS

7.3 VERTICAL ALIGNMENT

7.3.1 GRADIENT

The project road should provide for a smooth longitudinal profile. Grade change should not be too frequent as to cause kinks and visual discontinuities in the profile. The ruling and limiting gradients are given below:

Classification of Gradient	Mountainous terrain	Steep terrain
i) Ruling gradient	5.0%	6.0%
ii) Limiting gradient	6.0%	7.0%

7.3.2 VERTICAL CURVES

Vertical curves should be provided at all grade changes exceeding those indicated below. The minimum lengths of curve for satisfactory appearance are shown alongside for hill road:

Design Speed (km/hr)	Maximum Grade Change (%) not requiring a vertical curve	Minimum Length of -vertical curve (m)
Upto 35	1.5	15
40	1.2	20
50	1.0	30
65	0.8	40

7.3.3 SUMMIT CURVES

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

FOR SAFE STOPPING SIGHT DISTANCE:

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

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

Where,

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

L = Length of parabolic vertical curve in metres

S = Sight distance in metres

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

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

FOR INTERMEDIATE SIGHT DISTANCE:

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

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

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

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

7.3.4 VALLEY CURVES

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

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

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

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

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

In both cases,

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

L = Length of parabolic vertical curve in metres

S = Stopping sight distance in metres

7.3.5 HAIR-PIN BENDS

Hair-pin Bends are designed as a circular curve with transition curves at each end. The following design criterion is adopted for design of Hair-pin Bends:

Minimum design speed	= 20 km/hr
Minimum roadway width at apex for NH/SH	= 11.5m for Double Lane
Minimum radius for inner curves	= 14.0 m
Minimum length of transition	= 15.0 m
Minimum gradient	= 0.5 % (1 in 200)
Maximum gradient	= 2.5 % (1 in 40)
Maximum super-elevation	= 7%

Inner and outer edges of the roadway should be concentric with respect to the centerline of the pavement and preferably the full roadway width should be surfaced.

7.4 FLEXIBLE PAVEMENT DESIGN STANDARD

DESIGN OF NEW FLEXIBLE PAVEMENT

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

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

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

Step 3: Design life of Pavement.

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

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

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

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

Where,

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

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

D = Lane Distribution Factor

n = Design life in years

r = Annual growth rate of commercial vehicles

F = Vehicle damage factor

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

Methodology flow chart for the design of new Flexible pavement has been shown in **Figure- 7.3**.

DESIGN OF OVERLAY THICKNESS

Overlay Design has been carried out over existing pavement based on IRC 81-1997. The guidelines provide the method for determining characteristic deflection using Benkelman Beam. The required characteristics deflection values used for design purpose have been obtained from the following formula:

$$D_c = \bar{X} + 2\sigma$$

Where, D_c = Characteristic Deflection (in mm)

$\bar{X}$ = Mean Deflection (in mm) determined on the basis of individual deflection corrected for temperature and seasonal variation

σ = Standard Deviation

Using the Overlay Thickness Design Curves as presented in page 19 of IRC: 81-1997, based on Traffic (msa) and the calculated characteristics deflection (mm), the overlay thickness in terms of

Bituminous Macadam (mm) has been derived. This thickness of Bituminous Macadam has been converted to BC/DBM thickness using the recommended multiplier value of 0.7. Methodology flow chart for the design of overlay thickness has been shown in **Figure- 7.4**.

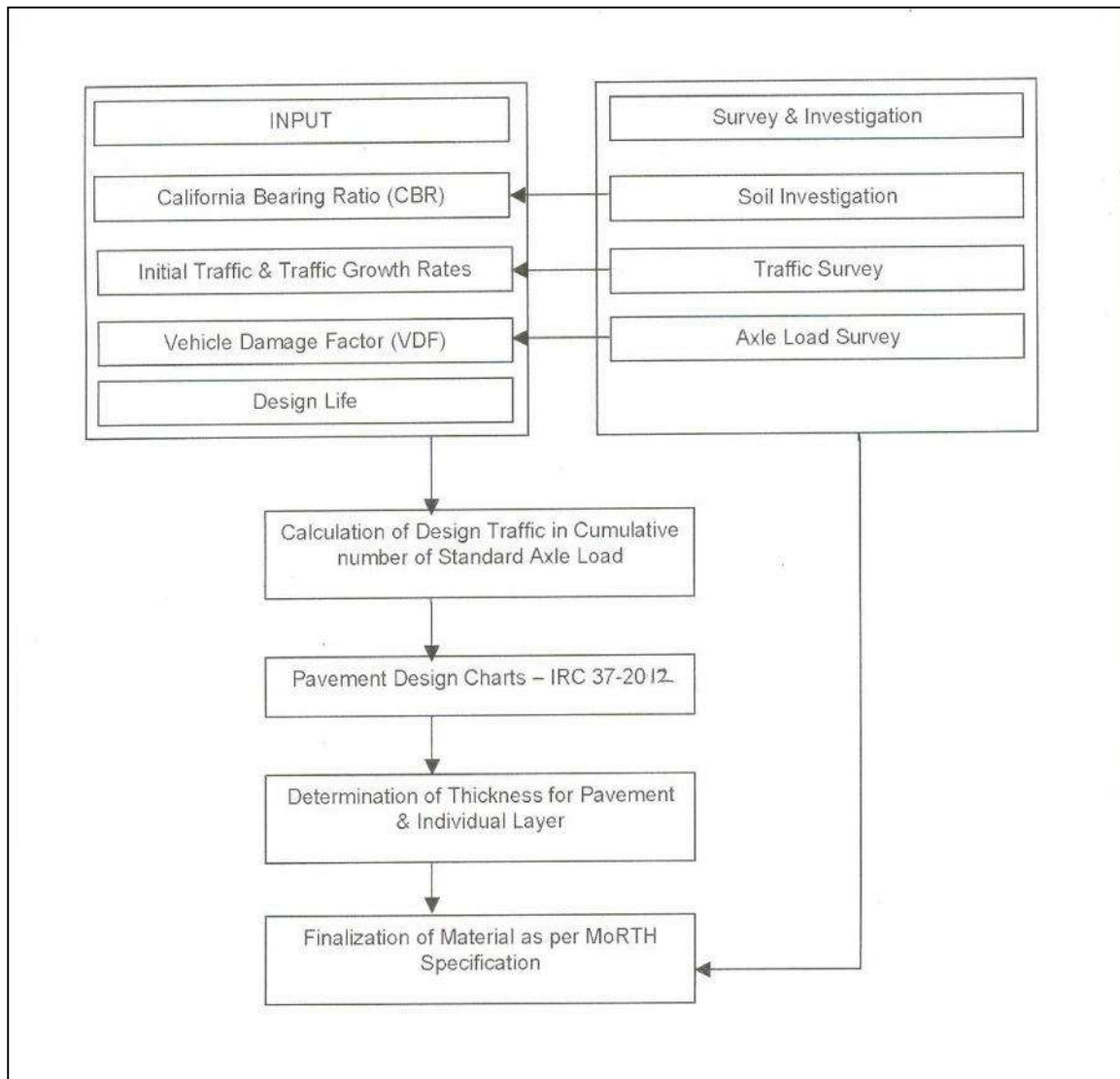


Figure- 7.3: Methodology Flow Chart for Design of New Flexible Pavement

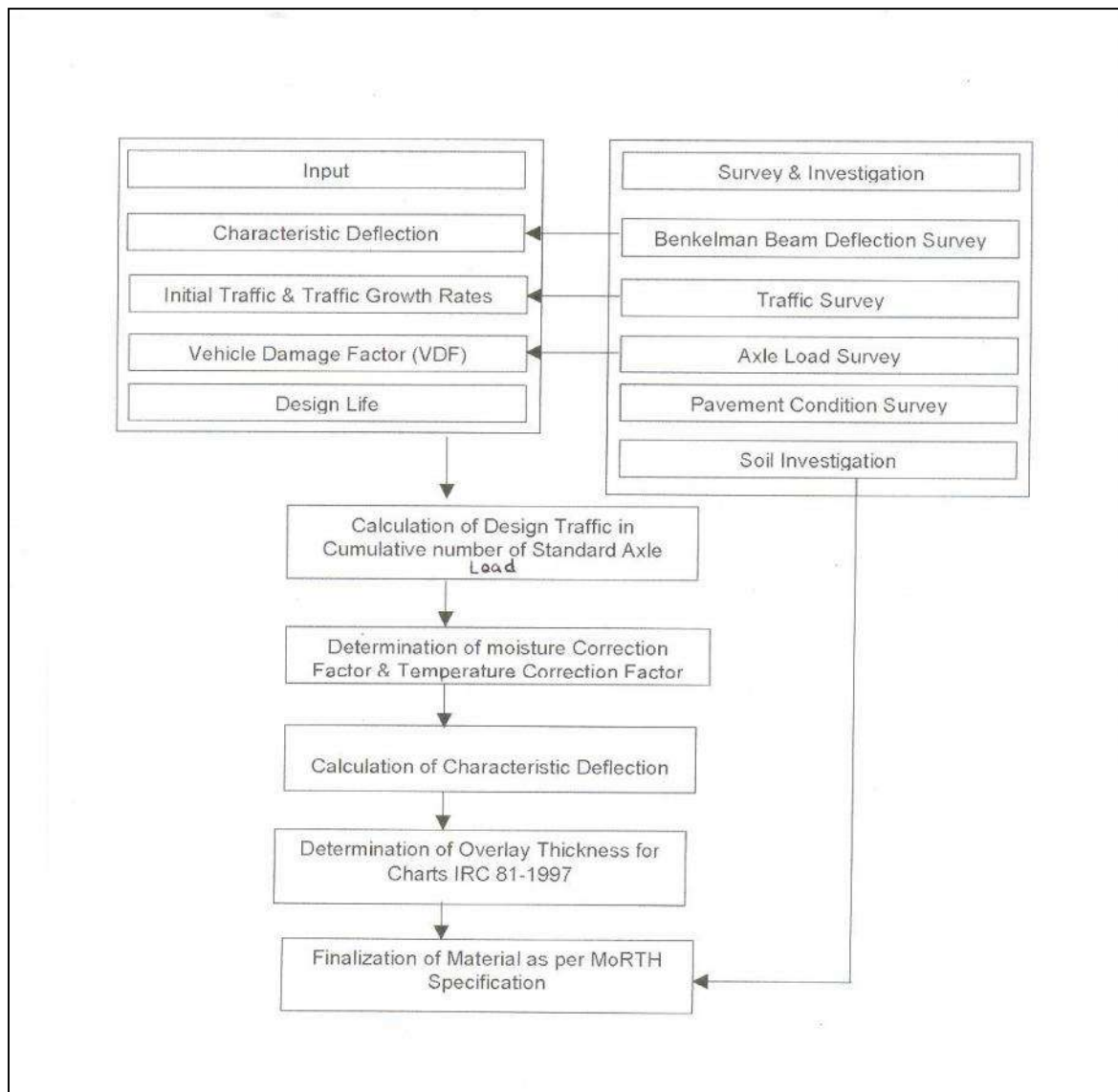


Figure- 7.4: Methodology Flow Chart for Overlay Design

7.5 GEOMETRIC DESIGN STANDARDS FOR BRIDGES AND CROSS- DRAINAGE STRUCTURE

7.5.1 SPECIFICATIONS

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

The following Indian standards will be incorporated wherever appropriate:

Ordinary Portland cement	IS: 269
High Strength Ordinary Portland Cement	IS: 8112
Admixtures (where permitted)	IS: 6925 and IS: 9103
Thermo mechanically treated deformed Bars (TMT/H.Y.S.D)	IS: 1789
Prestressing Steel:	
Uncoated stress relieved low relaxation Strands for 19 T 13 cables	IS: 14268
Sheathing: "Drossbatch" 0.4 mm thick	IS: 18-1985, appendix: 1
Water	IRC: SP33-1989, Clause 5.1 (ii)
Bearings	IRC: 83-1987 (Part II) or BS: 5400
Foundations	IRC: 78-2000 and IRC-SP: 33-1989

7.5.2 DESIGN STANDARDS

GEOMETRIC DESIGN

- i) The overall width (out to out of kerb) of the deck slab will be kept equal to the top width of the approach embankment.
- ii) The span arrangement and span lengths provided will be such that piers/abutments are in line with those of the existing bridges/culverts and ensure smooth flow of water. The new spans are either equal to or a multiple of the spans of old structure.
- iii) The linear water way provided will be determined from the consideration of design discharge, effective and adequate drainage.

7.5.3 LOADING STANDARD

- i) All structures will be designed for 3 lanes of IRC class A with due consideration to reduction allowed for a multi-lane bridge and single lane of class 70-R +single lane of class A whichever produces worst effect. IRC Class Special vehicle will also be considered in design of structures.
- ii) LL on footpath will be taken as 5 KN/m²
- iii) Environmental loadings such as earth pressure, water current, seismic forces and temperature effect will be taken as per IRC/BIS Codes. 15-1893 will be followed in evaluating dynamic increment of earth pressure.

7.5.4 GUIDING STANDARDS FOR STRUCTURES

The Structural planning of new bridges or culverts will be guided by the layout of existing structures. The preliminary designs of proposed structures will be carried out in accordance with the provisions of the following IRC Codes/guidelines.

❖ IRC:5-2015	-	Section I, General Features of Design
❖ IRC:6-2014	-	Section II, loads and Stresses
❖ IRC:112-2011	-	Code for Concrete Road Bridges
❖ IRC:22-2015	-	Section VI, Composite Construction
❖ IRC:40-2002	-	Section IV, Brick, stone & Block Masonry
❖ IRC:45-1972	-	Recommendations for estimating the Resistance of soil Below Maximum scour level in the Design of Well
❖ IRC:SP:73-2015	-	Two Lane Highway with Paved Shoulder Manual
❖ IRC:SP:13-2004	-	Guidelines for design of small bridges and culverts

Foundations of Bridges

❖ IRC:78-2014	-	Section VII, Foundations and Structure
❖ IRC:83-2015	-	Section IX,(Part I), Metallic Bearings
❖ IRC:83-2015	-	Section IX,(Part II), Elastomeric Bearings
❖ IRC:83-2002	-	Section IX,(Part III), POT Bearings
❖ IRC:87-2011	-	Guidelines for the Design & Erection of False work for Road Bridges
❖ IRC:SP-33-1989	-	Guidelines on Supplemental Measures for Design, Detailing and Durability of Important Bridge Structures
❖ IRC:89-1997	-	Guidelines for design and construction of river training and control works for road bridges (1st Revision)

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

7.5.5 SEISMIC DESIGN

The project road falls in Seismic Zone V, as per the classification specified in IRC: 6. All bridges will be designed for Seismic forces as per clause 219 of the said code.

7.5.6 SOIL PARAMETERS

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

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

ϕ	=	30°
δ	=	20°
γ_d	=	20 KN/m ³
γ_{sub}	=	10 KN/m ³

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

7.5.7 HYDRAULIC DESIGN

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

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

7.5.8 FOUNDATIONS

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

7.5.9 SUBSTRUCTURE

RC wall type piers and wall type / spill through type abutment will be provided in the bridges, matching the requirements, site conditions and constraints. Their design will be carried out in conformity with IRC: 78-2000. The shape, size and alignment will be matching with the existing structure from aesthetic and hydraulic considerations.

7.5.10 SUPERSTRUCTURE

- I) MORT&H standard drawings of RC Beam and Slab and PSC super-structure will be adopted wherever applicable. RC slab will form the deck for all new culverts, Multi-cell box structure may be adopted in the minor bridges and culverts, if found appropriate.
- II) **BEARINGS:**
Neoprene/metallic/POT bearings will be used in the bridges as required for specific span, loads etc. and tar paper will be used in the culverts.
- III) **RAILINGS:**
Reinforced concrete railings in M-30 grade concrete following MOST standard will be provided.
- IV) **EXPANSION JOINTS:**
Burried type expansion/strip seal joints as per MORT&H standard will be used.
- V) **WEARING COURSE:**
65 mm thick asphaltic concrete wearing course will be adopted.
- VI) **APPROACH SLAB:**
R.C. approach slabs, 3.50 m long and 300 mm thick in M-30 concrete will be used at either end of the bridges and culverts to ensure riding comfort and to reduce vehicular surcharge on the abutment walls. One end of the approach slab is supported on R.C. bracket projecting out, from dirt wall while the rest of the slab is placed on compacted soil as per the guidelines.

issued by MORT&H. A leveling course, 10 cm thick in M-20 / M-15 grade concrete will be used under the approach slab.

VII) DRAINAGE SPOUTS:

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

VIII) TMT REINFORCEMENT AND PRESTRESSING CABLES:

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

7.5.11 PROTECTION WORKS

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

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

CHAPTER – 8 COST ESTIMATE

8.1 General

Cost estimates is an important component of the study as it provides vital input to economic & financial evaluation and insights for proper planning of project execution. Over and above construction costs, provision has been made for social and environmental mitigation measures. Cost estimates are based on the detailed engineering designs and detailed drawings presented in drawing volume.

8.2 Quantification

The construction items covered in cost estimates includes twelve different heads as:

- ✓ Site Clearance and Dismantling
- ✓ Earth work, Sub grade & Erosion Control
- ✓ Sub-Base & Base Courses
- ✓ Bituminous Courses
- ✓ Traffic signs, Road marking & other road appurtenances
- ✓ Junction Improvements (Major & Minor)
- ✓ Bus bay & Passenger Shelter
- ✓ Drainage and Protective Works
- ✓ Bridges & Culverts

8.3 Unit Rates

Rate Analysis of each item of work has been carried out as per Manipur Schedule of Rates, 2018 for National Highway – Works published by Public Works Department, Govt. of Manipur. The Standard Data Book for Analysis of Rates revised in 2010 by MoRTH has been essentially been taken as the basis for the publication of this schedule. The rates for materials and labour has been collected from the market and other sources and rationalized for the entire state of Manipur.

Leads for major construction materials, considered for the rate analysis, are given in Table 8.1.

Table 8.1: Leads for Major Construction Materials

Sl. No.	Name of Material	Name of Source	Distance from Source to Start/ End Point of Project Road (Km)	Approach Road (Km)	Distance on Project Road (Km) (Half of Project Road)	Total Lead (Km)
1	Sand (Fine)	Barak Near Dzuku	22.144	2	6.175	30.319
2	Filling Material	Local	-	-	-	10
3	Stone Metal	Barak Near Dzuku	22.144	2	6.175	30.319
4	Stone Boulder	Barak Near Dzuku	22.144	2	6.175	30.319
5	Stone Chips, Aggregate	Barak Near Dzuku	22.144	2	6.175	30.319
6	Coarse Sand	Barak Near Dzuku	22.144	2	6.175	30.319
7	Cement	Imphal	158	2	6.175	166.175
8	Steel	Imphal	158	2	6.175	166.175
9	Bitumen	Imphal	158	2	6.175	166.175
10	Bitumen Emulsion	Imphal	158	2	6.175	166.175
11	Structural Steel	Imphal	158	2	6.175	166.175

Table 8.2: Leads for Various Materials for PKG-IIIB

Sl. No.	Name of Material	Name of Source	Distance from Source to Start/ End Point of Project Road (Km)	Approach Road (Km)	Distance on Project Road (Km) (Half of Project Road)	Total Lead (Km)
1	Sand (Fine)	Barak Near Dzuku	0	2	11.07	13.072
2	Filling Material	Local	-	-	-	10
3	Stone Metal	Barak Near Dzuku	0	2	11.072	13.072
4	Stone Boulder	Barak Near Dzuku	0	2	11.072	13.072
5	Stone Chips, Aggregate	Barak Near Dzuku	0	2	11.072	13.072
6	Coarse Sand	Barak Near Dzuku	0	2	11.072	13.072
7	Cement	Imphal	170.35	2	11.072	183.422
8	Steel	Imphal	170.35	2	11.072	183.422
9	Bitumen	Imphal	170.35	2	11.072	183.422
10	Bitumen Emulsion	Imphal	170.35	2	11.072	183.422
11	Structural Steel	Imphal	170.35	2	11.072	183.422

8.4 Project Costing

The cost of the road portion has been worked out based on the cross-sections, plan and profile and other miscellaneous drawings related to road work items.

It is proposed that the excavated earth available from the roadway cutting would be used for the embankment construction, sub grade and shoulder preparation and median/ island filling. Adjustments have accordingly been made in the quantification of fill materials.

Locations of pavement reconstruction as identified in the pavement design and suitably quantified for dismantling and new crust composition. Extent of improvements to the cross roads at junctions has been considered up to the limits of proposed right of way. Quantification for road drainage has been in accordance with the recommendations of designs and drawings.

8.5 Bridges and Culverts

The quantification of various items of work has been detailed out from the respective GAD drawings of bridges and culverts.

8.6 Road Intersections

Quantification for major intersections along the corridor has been done for each intersection based on the preliminary designs and drawings. Quantification for minor intersections and different kind of improvement option considered for each intersection has been worked out on the typical designs and drawings.

8.7 Bus Bays and Bus Shelters

Total 2 nos. of Bus Bays with passenger shelters are provided at 1 location on both side of the project road near habitation area. Details are given below:

Sl. No.	Chainage (km)	Side
Package-III (No of Bus Bays with Shelters = 2 nos.)		
1	96+780	Both

8.8 Safety Barriers

W-Beam Crash Barriers have been provided on the outer side of carriageway on deep valley side and bridge approaches.

8.9 Traffic Signs, Markings and other Appurtenances

Road Signs are important features of traffic control devices and transmit visually vital information to drivers and ensure increased safety and efficiency in free flow of traffic. All these signs shall be of informatory nature. All signs shall be retro-refractive type. Quantification for road signs have been done based on the locations of intersections and other features along the corridor.

Road Markings would be done with thermoplastic paints with reflective bands. It will consist of lane line and edge line. The details of traffic sign and road markings are given in Road Works Drawings volume.

The other items covered under this sub-head are road furniture like km stones, 5th km stones, Hectometer stones, delineators, and boundary stones. They are to be laid as per IRC specifications over the entire length of the road. Overhead gantry signs are also considered at the start and end point of the project road.

Delineators have been proposed depending upon the proposed radius of the horizontal alignment and height of embankment or valley site. The delineator posts have been proposed near all curves of radius less than 1000m, with spacing given as per IRC 67-2012. The delineators will be painted with alternate black and white paint bands and reflectors will be provided in each post.

8.10 ABSTRACT OF COST

TABLE 8.3a: ABSTRACT OF COST ESTIMATE (Package – IIIA)

DESCRIPTION OF WORKS		TOTAL COST (In Cr.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	% of Cost of Civil Works (% of C)
A.	ROAD WORKS			
1	Site Clearance and Dismantling	0.84	0.07	0.80%
2	Earth work ,Subgrade and Erosion control	33.55	2.72	31.89%
3	Sub-Base & Base	22.00	1.78	20.91%
4	Bituminous Courses	13.77	1.11	13.09%
5	Junction Improvement (Major & Minor)	0.03	0.00	0.03%
6	Traffic signs, Road marking & other road appurtenances	1.07	0.09	1.02%
	Drainage and Protective Works			
7	Longitudinal Drains	8.31	0.67	7.90%
8	Retaining wall	8.90	0.72	8.46%
9	Breast wall	4.17	0.34	3.96%
B.	BRIDGES & CULVERTS			
10	Culvert	9.51	0.77	9.04%
11	Major Bridges		0.00	0.00%
12	Repairing & Rehabilitation of Minor Bridges		0.00	0.00%
C.	COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)	102.15	8.27	
D.	Escalation @ 3% WPI	3.0645		
E.	Total Civil Cost including Escalation@3%	105.21	8.52	
F.	Maintenance for 5 years, i.e 2.5% on civil cost (E)	2.63		
G.	GST @ 12% of (E)	12.63		
H.	Contingencies @ 2.8% over Civil Cost (E)	2.95		
I.	Supervision Charges @ 3% of (E)	3.16		
J.	Agency Charges @3% of (E)	3.16		
K	Escalation Cost @ 2.5% during Construction Period(For 1.5 Yrs. of construction period, No escalation in 1st Year and 2.5% for 0.5 Years)	2.63		
L.	TOTAL CONSTRUCTION COST (E+F+G+H+I+J+K)=L	132.37	10.72	
K.	DEPARTMENTAL COST			
a.	LA Cost	8.46		
b.	R&R Cost	1.87		
c.	Utility Shifting (Electrical+PHE)	1.05		
d.	Environmental Budget +Forest Clearance	1.52		
L.	Sub Total (K)	12.90		
M.	TOTAL CAPITAL COST (K+L)=M	145.27	11.76	

TABLE 8.3b: ABSTRACT OF COST ESTIMATE (Package – IIIB)

DESCRIPTION OF WORKS		TOTAL COST (In Cr.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	% of Cost of Civil Works (% of C)
A.	ROAD WORKS			
1	Site Clearance and Dismantling	0.95	0.04	0.48%
2	Earth work ,Subgrade and Erosion control	74.83	3.38	37.45%
3	Sub-Base & Base	37.92	1.71	18.98%
4	Bituminous Courses	24.14	1.09	12.08%
5	Junction Improvement (Major & Minor)	0.17	0.01	0.09%
6	Traffic signs, Road marking & other road appurtenances	1.61	0.07	0.81%
7	Passenger Shelter	0.04	0.00	0.02%
8	Busbay	0.27	0.01	0.14%
	Drainage and Protective Works			
9	Longitudinal Drains	15.03	0.68	7.52%
10	Retaining wall	21.63	0.98	10.82%
11	Breast wall	5.97	0.27	2.99%
B.	BRIDGES & CULVERTS			
12	Culvert	17.26	0.78	8.64%
C.	COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)	199.82	9.02	
D.	Escalation @ 3% WPI	5.99		
E.	Total Civil Cost including Escalation@3%	205.81	9.29	
F.	Maintenance for 5 years, i.e 2.5% on civil cost (E)	5.15		
G.	GST @ 12% of (E)	24.70		
H.	Contingencies @ 2.8% over Civil Cost (E)	5.76		
I.	Supervision Charges @ 3% of (E)	6.17		
J.	Agency Charges @3% of (E)	6.17		
K.	Escalation Cost @ 2.5% during Construction Period (For 1.5 Yrs of construction period, No escalation in 1st Year and 2.5% for 0.5 Years)	5.15		
J.	TOTAL CONSTRUCTION COST * (C+D+E+F+G+H+I)=J	258.91	11.69	
K.	DEPARTMENTAL COST			
a.	LA Cost	16.35		
b.	R&R Cost	3.33		
c.	Utility Shifting (Electrical+PHE)	2.00		
d.	Environmental Budget+Forest Clearance	2.90		
L.	Sub Total (K)	24.58		
M.	TOTAL CAPITAL COST (K+L) = M	283.49	12.80	

CHAPTER – 9

ENVIRONMENTAL ASPECTS

9.1 ENVIRONMENTAL SCREENING

Environmental screening of the project is aimed to (i) recognize the applicability of relevant environmental legislations for the project (ii) identify the environmental issues that should be taken into account due to project interventions (ii) provide input to the engineering design team to consider various alternatives in the critical areas to (iv) determine the magnitude of potential environmental at planning/design stage (iii) identify need for further environmental studies like Initial Environmental Examination and Environmental Impact Assessment (EIA) and iv) suggest enhancement measures, if any.

9.2 RECONNAISSANCE SURVEY

Reconnaissance survey was done to determine the extent of environmental study, design the nature of the environmental survey to be carried out along the road alignment. This will facilitate to identify valued environment components, key stakeholders and key informants. Reconnaissance survey and initial consultations also recognized the need to conduct any additional study like bio-diversity assessment and wild-life movement etc.

9.3 APPROACH AND METHODOLOGY FOR IEE/EIA

- **Review of Country's Legal Framework:** India has a well-defined policy/legal framework for safeguard of environment. Prior to initiation of any civil work, it is essential to analyze the various permissions/clearances required for any developmental project. Same has been presented in later section of this chapter.
- **Primary Data Collection:** Environmental resource inventory will be prepared for all environmental features viz. terrain, land use, landslide and erosion prone stretches, waterways/water bodies, road side vegetation, sensitive receptors, common property resources, utilities, drainage, flooding/water logging, industries, accident prone areas etc. within the area of interest/core zone. Information about this will be done by trained persons under the supervision of an expert team comprised of university researchers. Similarly, floral survey was also carried out. Baseline monitoring was conducted at the locations for which data was not available in environmental assessment report conducted by detailed design team.
- **Secondary Data Collection:** Secondary sources include published government reports, environmental impact assessments conducted in the similar region, government websites, recognized institutions and relevant government departments (forest, irrigation, pollution control board, fisheries, statistics, Indian Meteorological Department (IMD) and Nagaland Space Application Centre (NSAC) etc. Recent Satellite images have been captured to view environmental features at regional scale.
- **Public Consultation:** Meaningful consultations were organized with the PWD, local people/beneficiary population to know the level of project acceptability, understand their concerns, apprehensions, and overall opinion. Information were gathered about existing baseline environmental condition viz. ambient levels and its effects on health, water resources, water logging/flooding, flora and fauna, socio-economic standing of local people.

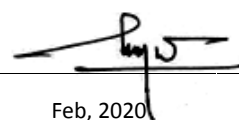
impact due to loss of land other assets and common property resources, accident risk during construction and operation stage, perceived benefits and losses, etc. Information thus gathered was used to integrate it in project design and formulate mitigation measures and environmental management plan.

- **Other Tools, Surveys and Studies:** Assessment of land use/land cover map of larger area beyond the project site will be prepared for better planning and decision-making before creating any physical infrastructure in the region. Remote sensing and Geographic Information System (GIS) based land use map of the study area (10 km buffer) will be prepared through recent satellite imagery. A rapid bio-diversity assessment will be carried out to generate baseline on floral and faunal elements in the project area. The survey will also help in assessing impact on any rare threatened or endangered species of floral species in the project area. Rapid bio-diversity assessment will also recognize wild life movement along across and impact due to improvement work.
- **Assessment of Potential Impacts:** The assessment of the type, nature, direct, indirect, cumulative or induced impacts and their significance to the physical, biological, and socio-economic components of the environment will be done to ascertain whether the project is environmentally sustainable or not. Nature of impacts will be classified as significant, insignificant, short-term, long-term, reversible, irreversible etc. After identification of nature and extent of impacts, mitigation measures will be suggested.
- **Preparation of the Environment Management Plan:** The project specific Environment Management plan will be formulated with an aim to avoid, reduce, mitigate, or compensate for adverse environmental impacts/risks and propose enhancement measures. This includes
 - a. Mitigation of potentially adverse impacts
 - b. Monitoring of impacts and mitigation measures during project implementation and operation
 - c. Institutional capacity building and training
 - d. Compliance to statutory requirements
 - e. Integration of EMP with Project planning, design, construction and operation.
- **Environment Monitoring Plan:** The monitoring and evaluation are critical activities in implementation of the project. Monitoring involves periodic checking to ascertain whether activities are going according to plan or not. It provides the necessary feedback for project management to ensure project objectives are met and on schedule. The reporting system is based on accountability to ensure that the environmental mitigation measures are implemented. Environmental monitoring program has the underlying objective to ensure that the intended environmental mitigations are realized and these results in desired benefits to the target population causing minimal deterioration to the environmental parameters. Such programme targets proper implementation of the EMOP. The broad objectives are:
 - To evaluate the performance of mitigation measures proposed in the EMP.
 - To evaluate the adequacy of environmental assessment.
 - To suggest ongoing improvements in management plan based on the monitoring
 - To enhance environmental quality through proper implementation of mitigation measures.

- To meet existing environmental regulatory framework and community obligations.
- **Performance Indicators:** The significant physical, biological and social components affecting the environment at critical locations serve as wider/overall performance Indicators. However, the following specific environmental parameters can be quantitatively measured and compared over a period of time and are, therefore, selected as specific Performance Indicators (PIs) for monitoring because of their regulatory importance and the availability of standardized procedures and relevant expertise. Performance indicators requiring quantitative measurements are:
 - Air quality with respect to PM2.5, PM10, CO, NOx and SO2 at selected location.
 - Water quality as per CPCB prescribed Standards
 - Noise levels at sensitive receptors (schools, hospitals, community/religious places).
 - Survival rates of trees planted as compensatory plantation.
- **Assessment of EA Capacity to address the environmental concern of the project:** EIA will assess the capacity of the executing agency for effective implementation of EMP. Accordingly, if needed, a training and awareness program will be formulated to enhance the capacity of officials for implementing proposed mitigation measures and monitoring the resultant effects, as well as create awareness amongst workers and public. The institutions/agencies like regional office of MoEF, SPCB/CPCB, and Indian Institute of Technologies can be consulted for such trainings. Independent subject's experts/consultants (e.g., for the environmental awareness program, impact assessment specialist will be the resource person) can also be the resource persons to impart trainings. These experts /agencies shall be appointed based on specific need for the training. A separate budget for training will be allocated under the Construction Supervision Consultant budget.

9.4 COUNTRY'S LEGAL FRAMEWORK AND REGULATORY REQUIREMENTS

The Government of India has laid out various policy guidelines, acts and regulations for the safeguard and conservation environment. The Environment (Protection) Act, 1986 provides umbrella legislation for the protection of environment. As per this Act, the responsibility to administer the legislation has been jointly entrusted to the Ministry of Environment and Forests (MoEF) and the Central Pollution Control Board (CPCB)/Manipur State Pollution Control Board in the present context. Table below presents all relevant policies/acts/rules and regulations and its applicability to the project.



APPLICABLE NATIONAL LAWS AND REGULATIONS FOR THE PROJECT

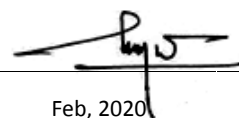
Sl. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Authority
1	Environment Protection Act-1986	To protect and improve overall environment	Yes	It is umbrella legislation and notifications, rules and schedules are promulgated under this act.	MoEF (Govt. of Manipur) State Gov. SPCB
2	Environmental Impact Assessment Notification, 14th Sep-2006 ¹ and its amendments	To accord environmental clearance to new development activities listed in schedule of EIA notification.	No	Project road is >100km but does not involve additional right of way greater than 40m in existing alignment and 60 m in bypass and realignment section.	MoEF, SEIAA
3	Fly Ash Notification, 1999 as amended upto 17th August 2003:	Reuse large quantity of fly ash discharged from thermal power plant to minimize land use for disposal	No	No thermal power plants within 100 km	MoEF
4	Office memorandum dated 18.05.12, by MoEF in view of Apex Court order dated 27.2.2012	Conserve top soil, aquatic biodiversity, hydrological regime etc. by haphazard and unscientific mining of minor minerals	Yes	In case of renewal of quarries and opening of new borrow areas	SEIAA

¹**Category A-i)** New National High ways; and ii) Expansion of National High ways greater than 100 KM, involving additional right of way greater than 40m in existing alignment and 60 m in bypass and realignment section.

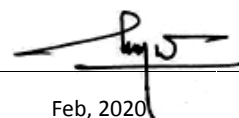
Category B-i) All new state High ways; and ii) Expansion projects in hilly terrain (above 1000 m above mean sea level and/or ecologically sensitive areas.

Note: A general condition applies to both of the above category: "Any project or activity specified in Category 'B' will be treated as Category A, if located in whole or in part within 5 km from the boundary of: (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive areas, (iv) inter-State boundaries and international boundaries".

Sl. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Authority
5	National Environment Appellate Authority Act (NEAA) 1997	Address Grievances regarding the process of environmental clearance.	Yes	Grievances if any will be dealt with, within this act.	NEAA
6	Forest Conservation Act (1980) ²	To check deforestation by restricting conversion of forested areas into non- forested areas	Yes	Road widening and improvement work requires diversion of significant forest land	Tree removal will be guided as per state government rules.
7	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution by & Transport controlling emission of air Department. Pollutants as per the prescribed standards.	Yes	For construction; for obtaining NOC for establishment of hot mix plant, workers' camp, construction camp, etc.	SPCB
8	Water Prevention and Control of Pollution) Act 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Yes	This act will be applicable during construction for (establishments of hot mix plant, construction camp, workers' camp, etc.	SPCB
9	Noise Pollution (Regulation and Control Act) 1990	The standards for noise for day and night have been promulgated by the MoEF for various land uses.	Yes	This act will be applicable as vehicular noise on project routes required to assess for future years and necessary protection measure need to be considered in design.	SPCB
10	Public Liability and Insurance Act 1991	Protection form hazardous materials and accidents.	Yes	Contractor need to stock hazardous material like diesel, Bitumen, Emulsions etc.	----
11	Explosive Act 1984	Safe transportation, storage and use of explosive material	Yes	Blasting may be involved in some locations	Chief Controller of Explosives




Sl. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Authority
12	Minor Mineral and concession Rules	For opening new quarry.	Yes	Regulate use of minor minerals like stone, soil, river sand etc.	District Collector
13	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989	To check vehicular air and noise pollution.	Yes	These rules will be applicable to road users and construction Machinery.	Motor Vehicle Department
14	National Forest Policy 1952 National Forest Policy (Revised) 1988	To maintain ecological stability through conservation and restoration of biological diversity.	Yes	This policy will be applicable as project intervention requires forest land to be acquired.	Forest Department, Govt. of Manipur and Gol
15	The Mining Act	The mining act has been notified for safe and sound mining activity.	Yes	The construction of project road will require aggregate through mining from riverbeds and quarries	Department of Mining, State Govt. of Manipur
16	The Building and Other Construction Workers (regulation of employment and conditions of service) Act, 1996	To regulate the employment and conditions of construction workers and to provide for their safety, health and welfare measure and for other matter incidental there to	Yes	A large number of construction workers skilled, semiskilled or unskilled will be employed temporarily during Construction Phase of the project	Ministry of Labor and Employment




Recent Policy Initiatives: Ministry of Environment & Forest (MoEF) vide O.M. No. L-11011/47/2011-IA.II(M) dated 18th May, 2012 in view of the Order of Hon'ble Supreme Court dated 27.2.2012 in I.A. no. 12-13 of 2011 in SLP (C) no. 19628-19629 of 2009 in the matter of : Deepak Kumar etc. Vs State of Haryana and others has informed that it has been decided in the MoEF that: (i) All mining projects of minor minerals including their renewal, irrespective of the size of the lease would henceforth require prior environment clearance. (ii) Mining projects with lease area up to less than 50 ha including projects of minor mineral with lease area less than 5 ha would be treated as category „B“ as defined in the EIA Notification, 2006 and will be considered by the respective State/ UT Level Environment Impact Assessment Authority (SEIAAs). (iii) All the respective SEIAAs in dealing with the applications regarding environment clearance should be disposed within ten days from the date of receipt of the applications in accordance with law. All State Governments should take action as per the decision of the MoEF.

Procedure for Forest Clearance: MOEFCC has initiated online submission and disposal of forest clearance cases. The detail procedure is available on ministry website <http://forestsclearance.nic.in/> However, the work-flow is unchanged which has been illustrated in Figure 9.1.

Project road passes through forest area. However, the stretch does not pass through any wildlife sanctuary or eco-sensitive zone. Therefore, Wildlife clearance will not be required. However, due to diversion of forest land to non forest purpose, Forest clearance will be required.

A Key Plan of the project road is enclosed for reference.

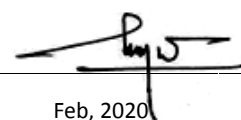
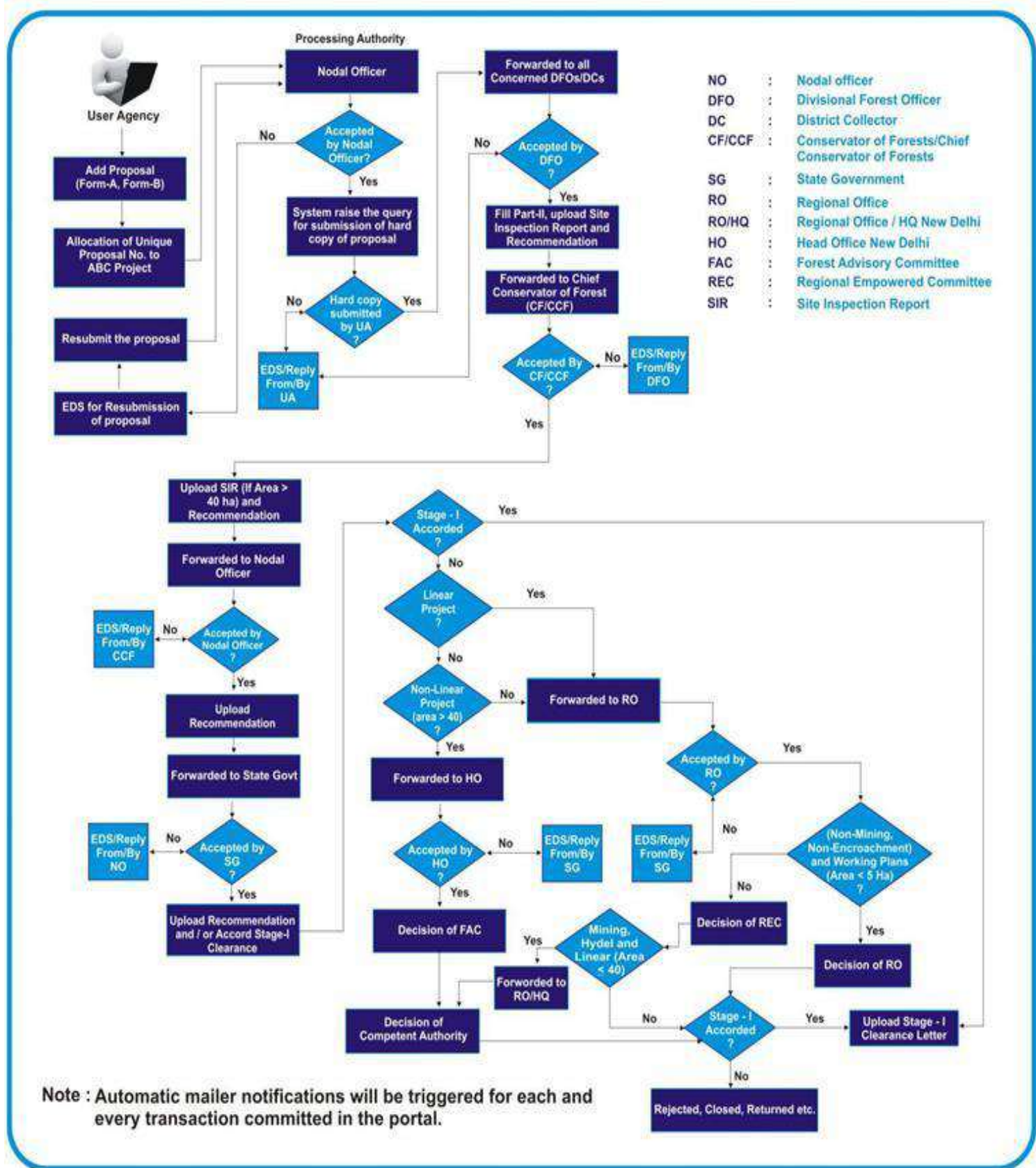


FIGURE-9.1: PROCEDURE AND WORK FLOW FOR FOREST CLEARANCE



STEPS AND PROCEDURE FOR OBTAINING BORROW AREA PERMIT

Steps	Activities
1	Contractor identifies the Borrow Area (BA) quantity based on prospective BA identified in F/S/DPR
2	Contractor identifies the Borrow pits with quantity and raise Request for Inspection (RFI) to IE/CSC.
3	IE/CSC inspects borrow pit in the presence of Environmental Engineer of contractor and land owner with his lease document.
4	Contractor takes the sampling of soil in identified pit and test in lab. IE/CSC approves the pit based on the test report (Moisture contents, particle size etc.)
5	Contractor makes the agreement with land owner and get NOC from Gram Panchayat if necessary
6	If BA is more than 5Ha (B1 category), contractor submit application for clearance to State Environment Impact Assessment Authority (SEIAA) the project is treated as B1 EIA and Public Hearing needs to be carried out.
7	If BA is < 5Ha (B2 category), contractor submit application in Form 1M, Prefeasibility report and approved mine plan to District Environment Impact Assessment Authority (DEISAA). DEIAA gives clearance base on the recommendation of District Environment Appraisal Committee (DEAC).
8	Contractor pays Royalty amount to state government at the prescribed rate.
9	Contractor submit Borrow Area Redevelopment plan to IE/CSC.
10	Contractor raise RFI to IE/CSC for Borrow pit excavation
11	Contractor fulfils the compliance of EC agency observations if any.
12	Contractor will maintain haul road and ensure for fugitive dust suppression
13	Contractor does sampling of each pit at the time of excavation test and gets approval of IE/CSC.
14	Contractor raises RFI to IE/CSC before closing the pit.
15	Contractor reclaims borrow pit as per owner agreement and gets clearance from him.

Key Considerations prior to selection of Borrow Areas

- Cluster shall be formed if the distance between peripheries of one lease to the other and is less than 500m in homogenous mineral area.
- Minimum distance between two clusters is 500 meters.
- Maximum depth of excavation 2000mm from existing ground level.
- In case of fertile land; 15 cm top soil is stock piled. further up to max.30 cm depth.
- Maintain 5m distance from the toe of the final section of the road/Embankment.
- BA should not be dug within 1500 m of village. If unavoidable should not exceed 30 cm in depth.
- Ridges not less than 8m width shall be left an interval of not exceeding 300m.



9.5 MUCK DUMPING PLAN

Selection of Dumping Sites

The muck from hill cutting and construction activities will be safely disposed at suitable locations. Principle adopted for selecting muck dumping areas was to avoid sensitive areas like dense vegetation, natural water courses and areas prone to landslides. During the selection of the dumping sites preference was given on the following aspects.

- The muck does not fall/ flow into stream/river.
- Dumping sites should be at least 30 m (horizontal) away from the High Flood Level of the River/ stream.
- The sites are free from active landslides or creeps.
- The sites should not fall within pristine forest nor are these habitats of threatened species of flora and fauna.
- The sites are located close to its source in order to avoid long distance haulage.

Requirement of total muck disposal area has been given below:

Muck Disposal Estimate (Maram-Peren Road)											
PKG No.	Chainage (KM)		Quantity of Muck/Debris generated (in Cum)	Quantity of Muck with 30% swell factor (in Cum)	Total Quantity of Muck/Debris including swell factor (in Cum)	Estimated Quantity of Muck/Debris proposed to be utilized for Filling (in cum)	Estimated quantity of muck/debris proposed to be dumped (in cum)	Estimated quantity of muck/debris dumped in other location (in Cum)	Avg. Dumping Height (m)	Avg. Dumping Area (Sqm.)	Avg. Dumping Area (Ha.)
	From	To									
PKG-III	75+000	109+494	4,228,021.00	1,268,406.30	5,496,427.30	241,979.00	5,254,448.30	5,254,448.30	15.00	350,296.55	35.03

Muck Disposal Plan

The loosely held muck can lead to the rise in SPM levels, sedimentation load in the river body and phyto-retardation of the nearby vegetation. Therefore, it requires stability with appropriate methods to avoid the subsequent ecological problems. The muck disposal plan involves both engineering and biological measures that depend on the eco-climatic conditions. A considerable amount of muck can be used as filling material at various project components, area/ bench development works and also as aggregates/boulders. Rest of the muck to be dumped and rehabilitated at designated dumping sites. For retaining the dumped material along the hill slopes, crated boulder toe walls will be constructed. Excavated muck would be dumped and compacted at these dumping areas with stable slopes. Planting/grass turf should be done for additional safety of slopes. The toe walls shall be kept at least 30 m away from the high flood level.

Muck Rehabilitation Plan

The muck rehabilitation plan involves both engineering and biological measures that depend on the terrain and eco-climatic conditions. Stability of the loosely held muck requires appropriate method of consolidation and biological measures so that the muck is not easily eroded leading to subsequent ecological problems.

Engineering measures

Crated boulder walls should be provided at the toe of each Muck Dumping Area and a minimum distance of 30m (horizontal) will be maintained from the High Flood Level (in case of Muck Dumping Yard near any water body). These toe walls will provide stability to the slope of dumped muck besides arresting spread of muck beyond the designated area.

Biological measure

Vegetation cover controls the hydrological and mechanical effects on soils and slopes. Therefore, biological measures to stabilize the loose slope are essential. However, such measures are dependent on the local environmental conditions. The stages in implementation of such measures are discussed below.

Selection of Plant Species

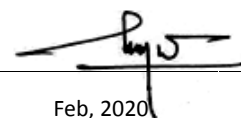
Different plant species may be utilized for different ecological and engineering functions. Grasses are more suited for armoring the loose soil surface and shrubs or trees hold the soil up to the deeper level. The selection of plant species used for rehabilitation of soil/muck must take into account the climatic, soil and drainage conditions of the site. The dumping sites of project road are located in the altitudinal range of 1300 to 1600 m. The area has sub-tropical climate and major part of the precipitation is received during April to September. The period from November to February is relatively dry. Considering all these factors as well as the existing natural vegetation in the area, the species recommended for plantation are Chir pine, alder, broom grass, bamboo etc.

Planting of Trees

The selected species will be planted on the slopes of muck dumping areas. The plantation can be carried out in lines across the slope, usually following the contour to prevent the development of rill and trap material moving down the slope. Brush layers, fascines and palisades can be used because of their uses *i.e.* controls erosion, catches debris and provides strong, fibrous root reinforcement. Different plant species when used together will provide increased stability. Grasses planted in a line across a slope will provide a continuous chain of support in retaining debris, reinforcing soil of the area. Plant saplings may be raised on biodegradable pots and transplanted as such. The plantation should be done during monsoon season. The pit size has been recommended as 45 x 45 x 45 cm for trees and 30 x 30 x 30 cm for shrubs with some soil rich in nutrients. Compost from the local organic waste can be used. An integrated biotechnological approach will be very useful for sustenance and growth of plants. This approach involves the following steps:

- Assessment of the nutrient status of the soil and evaluation of the physical and chemical properties of the dumped material.
- Formulation of the appropriate blend of organic waste and soil to enhance the nutrient status of the rhizosphere.
- Isolation and screening of specialized strains of mycorrhizal fungi, rhizobium, azobacter and phosphate solubilizer (bio-fertilizer inoculums) which can be best suited for the dumped material.
- Mass culture of plant specific bio-fertilizer and mycorrhizal fungi.
- Plantation of dumping sites/areas using identified blend and bio-fertilizer inoculums.

The rich soil and farmyard manure requirement for nearly 100 pits will be about 1 cubic meter with approximate weight of 200 kg. The saplings will be planted at 3 m intervals along the contour and 5 m across it. Wherever terracing shall be prescribed, the same will be done on terraces at 3m intervals leaving one-meter space from the edge of the terrace. About 1100 seedlings shall be planted per Ha depending on the space available at the site. Shrubs and herbs will be planted in the interspaces. The required saplings will be locally procured from State Forest Department/ private nurseries on the prevalent rates.



Fencing

After rehabilitation of muck the dumping areas need to be protected for some time, from grazing by domestic animals, livestock, sheep and goats. For this reason fencing over the muck deposits is required. Barbed wire strands with two diagonal strands, clamped to wooden/concrete posts placed 3 m apart is proposed for this purpose. Both the ends of the wooden fence posts should be coated with coal tar to ensure longevity of the intervention.

Applicable Indian Road Congress (IRC) Codes to the Project Road: Key IRC guidelines have been summarized that have a direct/indirect bearing on the environmental management during design and construction stages.

APPLICABLE INDIAN ROAD CONGRESS (IRC) CODES

S. No	Code Title/Theme	Code
1	Guidelines on requirement of environmental clearance for road projects	IRC:SP:93-2011
2	Guidelines on Landscaping and tree plantation	IRC:SP: 21-2009
3	Guidelines for EIA of Highway projects	IRC:104-1988
4	Guidelines for Borrow area identification, use and its rehabilitation	IRC:10-1961
5	Guidelines for Pedestrian Facilities	IRC: 103 -1988
6	Ribbon developments on highways and its prevention	IRC: SP: 1996
7	Manual on Landscaping of road	IRC: SP: 21-1979
8	Report on recommendations of IRC Regional workshops on highway safety	IRC: SP: 27-1984
9	Road safety for Children (5-12 years old)	IRC: SP: 32-1988
10	Guidelines on road drainage	IRC: SP: 42-1994
11	Highway safety code	IRC: SP: 44-1994
12	Guidelines for safety in construction zones	IRC: SP: 55-2001
13	Hill road manual	IRC: SP-48-1998
14	Recommended practice For treatment of embankment slopes and erosion control	IRC: 56-1974

9.6 EXISTING BASELINE ENVIRONMENTAL CONDITIONS

Manipur has a total geographical area of 22,327 Sq. Km. of which 90% are hilly regions, largely, characterized by dense forests and inaccessible terrains. The valley (Plain area) at the centre is surrounded by the hills claims 10% only. The valley area is cadastrally surveyed while only some parts of the hills are surveyed. As part of peculiarity of this physical feature of the area, 61.54 percent of the total population is in the valley while 38.45 percent in the hill districts. Beside, the state is surrounded by equally backward states on the north and west; Nagaland and Mizoram while on the south there is Myanmar, a very less developed country. The positive “spill-over” effects of development are visibly limited. The length of international border shared by the state is 352 kms accounting for 41.21% of the total length of the border. This peculiar location has been a visible handicap on the perceptible process of development of the state.

Rainfall: The rainfall in the state is around 1435 mm. Monsoon confers upon Manipur a very handsome rain as seen below: -

- South-West monsoon (June-Sept.) - 825 mm
- Post monsoon period (Oct. to Dec.) - 151 mm
- Winter monsoon (Jan. to Feb.) - 52 mm
- Pre monsoon (March – May) - 407 mm



- **Total - 1435 mm**

Geology: Geologically, Manipur belong to the young folded mountains of the Himalayan system. The rocks in the state vary from upper Cretaceous to the present alluvium. The oldest rocks found in the state are mainly confined in the eastern part of the state close to Indo-Myanmar border and the rocks are grouped as cretaceous rocks consisting of chromites (Epilates), serpentine etc. Availability of Asbestos, Chromite, Copper ore, Coal, Big iron, Lignite, Lime stone, Nickel ore and petroleum is reported in some parts of the state.

Soil: The soil of the state is of two major types – residual and transported, which cover both the hill and plain of the State. The residual soils are either laterized or non-laterized. The laterized red soils covering an area of 2,500 sq. km. in the Barak drainage on the Western slope of Manipur. It contains rich portion of nitrogen and phosphate, a medium acidity and lesser amount of Potash. The old alluvial is brought down by river Barak basin and Jiri river and their tributaries from their lateritic water ship hills. The compact and less permeable soils contain higher quantity of potash, fair amount of nitrogen and phosphorus with medium acidity. The transported soils are of two types – alluvial and organic. The alluvial soils cover 1600 sq. km. in the valley. These soils have general clayey warm texture and grey to pale brown colour. They contain a good proportion of potash and phosphate, a fair quantity of nitrogen and organic matter and are less acidic. The organic soils cover the low lying areas of the valley. With dark grey colour and clayey loam texture, these peaty soils have high acidity, abundance of organic matter, a good amount of nitrogen and phosphorus but are poor in potash. The hill soils are more or less rich in organic carbon (1% to 3%) in the top soil, but poor in available phosphorus and potash. They are acidic in nature.

Following figures are enclosed in GIS Environment to visualize the following parameters in the surrounding region of Maram-Peren road network.

Fig. 9.1: Land use and Land Cover Information

Fig. 9.2: Drainage Information

Fig. 9.3: Elevation Map

Fig. 9.4: Digital Terrain Model

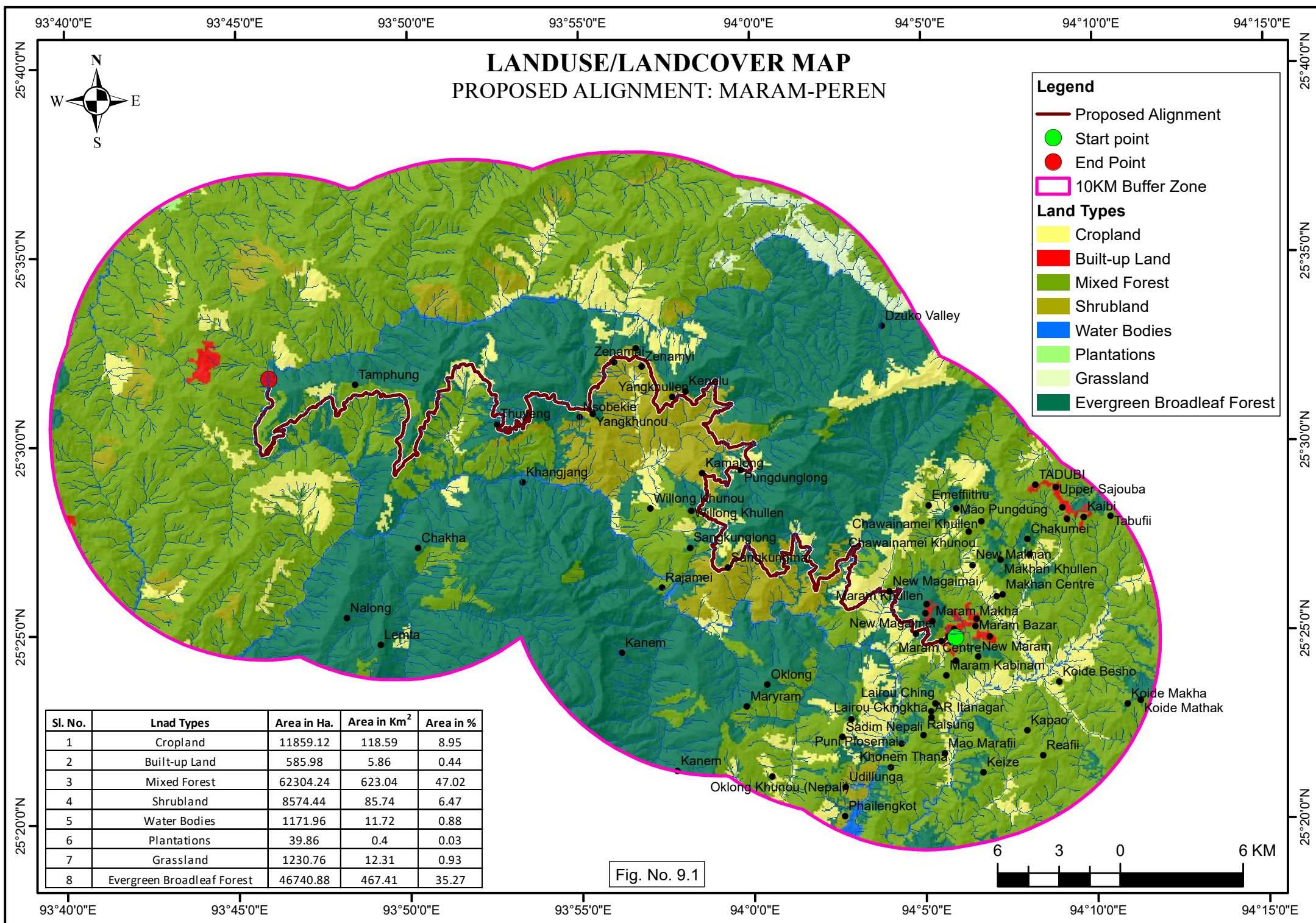
Fig. 9.5: Slope Map

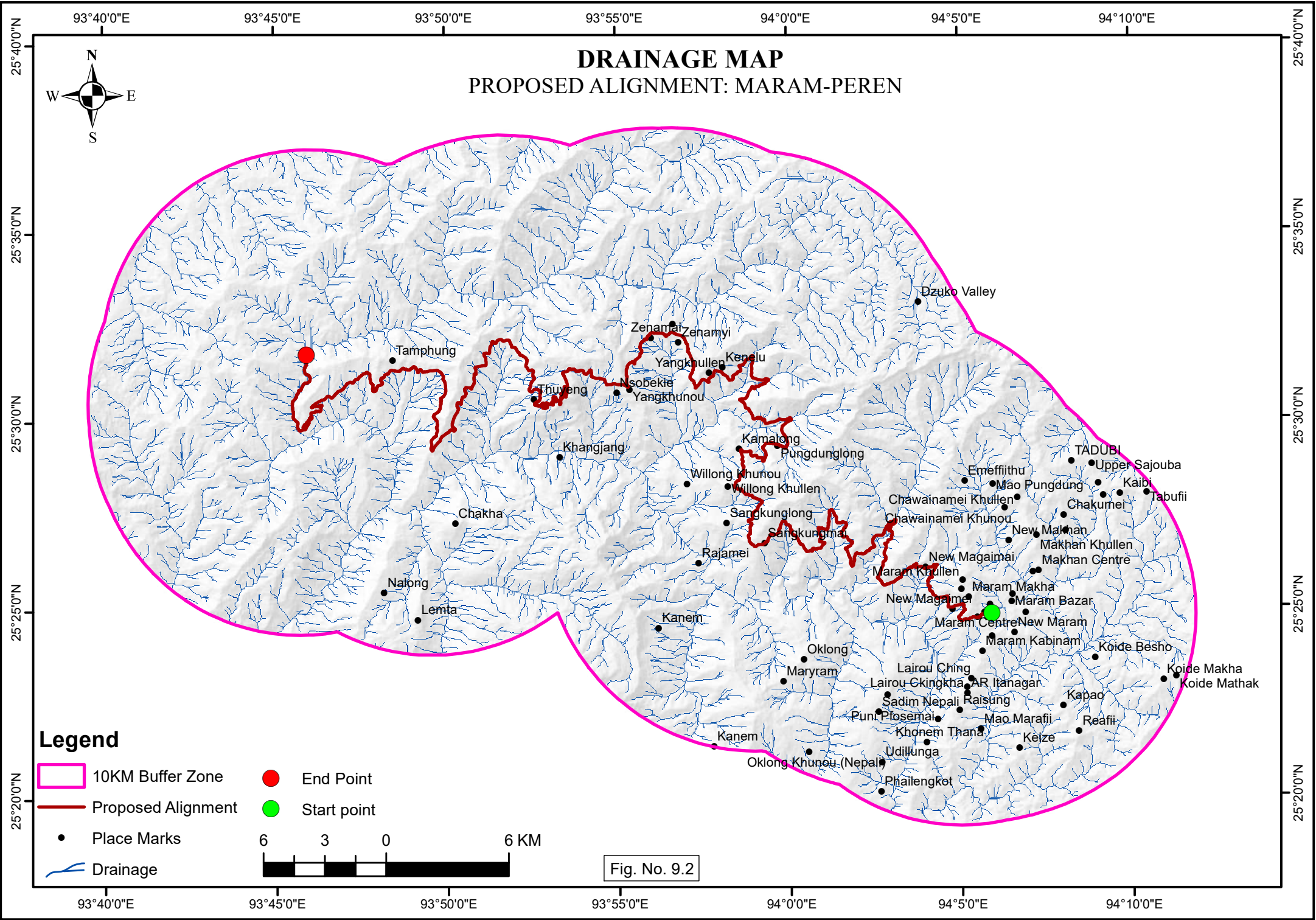
9.7 GENERIC AND SITE-SPECIFIC KEY IMPACTS IDENTIFIED DURING SCREENING

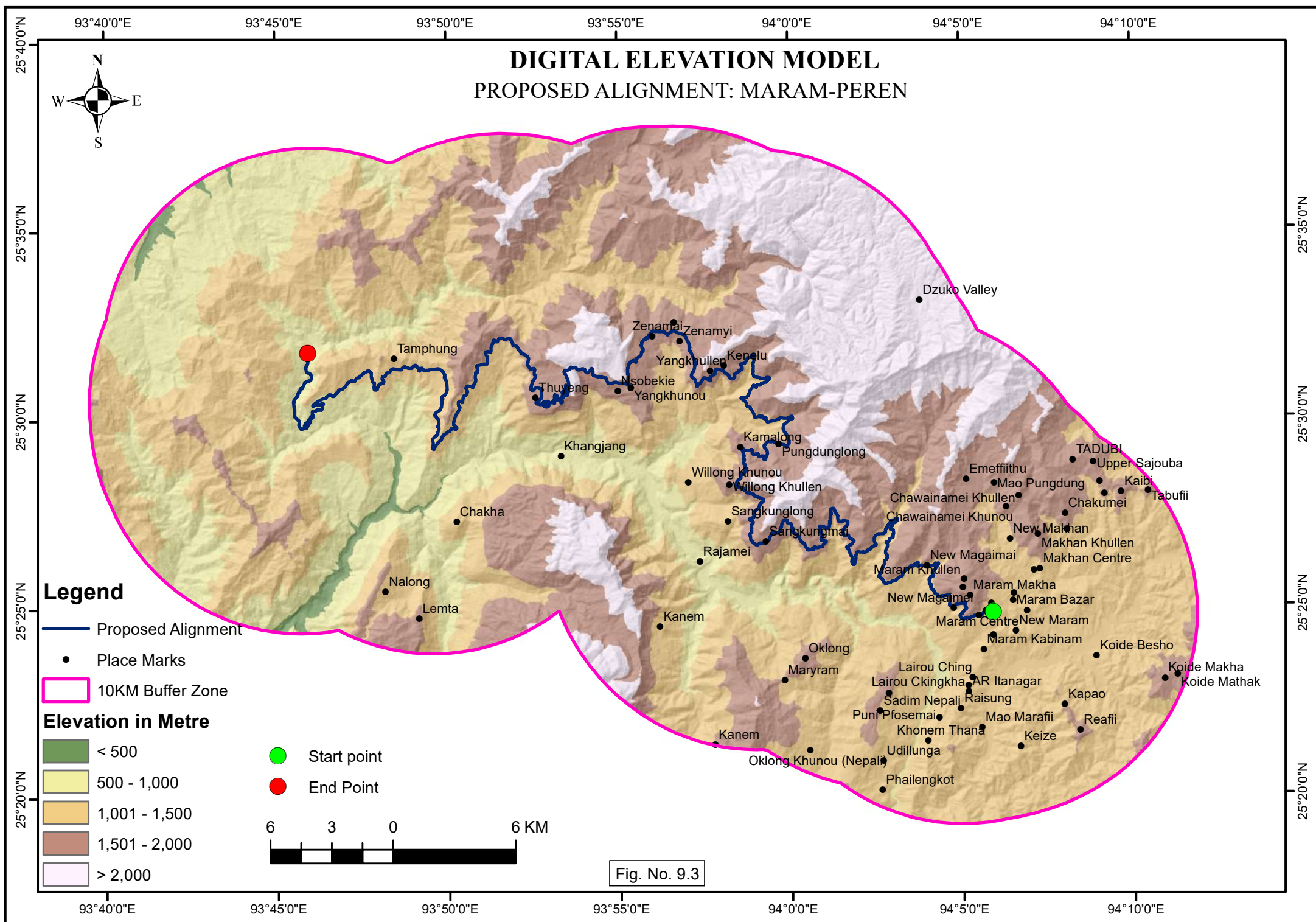
➤ Pre-construction Impacts:

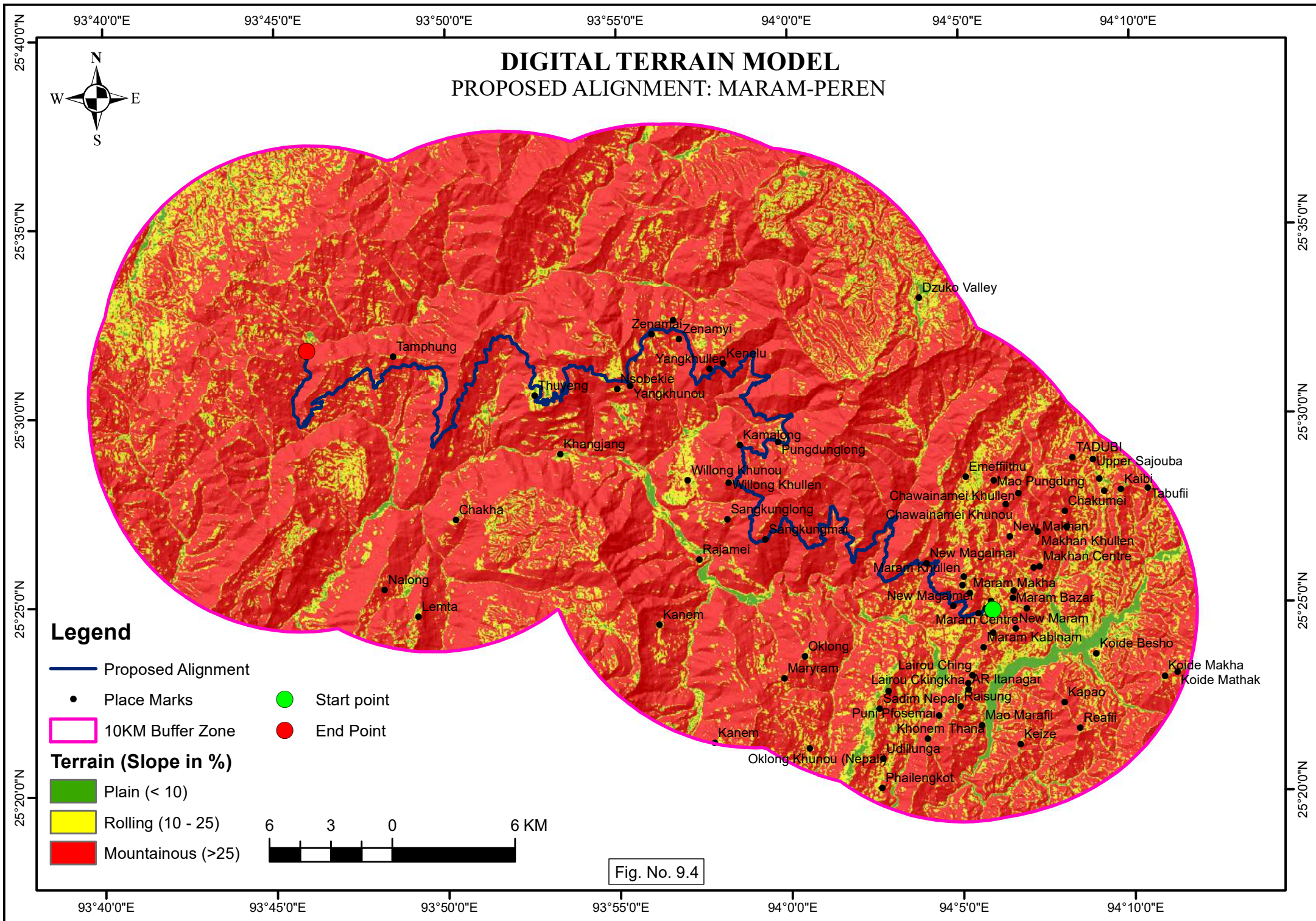
There will be diversion of forest cover for widening the existing road. Private Land also needs to be acquired for widening since the existing road is single lane configuration. Road design has considered all major preconstruction impacts and taken avoidance measures at an early stage of planning.

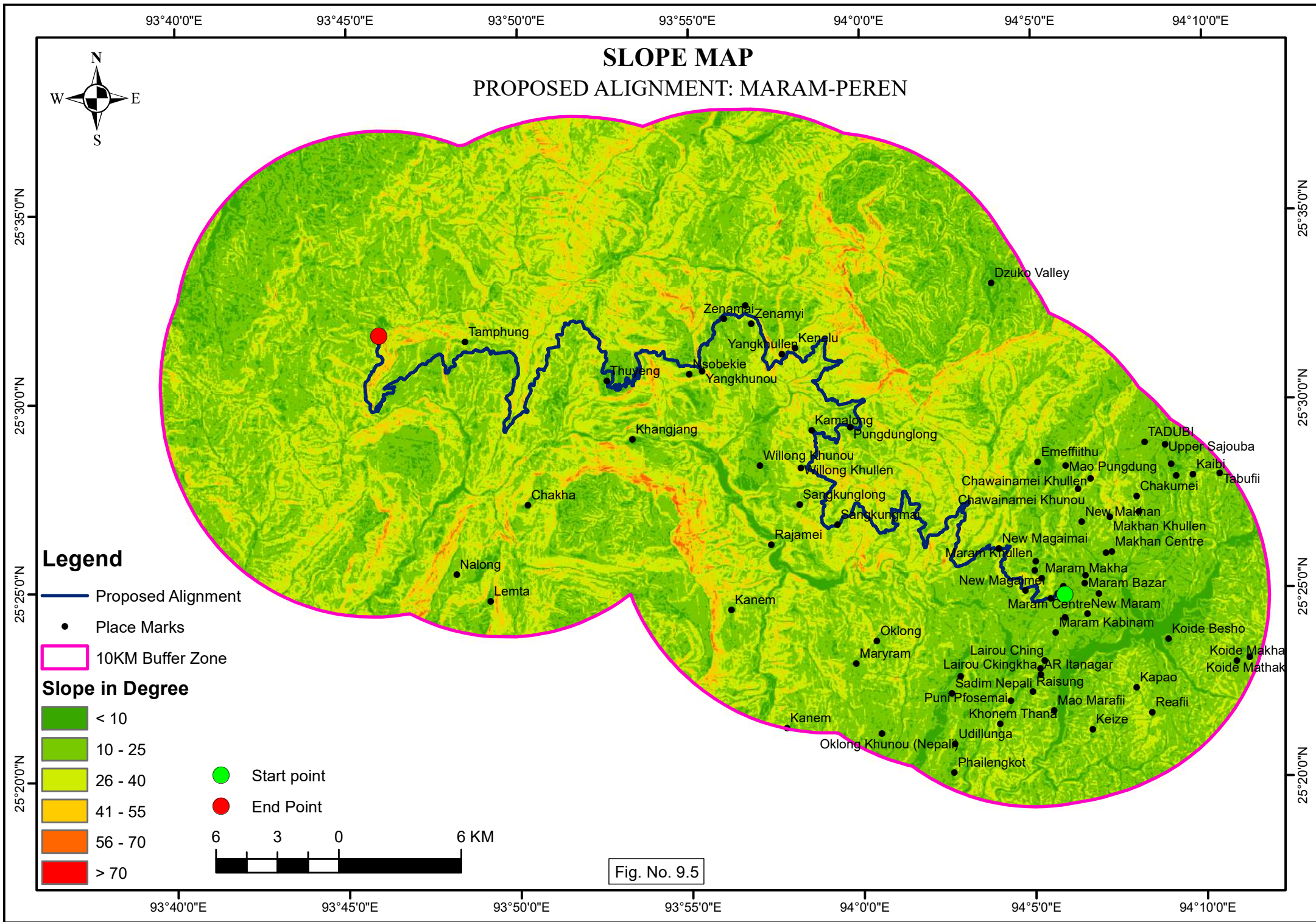
- Alignment:** Final alignment has been determined to minimize land acquisition, impact on structures, archaeological/cultural sites, interference with water sources, shifting of existing utilities etc.
- Water bodies:** construction of culverts and bridges in during lean flow period. If technically not feasible toe walls/retaining walls have been proposed. Aggregate will be procured from existing licensed quarries.











- (iii) **Tree Cutting:** Proposed to restrict tree cutting to formation width.
 - (iv) **Construction material Sourcing:** Borrow areas have been identified at non-agricultural land. Illegal Quarrying is not proposed.
 - (v) **Dust and air pollution:** No new borrow areas/quarry sites to be opened for the project. Aggregates will be sourced from existing licensed quarries. Waste disposal sites and asphalt mixing sites have been sited away from populated areas.
 - (vi) **Noise and Vibration:** Time regulation for blasting and construction near sensitive receptors and residential areas. There are two existing crusher plant in adjacent to proposed road.
 - (vii) **Soil Erosion, Cut and fill:** The design attempted to equalise cut and fill, but due to improvement in longitudinal profile as well as roadside hill cutting, cut material is found more than fill material. Adequate erosion control measures are included in the design.
 - (viii) **Construction Camp and Waste Disposal:** No such facility is sited near any water bodies, forest area and settlements.
 - (ix) **Natural Hazards:** The project area is located in seismic zone V which is very high damage risk zone. Relevant IS codes shall be adopted while designing the civil structures to sustain the earthquake of highest magnitude in Seismic zone V. Retaining walls and breast walls need to be provided at all potential landslide locations.
- **Generic impacts attributable to any road up-gradation projects are:**
- (i) Increase of local air pollution and noise level due to construction and site clearance activities, earthworks, borrowing and quarrying, operation of hot mix plants etc;
 - (ii) Deterioration of surface water quality due to silt run-off, spillage from vehicles and discharge from labour camps;
 - (iii) Health impacts from labour camps;
 - (iv) Disruption to access/traffic;
 - (v) Occupational health and community safety. Operation stage impacts anticipated are road accidents, accidental spillage, submergence/overtopping of CD structures, water logging due to blockade of side drains, increased air pollution and noise level, survival of compensatory afforestation and avenue plantation etc.

All these are mainly associated with maintenance and monitor of effectiveness of mitigation measures taken during design and construction stage. Executing agency is mandated to undertake regular maintenance of the road conditions and its appurtenances.

Besides above, since the project is located in a mountainous terrain, following site-specific impacts achieves greater attention need to be addressed in detail during further stages of study.

➤ **Site Specific Potential Impacts due to Road up gradation and Widening**

- **Landslides:** The litho logy of the project area combined with high rainfall makes the hill slopes unstable. Destabilization of slopes due to hill cutting may cause extensive erosion resulting to siltation in nearby water bodies may invite impact on properties. Hence, suitable protection measures are recommended viz.

(i) Retaining walls for stabilization of uphill, (ii) breast walls for down slopes and (iii) parapet walls/guard posts/railings/edge stones. Some Bio-engineering measures like bamboo terracing, bamboo crib walls, and bamboo knitting a slope, (ii) contour trenching, (iii) series of check dams on hill slopes etc. may also be recommended for slope stabilization. In addition to Controlling soil

erosion, this will generate employment to local people, manifold saving against masonry structures, increase productivity of hill slopes and reduce carbon emissions.

- **Soil Erosion/Silt Runoff:** Soil erosion may take place near cutting areas, at mountainous and un-compacted embankment slope, and wherever vegetation is cleared. Soil erosion may have cumulative effect viz. siltation, embankment damage, drainage problem etc. Loss of soil due to run off from earth stock-piles may also lead to siltation. Need for opening borrows areas and quarries are not anticipated since abundant material will be available from hill cutting. However, if requirement emerged, it may cause some adverse impacts if left un-rehabilitated. It may pose risk to people, particularly children and animals of accidentally falling into it as well as become potential breeding ground for mosquitoes and vector born disease. Illegal quarrying may lead to unstable soil condition; destroy the landscape of the terrain, air and noise pollution. Opening of new quarries is not envisaged due to the proposed project. Quarry material will be sourced from existing licensed quarries. The dredging and use of dredged material, if involved, may have its impact in terms of localized sedimentation level increase and dispersion of pollutants present in the dredged material in the river water.
- **Blasting:** In case if blasting is required the blasting operation may cause noise and vibration, destabilization of rock units and safety hazard and physical damage to downhill inhabitants, assets and properties. In forest areas, it may pose adverse impacts on faunal elements. Blasting, if required shall be restricted to daytime only. Blasting should be carried out as per "The Explosive Act, 1884 and the rules, 1983" pertaining to procurement, transport, storage, handling and use of explosives. Blasting schedules shall be carried out as per pre announced scheduled which shall be also displayed in advance in areas where residents may be affected by the blasting operations. Red danger flags shall be displayed prominently in all directions during the blasting operations. The flags shall be planted 200 m and 500 m from the blasting site in all directions for blasting at. People, except those who actually light the fuse, shall be prohibited from entering this area, and all persons including workmen shall be excluded from the flagged area at least 10 minutes before the firing, a warning siren being sounded for the purpose. The Contractor shall notify each public utility body having services in proximity to the site of the work of his intention to use explosives. The Contractor shall adequately compensate in a timely manner for any damage to property/services and life caused by their blasting"
- **Debris Disposal:** Cutting the hillside to widen a road invariably generates debris. Disposing of this debris in the hilly areas is a challenging task as loose debris can potentially cause landslides, lead to unsightly scarring, and cause the hill slopes where it is dumped to lose their productivity. Although the road's technical design had reduced the generation of debris significantly by filling the valley portions with the debris however significant amount would still need to be disposed. Dumping sites have been tentatively identified keeping in mind requisite environmental consideration viz. distance from water body, distance from forest and vegetated areas etc. during preliminary survey which needs further examinations viz its ownership and their consent and other technical considerations.

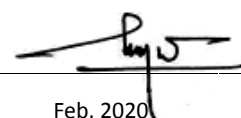
A fairly large proportion of people use hill slopes for agriculture where they still follow the traditional practice of 'jhum', or shifting cultivation, a 'slash and burn' method of cultivation that requires large tracts of land. The productivity of these slopes would therefore need to be retained, and any land acquisition for project work or the disposal of debris would need to be done in close

consultation with the local people since significant part of the land is jointly owned and administered by the community.

- **Alteration of Surface Water Hydrology/Drainage:** Diversion of rivers and major streams construction is not envisaged. Reconstruction/new construction of culverts will be done during lean flow period. Diversion of some nallahs may be required for a very short period. Their courses will be brought back to original within no time once construction is finished.

Ecological Resources: There are no national parks, wildlife sanctuaries or any other similar eco-sensitive areas in the project area (refer key plan). Major portion of the project road is passing through unclassified/open mixed jungle. Wildlife movement is not reported along/across the project road. A rapid bio-diversity assessment will be carried out to generate baseline on floral and faunal elements in the project area. The survey will also help in assessing impact on any rare threatened or endangered species of floral species in the project area. Rapid bio-diversity assessment will also recognize wild life movement along across and impact due to improvement work. Tree enumeration will be conducted to identify no of trees likely to be affected. The list will include Girth size and species of all affected trees. Risk of forest fire cannot be ruled out due to uncontrolled burning of grasses/shrubs for clearance of ROW, fuel accumulation due to accidental spillage or improper storage of explosives.

Based on the above findings and valued environmental components identified, the EIA report during later stage of submission will addressed all key concerns/issues adequately and accordingly an EMP will be formulated which may form part of the BOQ as desired by NHIDCL.



CHAPTER-10

ROAD SAFETY AUDIT

10.1 Introduction

Road Safety Audit (RSA) is a formal procedure for assessing accident potential and safety performance in the provision of new road schemes and schemes for the improvement and maintenance of existing roads.

However, its systematic application can also ensure that a growing awareness about good road safety principles is achieved throughout in highway planning, design, construction and maintenance organization. The essential elements of the definition are that it is:

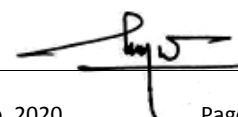
- a) A formal process and not an informal check,
- b) Carried out by persons who are independent of the design and construction, IRC: SP: 88-2010
- c) Carried out by persons with appropriate expertise, experience and training, and
- d) Restricted to road safety issues.

Road, engineers will apply quality assurance techniques by established procedures and regularly check the details of their own work. This regular checking includes checking safety aspects. This type of assessment, however, is not 'road safety auditing' because it is not done with a 'fresh pair of eyes' and it is probably not applying road safety engineering skills and experience required for the task. Road safety audit, on the other hand, is a 'step-by-step' process, performed at all stages. An independent road safety audit of the design is sought, to permit independent road safety engineering advice to be input, for the benefit of the future road users. Presently, it has become practice of involving safety engineers during the life of project, liaising informally with professionals of all disciplines at all stages, from feasibility/concept stage to completion. In turn, quality assurance can be applied to the providers of road safety audit services.

Road safety is now recognized as a major socio-economic concern in India. Increasing traffic volumes, the rapid growth in two and three wheeled traffic, higher speeds due to construction improvement / rehabilitation of roads has increased safety problem. A Road Safety Audit (RSA) is the safety performance examination of a road section through experienced road safety expert. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users. The road safety audit investigates general safety conditions, focuses on specific concerns or users. This also includes pedestrian safety as well as safety of transport use.

10.2 Road Safety Audit and Quality Assurance

Road safety audit is an important aspect of Quality Assurance (QA), applied to the implementation of a road project. It is a management process in which the provider of goods or services assures the customer or client of the quality of those goods or services, without the customer or client having to check each time.



Quality assurance is done by the implementation, in the organization, of a set of procedures designed to ensure that agreed standards are met. Quality assurance procedures for the design and implementation of new road or traffic projects are to input road safety engineering expertise into the design. Often the client and the customer are the same person or organization. In case of roads, the client for whom the road is designed and built is usually the highway authority, whereas the customer is the road user. A road safety audit is undertaken for the highway authority to ensure that the customer is afforded a level of protection from unsafe design and construction.

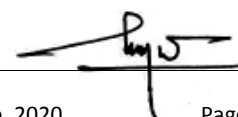
'Getting it right the first time' is the underlying theme of quality assurance. Road safety audits seek to ensure the road operates 'right the first time' once it opens and that the road users make fewer mistakes. Quality assurance is a continuous process. So far as the safe design of roads is concerned, quality assurance starts with a safety culture in an organization. While designing a road, engineers will apply quality assurance techniques by established procedures and regularly check the details of their own work. This regular checking includes checking safety aspects. This type of assessment, however, is not 'road safety auditing' because it is not done with a 'fresh pair of eyes' and it probably is not applying road safety engineering skills and experience required for the task. Road safety audit, on the other hand, is a 'step-by-step' process, performed at all stages. An independent road safety audit of the design is sought, to permit independent road safety engineering advice to be input, for the benefit of the future road users. Presently, it has become practice of involving safety engineers during the life of project, liaising informally with professionals of all disciplines at all stages, from feasibility/concept stage to completion. In turn, quality assurance can be applied to the providers of road safety audit services.

10.3 Objective of Road Safety Audit

Road safety audit must assess projects on the basis of road user knowledge, attributes and skills, day/night and wet and dry road conditions. Safety audit is only a study of safety aspects and an auditor may indicate road safety problems inherent in designs that conform to our road standards. This is due to the fact that our road standards are an expression of a socio-economic balance between road safety, accessibility, environment and economy.

The goal of road safety audit is to ensure that all new road projects – and major operating and maintenance activities on existing roads-are assessed from the standpoint of road safety, so that any parameters of the project that are unsuitable from the standpoint of road safety are Corrected in time. The benefits of conducting road safety audit are that:

- The likelihood of accidents on the road network can be reduced,
- The severity of accidents can be reduced,
- Road safety is given greater prominence in the minds of road designers and traffic engineers,
- The need for costly remedial work is reduced, and
- The total cost of a project to the community, including accidents, disruption and trauma, is minimized.



The cost of road safety audit and the consequent cost of changing a design are significantly less than the cost of remedial treatments after works are constructed. It is easier to change the lines/alignment or so on a plan than to move concrete structures. With less remedial work included in a highway authority's work program, budgets can be kept down or the same money can be utilized more effectively.

10.4 Road Safety Audit: What is done and not done

ROAD SAFETY AUDIT IS:

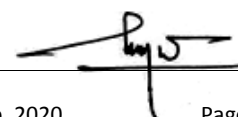
- a) Minimizing the likelihood of crashes occurring through safety-conscious planning and design;
- b) Ensuring that, if a crash occurs, then the likelihood of the injury is minimized (such as provision of anti-skid surfacing and crash barriers);
- c) Ensuring that safety related design criteria (e.g. critical sight distances) have been met;
- d) Managing risks, such that the risk of major safety problems occurring is less than the risk of minor problems occurring;
- e) Reducing the whole-life cycle costs of a design (unsatisfactory designs are expensive to correct after they are built);
- f) Minimizing the risk of crashes on the adjacent road network (particularly at intersections) as well as on the new road scheme;
- g) Enhancing the importance and relevance of road safety engineering in highway design work and to enhance consideration for the safety of all categories of road users in all new and existing schemes.

ROAD SAFETY AUDIT IS NOT:

- a) A way of assessing or rating a project as good or poor;
- b) A means of ranking or justifying one project against others in a works program;
- c) A way of rating one option against another;
- d) An accident investigation;
- e) A redesign of a project;
- f) Something to be applied only to high cost projects or only to projects involving safety problems;
- g) The Name you use to describe informal checks, inspections or consultations;
- h) An opportunity to raise subjective concerns.

10.5 Safety Auditors

To be effective, the safety audit needs to be carried out by specialists, who are independent of the design process. In this way auditors will be taking a fresh look at the project without the distraction of having been involved in their design. Road safety audit involves one set of professionals checking the work of other professionals. Crucial factor is that auditors should be independent and impartial. Road safety auditor must not question the justification for a project but must bring to light its consequences on road safety and endeavor to ensure that the project as presented in the brief is as safe as possible. Auditors need to be objective in their assessments, yet sensitive to the fact that no one likes criticism. Designers and clients need to consider audit recommendations objectively as brought out from the audit outcome.



Expertise and experience in road safety engineering are the essential ingredients in any road safety audit team. This should be linked to an understanding of:

- Traffic engineering and traffic management, and
- Road design and road construction techniques

A person who has an understanding of road user behavior and human perception is also likely to be able to develop road safety audit skills. This understanding is in fact a desirable skill because of the interactive nature of road user behavior with the road environment. An audit team leader must not only have knowledge and skills in road safety engineering, but also should have received training and participated in a number of audits. It is expected that the safety auditors will apply due diligence in identifying the deficiencies and evolving audit recommendations which should be supported with reasons.

The Authority, which engage safety auditors should ensure that the team leader has:

- Adequate road safety engineering experience for the stage of the audit,
- Successfully completed a recognized audit training course,
- At least five years' experience in a relevant road design, road construction or traffic engineering field, and
- Undertaken at least three road safety audits including design stage, etc.

It is not practical or necessary to have a multi-member team conducting an audit. An audit of a low budget project, a road safety audit by more than two persons may not be justified. For large projects, three persons are needed whereas for small projects two persons will be required.

10.6 Organizations Involved In Road Safety Audit

Road Safety Audit Road Safety Audit is based on the principle of an independent review. Road safety audit process reveals that three parties will be involved in this process-Client, Designer and Auditor. For the Public Private Partnership projects (PPP) the client would be both the Govt., and the Concessionaire with their respective obligations as provided in the Concession Agreement. One fundamental idea is that disagreements between the designer and the auditor are resolved not by the designer but by the client. So it is an interaction between different parties, whose roles are predefined at specific stages. In India, for large and small projects client may be National Highways Authority of India (NHAI)/Ministry of Road Transport and Highways/NHIDCL/concerned Public Works Departments (PWD). Designer may be one consultant and Auditor may be another consultant/Govt. institution approved by the Authority. Main functions of the key players in road safety audit are shown in Table 11.1.

10.6.1 Role of designer

Designer is responsible for planning/designing the project. Designer bears the responsibility for ensuring that a road safety audit is conducted and that the necessary measures are agreed on the basis of the auditor's recommendations and/or the client's decisions. The designer is also responsible for ensuring that the audit input information is unambiguously defined and that all circumstances are described in an easily understandable manner. For existing roads, it is the responsibility of operating organization of the relevant highway authority which requests the auditor to prepare accident analysis of the project and

which arranges for the road operator to be notified about the results of the audit. The project manager, or design engineer should be responsible for initiating the safety audit process for each scheme and for responding to the audit. The role of the designer is thus to:

- Attend commencement and completion meetings.
- Bring out the action proposed in response to the audit report and its recommendations and to document these proposed actions.
- Implement the decisions given by the client on the proposed action by amending the original design
- Feed the experience back into the designer's organization and to avoid similar design problems recurring.

Table 10.1 Main Functions of the Key Players in Road Safety Audit

Key Player	Main Functions
Project Owner (Govt. and/or Concessionaire)	• Expresses a commitment to road safety • Provides funding and resources • Considers safety audits and reviews as an essential quality control requirement • Commissions audits and reviews at appropriate times • Selects road safety audit team • Facilitates the response to the recommendations of audits and reviews and arranges implementation of recommendations that are accepted • Attends commencement and completion meetings
Design Team	• Attends commencement and completion meetings • Provides relevant information to safety team • Acts upon and documents response to recommendations of audit
Safety Audit Team	• Identifies safety issues in the proposed design • Makes constructive recommendations to enhance safety • Documents safety issues and recommendations • Holds commencement and completion meetings with the client and design team

10.6.2 Role of client

Client is one who allots the project to the designer and owns the project. As the party responsible for the basic conditions of the project, it is the task of the client to decide in cases where the designer and auditor disagree. Disagreements are presented to the client who conveys its decision to the designer and the auditor. Road operator assumes this responsibility in case of existing roads. The client should be responsible for ensuring that clear terms of reference are laid down to cover the whole range and scope of audit and for commissioning audits at appropriate stages. The role of the client is thus to:

- Select an appropriate auditor,

- Provide all the relevant and necessary documents, and
- Hold a commencement meeting with the auditor and the client.

10.6.3 Role of auditor

Auditor's responsibility is to carefully review the presented project material in its entirety, in the light of best road safety expertise and from the viewpoints of all relevant road users. Auditor also indicates all circumstances that cause misgivings concerning road safety. Persons designated as Road Safety Auditors work with, and have experience of, road accident analyses and road accident reduction. Auditors must be familiar with road planning, design and construction work and must undertake to keep their expertise up-to-date.

Auditors should comply with the terms of reference. They should comment only on the safety implications of schemes and provide constructive recommendations as to how any potential difficulties can be resolved. The role of the auditor is thus to:

- Review all the documents and audit the drawings and designs,
- Inspect the site (including during night time),
- Repeat these two steps,
- Prepare a report,
- Hold a completion meeting with the designer or client or both,
- Participate in the meeting organized by the client sequel to designer's reactions in the Auditor's Report.

10.7 Ways of Organizing a Road Safety Audit

There are many ways of organizing a road safety audit. However, the two essential attributes of road safety auditor are that the person should be skilled and independent. Practically, two options are there for conducting a road safety audit:

- Audit by specialist auditors,
- Audit by those within the original design team or by other road designers.

In case of audit by specialist auditors, team needs to be a separate entity from the normal road design functions of an organization and team members should not, except for the purpose of an audit, be involved with the design of the project. There needs to be a clear understanding, prior to commencement of an audit, about how the audit findings and recommendations will be dealt with. Someone has to consider the safety recommendations and resolve the inevitable trade-offs i.e., project cost, road capacity, likelihood of severity of accidents, etc. In every case where an audit recommendation is rejected, the reasons must be stated and documented. Other ways of dealing with audit recommendations can include:

- A requirement that each recommendation must be formally considered by the client with a view to its acceptance in a normal course and the work cannot proceed to the next stage until formal written approval has been issued by the client based on the recommendations of the audit team.

- The audit recommendations are considered by the designers, or by the project manager. This has the risk that the safety concerns may be rationalized away, in the atmosphere of keeping the project moving with minimal changes.

Instead of using specialist auditors, another designer or design team could undertake the audit. This approach may be applicable in organizations, which have sufficient road design work to have two or more separate design teams. This separation provides a level of independence. But this arrangement does not provide for the one essential ingredient in any road safety audit experience in road safety engineering. Using auditors from within the same organization also has its limitations. It may be considered that the original designer can audit his or her own designs, on the basis that this is better than nothing. However, this option does not meet requirement of independence. Experience shows that no matter how concerned a designer or design team is about road safety, it is almost inevitable that they will be too close to the issues in the design to apply the 'fresh pair of eyes' needed to inquire into design policies, approaches or details. A more effective way to organize a road safety audit is to engage specialist auditor(s) who is (are) independent and possess requisite road safety engineering skills and experience. The independence of the RSA Team is vital to ensure that the design team does not influence the recommendations of the Safety Audit and, therefore, compromise safety at the expense of other issues. This, however, does not mean that there should not be any interaction between the Design Team and the Safety Auditors. A meeting between Safety Auditors at the start and at the end of the audit process would be useful and Safety Auditors could be asked to provide advice on safety issues during the design. However, the independence of the Audit Team is critical and should not be compromised.

10.8 Stages of Road Safety Audit (RSA)

As per the scope of works RSA needs to be performed in the following stages:

- During Feasibility Study Stage (planning stage)
- On completion of Preliminary Design Stage
- On completion of Detailed Design Stage

This report is related to safety audit report at detailed design stage. The audit team reviewed proposed design from road safety perspective and checked the following aspects. RSA related to construction stage and monitoring existing road stage is not discussed here.

10.9 Aspects to be checked

Broadly following items have been checked or reviewed during the detailed project report stage based on site data, existing road and proposed designs.

- Safety and operational implications of proposed alignment and junction strategy with particular references to expected road users and vehicle types likely to use the road.
- Width options considered for various sections.
- Departures from standards, if any and accordingly actions taken.
- Provisions of pedestrians, cyclists and intermediate transport.



- Safety implications of the schemes beyond its physical limits, i.e., how the scheme fits into its environs and road hierarchy

Road Safety Audit is a formal procedure that uses extensive safety engineering knowledge to identify safety deficiencies in road sections. A broad experience in road, traffic and safety engineering needs to be acquired to ensure that a Road Safety Auditor has the knowledge and ability to refer back to the basic principles in road safety, and propose appropriate mitigation measures. Following points are generally adequately clarified during a road safety audit.

- Confusion or ambiguity due to design layout for road users that could lead to potential road traffic accidents
- Insufficient information for road users
- Improper visibility, or an obstruction to road view s of road users
- Hazards in layout create or obstacles to road users that could contribute to an increased risk of injuries

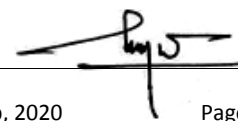
In the above cases safety of the scheme may be compromised and remedial measures may be required to remove this potential or actual deficiency. Road users need to perceive and process vast amounts of sensory and visual information to negotiate a road layout. On the other hand role of designer is to provide a safe road environment that should:

- provide adequate information for road users of the layout and conditions ahead;
- provide adequate warning of hazards or unusual layouts ahead;
- provide positive control of road users passage through conflict points or unusual sections;
- provide a road performance that can nullify road user's errors or inappropriate behavior;
- provides clear, concise and phased release of road user information;
- provides a consistent standard of road design and traffic control;
- Provides adequate warning of hazards.

Desirable minimum Design Standards should be used wherever possible and advance information and warning should be used to inform road users of the layout ahead. However, driver overload must be avoided as it may cause road users to focus too much on the unimportant data and shed vital information. Conflicting information, an over abundance of road signs or a lack of delineation can cause overload. Therefore a "safer" road environment can be defined as a layout that:

It is important that a road improvement caters for all road users. Often the needs of the motorist are incorporated within a scheme whilst the needs of the vulnerable user are ignored. The vulnerable road users that need to be considered are: pedestrians – the old, young and those with mobility or sight impairment; cyclists – children, commuters and leisure users; and motorcyclists.

Each vulnerable road user has different needs from the road network. In the habitation environment the pedestrian is likely to be the principal user and designs must incorporate safe crossing locations, adequate visibility to and from the crossings and appropriate lighting. In addition to the needs of vulnerable road users, particular attention should be paid to the needs of trucks, buses or other specialist vehicles.

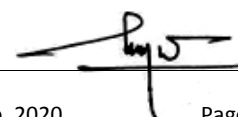


Safe road design varies from the urban to the rural road network; and a number of external factors can create a situation in which a safe road in one location becomes unsafe due to external factors. These factors can include traffic volumes, population density, noise, or road user familiarity. The function of a road should be clear to all road users, and a well planned and defined road hierarchy can assist in providing a safe road network. The design speed can also be an important factor in influencing the safety of a road and should be appropriate to the location, local road users and level of private access control.

One important aspect to the safety of junctions is that layout as well as control method need to be simple and clear, with defined priorities for all road users. The assumption that 'straight on' traffic has priority is widely accepted and it needs to be remembered that alterations to this, despite reinforcement with signs and lines can still be confusing if visual clues such as fences, kerbing or lighting remain unchanged. It is important to attempt to make any minor approach perpendicular to the main road. Y-junctions with acute angles should be avoided. These angled junctions pose problem for road users, including restriction of forward and side visibility. Similarly, it is advisable to avoid intersections on the inside of bends as foliage often encroaches into sight lines after several years. Roundabouts used as a form of junction control have their own rules and design requirements. One of the primary requirements in good roundabout design is that the radius is tighter on the entry than the exit. This ensures a slow entry and lower circulating speed. Visibility is a key requirement for all junction types, all road users need to see and be seen by others. Care should be taken with fixing street furniture and vegetation within visibility splays. Vulnerable road users often experience difficulties during crossing at junctions. It is important that their needs are provided for and that safe crossing places are implemented where required.

The relationship between cross-sectional elements (carriageway, shoulders, etc.) and safety is affected by the type and volume of traffic, and also by the surrounding environment. Lane widths can be critical in affecting safety, where they are too narrow vehicles may collide on horizontal curves, and there may also be inadequate space for two wheeled vehicles. Where lane widths are too wide the alignment may encourage excess speed. On high speed links there is a safety benefit to be gained by the provision of a hard shoulder and central reserve gaps should be of adequate width, depending on the size of vehicles turning. Vehicles parked on the carriageway affect the road environment, layout and consequently safety. Safety problems experienced with parked vehicles are:

- parked vehicles causing physical obstructions which are sideswiped or run into
- parked vehicles causing sudden braking or nose-to-tail shunts
- parked vehicles which deflect oncoming vehicles into adjacent vehicle paths
- parked vehicles blocking visibility for any road user
- parked vehicles between which pedestrians emerge



To reduce the risk of parked vehicles contributing to an accident it is important that designs should minimize parking in main traffic lanes. Trees and foliage can greatly enhance the environmental impact of the street scene. However, left un-maintained, they can also restrict visibility considerably. In addition to this, saplings grow into large trees, which can provide an unforgiving road hazard in the event of a road traffic accident.

With the above discussions and study / analysis of the project road sections safety issues that have been conceived are presented below in Table 10.2

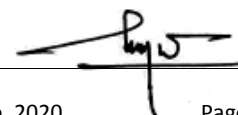


Table 10.2: Road Safety Issues

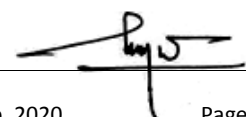
Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
A1. General	Departure from Standards	The horizontal alignment of the existing road has many sub-standard and sharp curves including reverse S-curves. There is also deficiency in transition length as per MoRT&H standards.	Proposed alignment has been designed based on the design speed adopted for mountainous terrain as per standard specified in IRC: SP 73-2015 and Hill Road Manual (IRC: SP 48-1998) Horizontal curves including the sharp/blind curves as well as zigzag ones has been improved to achieve required design speed and super elevation reversal for riding safety and comfort in conformation to MoRT&H standards. (Refer Package wise Plan & Profile Drawing No) <u>Package – IIIA</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-III A/PP <u>Package – IIIB</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIB/PP and Package wise Horizontal Alignment Report Drawing No. <u>Package – IIIA</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-III A/HAR <u>Package – IIIB</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIB/HAR	Considering mountainous terrain in general design speed has been adopted as 40 Kmph. However, speed has been reduced up to 20kmph in case of hair pin bends location.



Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Cross sectional Variation	The existing carriageway width is generally varies from 3.5 m to 7.0 m, with formation width varies from 6.5 m - 10.0 m	<u>(1) Open Area without Retaining Wall:</u> a)Carriageway Width = 7.0 m b)Hard Shoulder Width = 2 x 1.5 m c)Earthen Shoulder Width on Valley side = 1.0 m d) Roadway Width= 11.0 m <u>(2) Open Area with Retaining Wall:</u> a)Carriageway Width = 7.0 m b)Hard Shoulder Width = 2 x 1.5 m c)Earthen Shoulder Width on Valley side = 1.0 m d)Roadway Width= 11.0 m <u>(3) Built-up Area :</u> a)Carriageway Width= 7.0 m b)Hard Shoulder Width = 2 x 1.5 m c) Footpath cum Drain = 2 x 1.0 m d)Roadway Width= 12.0 m For Cross-sectional Parameters, refer package wise TCS Drawing No. <u>Package – I</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-I/TCS	Extra widening has been provided on the curves having radius less or equal to 300m.



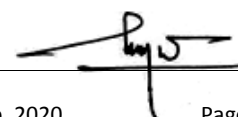
Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Drainage	Existing drainage condition is poor with improper camber and longitudinal gradient of carriageway and shoulder.	Efficient drainage system is provided along the project road including structure and outfall facility. For quick disposal of precipitations, carriageway and shoulder have the requisite camber and longitudinal gradient. The water from road and adjacent areas to be intercepted and carried through roadside drains to natural outfall. RR masonry open trapezoidal drain is proposed for a length of 49348 m for effective surface drainage. Package wise details are given below: <u>Package: IIIA</u> Length of RR Masonry Trapezoidal Drain = 16998 m <u>Package: IIIB</u> Length of RR Masonry Trapezoidal Drain = 32350 m (For drainage details, refer package wise drawing as given below: <u>Package – IIIA</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIA/TCS <u>Package – IIIB</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIB/TCS	
	Climatic Conditions	Generally Temperature varies from 5°C to 35°C. The average annual rainfall is 1517 mm.		HFL has been considered to fix road top level at bridge location.




Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Landscaping	Landscaping on the existing road is not proper due to irregular spacing of trees & absence of proper protection work in hill and valley side.	Proper Road side Plantation is being provided. Protection work shall be given on Hill and Valley side. <u>Package – IIIA</u> a) Total length of Retaining Wall=3042 m - Length of 1.5m Retaining Wall=984 m - Length of 2.0m Retaining Wall=1516 m - Length of 3.0m Retaining Wall=345 m - Length of 4.0m Retaining Wall=147 m - Length of 8.0m Retaining Wall=50 m b) Length of Breast Wall = 1319 m <u>Package – IIIB</u> a) Total length of Retaining Wall=6841 m - Length of 1.5m Retaining Wall=1422 m - Length of 2.0m Retaining Wall=3778 m - Length of 3.0m Retaining Wall=691 m - Length of 4.0m Retaining Wall=615 m - Length of 5.0m Retaining Wall=97 m - Length of 6.0m Retaining Wall=147 m - Length of 8.0m Retaining Wall=91 m b) Length of Breast Wall = 1988 m Application of Hydro-seeding has been conducted on cut slope of hill section and the area comes out as 20000 sq. m.	Trees and vegetation's on the site should be properly trimmed and removed if required so that these should not interfere with the overhead services, clear view of signs and efficiency of roadway lighting. A regular program of pruning of the offending trees shall be under-taken as a part of the maintenance operation. Trees shall be selected based on the soil, temperature, rainfall, water level and should be deep rooted to avoid any damage to the pavement crust.

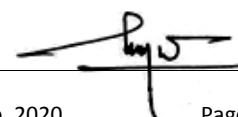
Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
			Package wise details are given below: <u>Package – IIIA</u> Total Area of Hydro Seeding=10800 sq. m <u>Package – IIIB</u> Total Area of Hydro Seeding=9200 sq. m For details of retaining wall & breast wall, refer package wise drawing no: <u>Package – IIIA</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/MISC-06 <u>Package – IIIB</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/MISC-06	
	Service Apparatus	Existing utilities like Electric poles, Transformer, High Tension Line, and Telephone Pole etc. are found along the existing road.	Existing utilities affected due to widening of road shall be relocated at proposed utility corridor within the proposed ROW. Utility corridor is shown in TCS drawing. Refer package wise drawing no: <u>Package – IIIA</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIA/TCS <u>Package – IIIB</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIB/TCS	It will be safe during maintenance
	Lay-byes	No Bus Bay has been observed along the project road.	Bus bays (2 nos.) along with passenger shelters at 1 location near settlement area: <u>Package: IIIA</u> Nil <u>Package: IIIB</u> 2 nos. at 1 Location For typical details of Bus Bay and passenger shelter, refer package wise drawing no: <u>Package: IIIB</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/MISC-7 & 8 respectively	

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Footpaths	No footpaths are observed along the existing road.	For details, refer TCS drawing No: <u>Package – IIIA</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIA/TCS <u>Package – IIIB</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIB/TCS	Footpaths are provided for smooth and safe movement of pedestrian.




Content	Items	Observation with respect to Safety		Remarks																
		Existing Situation	Proposed Situation																	
	Pedestrian Crossings	No pedestrian crossings are observed along the existing road.	Pedestrian crossings are provided at major intersections and other locations like schools, religious structure etc. where substantial conflicts exist between Vehicular and Pedestrian movement.	Installation of proper traffic sign/ signal near pedestrian crossings is mandatory. Pedestrian guard rails are also required to guide people																
	Access	Existing situation shows maximum access to the private property.	Private access should be minimized directly from the proposed carriageway by providing footpath at built up locations	Private access needs be minimized to maintain the design speed of the corridor as well safe passage to traffic and persons																
	Public Transport	Existing traffic survey shows that 2 axle and 3 axle trucks are plying through the project road and 2 wheeler and car/Jeep/Van are act major public transport compare to bus and minibus along the existing road.	After improvement of road to 2-lane trucks and public transport like bus and minibus etc. will play on the proposed road along with other motorized and non-motorized vehicles.	Refer Volume I: Main Report Chapter 7: Traffic Report																
	Future Widening	Existing Row=7.0 m to 16.40 m Existing ROW is less for future widening with respect to two lane	Proposed ROW required for - Open area = 18 - 24 m - Built-up area = 14 m Additional land acquisition is required to accommodate future 2- lane proposal.																	
	Staging of Contracts	Length of the project Road is 32.967 km	Design Length of the proposed road is 34.494 km. <table><tr><th>From</th><th>To</th><th>Length (Km)</th><th>Package</th></tr><tr><td>75+000</td><td>87+350</td><td>12.35</td><td>PKG-IIIA</td></tr><tr><td>87+350</td><td>109+494</td><td>22.144</td><td>PKG-IIIB</td></tr><tr><td colspan="2">Total design length=</td><td>34.494</td><td></td></tr></table>	From	To	Length (Km)	Package	75+000	87+350	12.35	PKG-IIIA	87+350	109+494	22.144	PKG-IIIB	Total design length=		34.494		
From	To	Length (Km)	Package																	
75+000	87+350	12.35	PKG-IIIA																	
87+350	109+494	22.144	PKG-IIIB																	
Total design length=		34.494																		

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Adjacent Development	Existing shoulders are generally in poor condition throughout the road. Footpaths are not found in the built up stretches. Insufficient traffic signs observed along the project corridor.	Proposed hard shoulder on both sides of the carriageway can be used for the movement of slow-moving vehicle during emergency as well as parking for stalled vehicle. Footpaths have been proposed in built up areas for safe movement of pedestrians. Installation of traffic sign for road safety purpose is being proposed. Refer package wise TCS drawing No: <u>Package – IIIA</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIA/TCS <u>Package – IIIB</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIB/TCS	




Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
A2. Local Alignment	Visibility	Visibility is not proper in many places as the existing profile of the road does not follow required sight distances (horizontal as well as vertical).	Proposed hard shoulder on both sides of the carriageway can be used for the movement of slow moving vehicle during emergency as well as parking for stalled vehicle. Footpaths have been proposed in built up areas for safe movement of pedestrians. Installation of traffic sign for road safety purpose is being proposed. Refer package wise TCS drawing No: <u>Package – IIIA</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIA/TCS <u>Package – IIIB</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIB/TCS	In stretches where intermediate sight distance is not available the profile shall be designed with stopping sight distance and overtaking prohibited traffic sign shall be installed in that location.
	New/Exist. Road Interface	Existing road interface are not smooth with improper horizontal and vertical profile.	In general Intermediate Sight distance is being followed for proposed 2 lane road.	
	Safety Aids on Steep Hills	Existing road alignment shows there is no steep hill section along the project road.	New/Existing road interface shall be designed with proper geometry and vertical profile as per codal provision so that the vehicle can moved smoothly & safely.	
A3. Junction	Minimize potential conflicts	Existing junctions are not properly developed with insufficient turning radius and absence of road signage as well as markings.	Requirement of Retaining wall, Breast wall have been considered as protective structures for traffic as the proposed road is passing through mountainous terrain.	Junctions should be developed with proper traffic sign and markings.
	Layout	Layout of the junctions are not proper	9 minor junctions to be developed with proper turning radius, signage and markings to minimize potential conflict between pedestrians and vehicles.	These are designed as per respective IRC guidelines and land acquisition to be kept absolute minimum.

Content	Items	Observation with respect to Safety		Remarks
		Existing Situation	Proposed Situation	
	Visibility	Visibility of the existing junctions are not proper	Layout of the proposed junctions are to be made with proper turning radius, acceleration/deceleration lane, island and median etc.	Traffic Sign at junctions should be informative enough.
A4. Non-Motorized road users provisions	Adjacent Land	Existing Scenario shows Pedestrians, Cyclists and non motorized vehicles are plying on the existing road due to damage road shoulder and absence of footpath in built-up areas and causing conflicts with fast moving vehicles which decrease the design speed.	To improve the visibility of the proposed junction's vertical profile of the road shall be designed with intermediate sight distance. If it is not found it should be taken care that at least stopping sight distance should be available throughout. For smooth movement of non-motorized road users, pedestrians and cyclist hard shoulder has been proposed on both side of the carriageway. Also, in built up stretches 1.0 m wide footpath cum drain has been proposed for less conflict between fast moving vehicle and pedestrians, cyclists etc. Refer package wise TCS drawing no: <u>Package – IIIA</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIA/TCS <u>Package – IIIB</u> CET/4046/NHIDCL/NH-129A/M-P/FDPR/PKG-IIIB/TCS	
	Pedestrians			
	Cyclists			
	Non motorized vehicles			
A5. Signs and Lighting	Lighting	Insufficient Lighting shall be found in built up areas.	Lighting shall be provided on major junctions, built-up stretches and bus bays locations	
	Signs/ Markings	Insufficient signs found on existing road. Markings are not found in the existing road.	Lighting shall be provided on major junctions, built-up stretches and bus bays locations	
A6. Construction and Operation	Build-ability	Guidelines for safety during construction need to be followed as per IRC: SP-55. Traffic control devices have to be provided as per requirements during construction time. Few of these are: barricading, signs and delineators.		
	Operational			
	Network Management			

CHAPTER - 11

FINANCIAL ANALYSIS

11.1 General

The financial viability analysis for the proposed road forms the basis for assessing whether the project is attractive enough for private sector participation. The analysis ascertains the viability of the investment proposal on BOT format. A provision of maximum 40% government grant is also considered if the project fails to achieve the desired result on BOT format. The financial analysis covers aspects like financing through debt and equity, loan repayment, debt servicing, taxation, depreciation, etc. The viability is evaluated in terms of the Project IRR [Financial Internal Rate of Return (FIRR) on total investment] and the Equity IRR (FIRR on equity investment), using discounted cash flow analysis, where both costs and revenues have been indexed to take account of inflation.

11.2 Tollable Traffic

All motorised vehicles (other than two and three wheelers) on the road would be tolled except certain categories of toll-exempt vehicles such as certain government vehicles, ambulances, fire brigades, etc. Leakage of vehicles from toll plaza has been taken as 0% of the total traffic on the road, since the volume is low. According to the guidelines of the MCA, growth rate of traffic is considered as 5% per annum.

11.3 Capital Cost and Phasing

The capital cost of the project relates to construction cost and includes civil works cost for Road, Bridges / CD Structures & Approach roads, Junction Improvement, Project Facilities, Traffic Sign & Road Appurtenances etc. Under BOT format, the government has to provide ROW land free of cost and encumbrances to the concessionaire. The cost for environmental mitigation measures would be borne by the concessionaire. Hence, costs other than for civil works cost and environmental mitigation cost, viz. LA, R&R, afforestation and utility shifting are taken to be borne by executing authority. In order to arrive at the cost for financial analysis, various other components have to be considered, which are discussed in the following paragraphs.

Base Cost

The base cost for financial analysis comprises the cost to the BOT concessionaire and excludes the cost to executing authorities. It includes civil construction cost and pre-operative expenses. The base cost is at 2018 prices.

Other Cost

With a view to account for inflation, Financial Cost comprising processing fee, sponsor's contingency etc, Interest during construction, the base costs have been escalated at a rate of 25 percent on Civil Cost as per MCA guidelines.

Landed Project Cost

The total landed cost of the project is the cost at the time of commissioning and includes

aggregates of civil cost, financial overheads, escalation costs and interest during construction (IDC).

Project Cost Summary

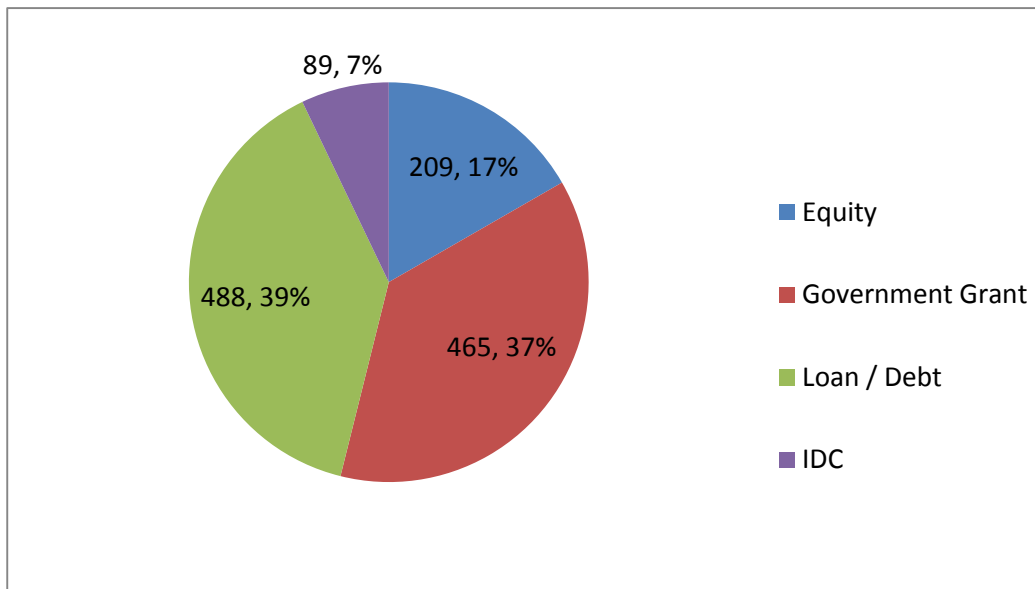
Sl.	Items	Rs. Cr.
A	Total civil cost	1,001
B	25% of Civil cost for contingency, supervision, financing cost and interest during construction	Others 161
		IDC 89
C	Total Project Cost	1,251

The construction is phased over three years (2019-2021). Cost Phasing would be 30%, 40% & 30% over 3 years.

Under BOT arrangement the permissible maximum limit of viability gap funding is 40% of capital investment.

Grant, Loan & Equity Requirement - during construction (Rs Crore)

	Total
Equity	209
Government Grant	465
Loan / Debt	488
IDC	89
Total Project Cost	1,251



11.4 Operations and Maintenance Cost

Operation and maintenance cost as considered in the financial analysis is as follows:

- o Annual Maintenance @ 0.5% of the Civil Cost on every year
- o Periodic Maintenance @ 2% of the Civil Cost at every 5 years
- o Toll Collection Expenses @ Rs 5.00 Lacs /year per Toll Plaza

- o Office Expenses @ Rs 5.00 Lacs/year
- o Patrolling, Electricity Expenses @ Rs. 0.40 Lacs/km/year

11.5 Basic Assumptions of Financial Model

Financial viability analysis has been done using a financial model. The model projects the key financial statements of the private investor over the concession period. A concession period of 20 years has been considered. Depreciation of capital items is calculated by using two methods, viz. the Written Down Value (WDV) Method and the Straight Line Method (SLM). The WDV method favours income shielding and is, therefore, used only to calculate taxes payable by the concessionaire. A tax holiday (i.e. 100 percent tax exemption on profits) for a block of 10 years has been assumed as per the Government's latest incentives for encouraging investments in the road sector. These tax incentives must be availed within the first 20 assessment years of operation. The corporate tax rate, at 33.23% is adopted for the analysis. Minimum Alternative Tax (MAT) rate of 19.93% on the book profit is also considered where there is no corporate tax. Summary of assumptions are as below

Operating Year to Traffic	2023 Start
Operating Period	20 Years
PPP Finishes at the end of	2042 End
Construction Start Year	2020 Start
Construction Time	3 Years
Construction End Year	2022 End
Expected Inflation	5%
Year of Accounting	2018
Corporate Tax Rate	33.23%
Minimum Alternate Tax (MAT)	19.93%
Tax Exemption Start	2023
Tax Exemption Length	10 Years
Cost of Equity	15%
No. of Lanes	2 Lane
No. of Toll Plaza	1 No.
Loan Term	20 Years
Moratorium	5 Years
Long Term Loan Rate	12%
VGF as % of Capex	40%
Debt/Equity Ratio	70%

11.6 Project Revenue

The toll revenue has been calculated for all categories of fast moving vehicles using the project road viz. Car, Bus, LCV, HCV and MAV. The toll rates considered for the analysis are based on existing practices for National Highways.

The fees structure / toll rate has been taken from National Highways Fee (Determination of Rates and Collection) Rules, 2008 and Amendment Rules, 2014 (dated 16th January 2014) –

For structures more than 60m, 10 times of the length has been considered

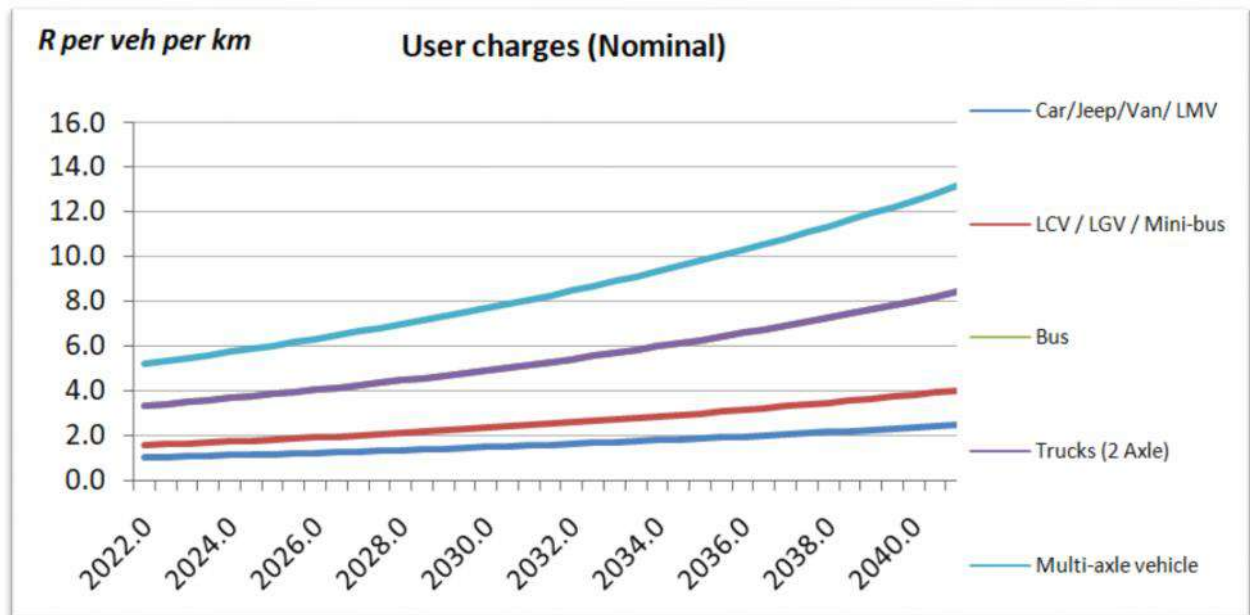
For Bypasses, 1.5 times of the length considered

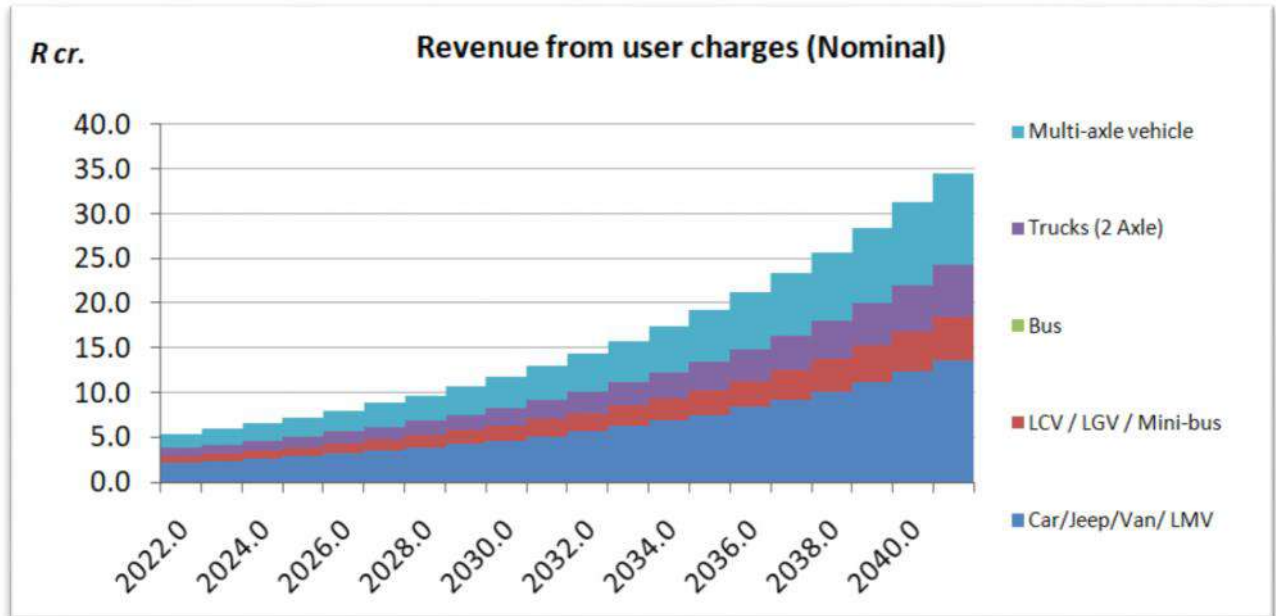
Toll Rate for 2007-08 base year for 4-Lane National Highway,

Vehicle Type	Base Rate of Fee per Km (In Rs.)
Car, Jeep, Van & LMV	0.65
LCV, LGV, Mini Bus	1.05
Bus, Truck	2.20
HCM, EME, MAV	3.45
Oversized	4.20

Toll Rate for 2-Lane National Highway is 60% of that of 4-Lane National Highway (refer sub rule 3 of Principal Rule 4)

Toll Rates are revised based on WPI as per Rule 5 of (Determination of Rates and Collection) Rules, 2008 and modified subsequently.





11.7 Financial Viability on BOT – Toll Mode

To assess whether the project is commercially viable, the returns to investors, in terms of Project IRR and the Equity IRR, are compared with the target IRRs. The target IRR for the present investment proposal is considered as 15% on equity investment. Since the investment proposal without any government proposal does not yield any result, a 40% grant is considered in the analysis. The entire grant will be provided as equity support.

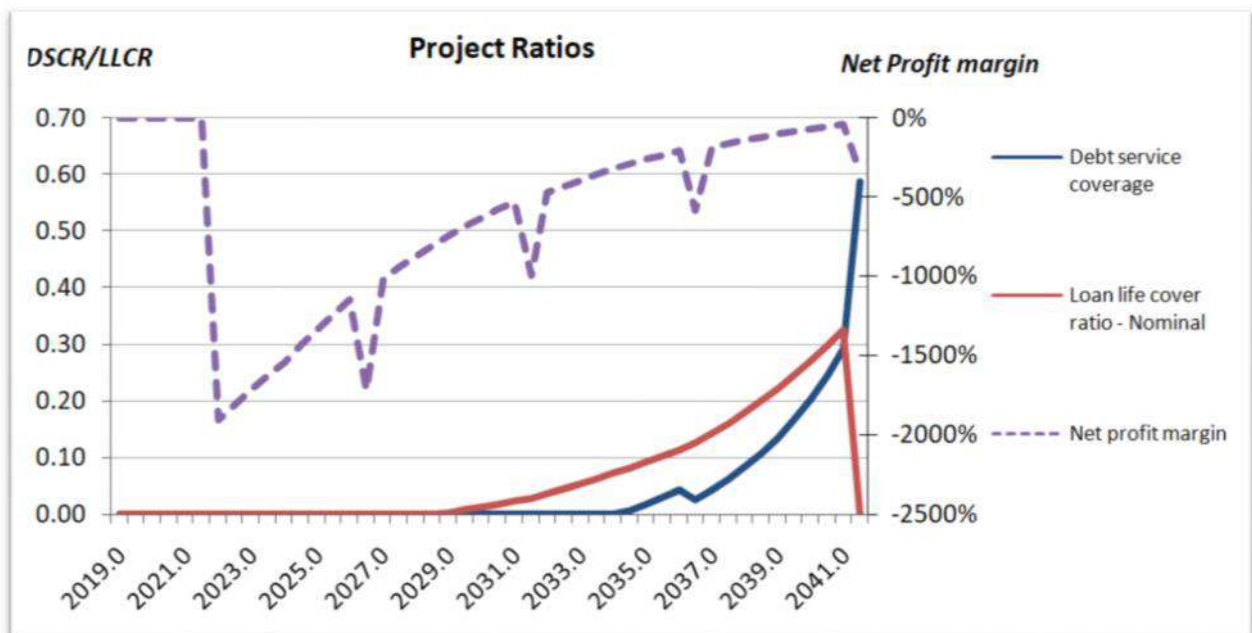
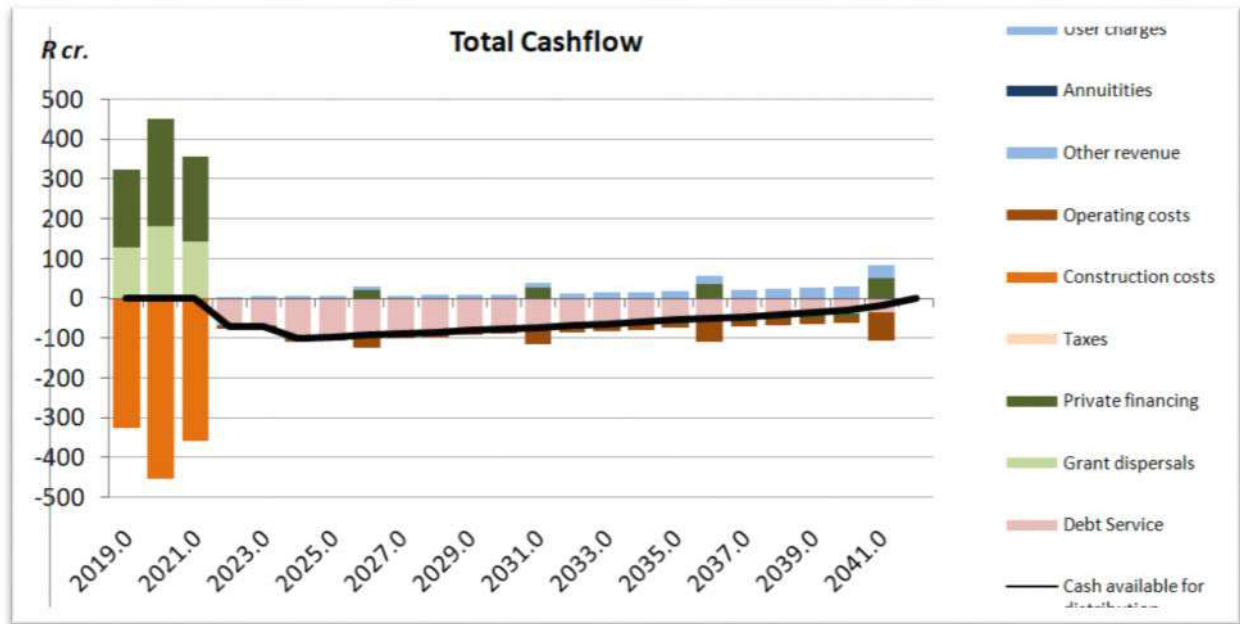
Results of Financial Analysis on BOT - Toll Basis

Project NPV	Rs cr.	-613.5
Project IRR	%	Low (Can't be calculated)
Equity NPV	Rs cr.	-170.9
Equity IRR	%	Low (Can't be calculated)

The return on the proposed investment is not enough even after a VGF of 40% on the TPC as equity support. Thus the project fails on the financial viability.

[Signature]





11.8 Conclusion

The project fails to generate the desired level of return, even with a grant of 40% on TPC. Thus the project does not qualify to be implemented on the BOT - Toll mode. It's recommended that the project to be implemented through EPC mode.

CHAPTER 12

CONCLUSION AND RECOMMENDATION

12.1 CONCLUSIONS AND RECOMMENDATIONS

The Package – III of project road of Maran-Peren Section starts near Ziumi village and ends at Dzuku Bridge near Peren town. The entire corridor falls under Senapati district in the State of Manipur. The objective of the project is to upgrade existing single lane road to 2 lanes with hard shoulder configuration. Total Design Length comes out to be 34.494 km. Total 2 nos. of existing bridges are situated along the project stretch out of which 1 no. major bridge and 1 minor bridge is retained. For proper cross – drainage purpose along the road total 144 nos. culverts have been proposed. All are RCC Box Culverts. There are 6 nos. of minor Junctions present on the project road which needs to be improved at grade. 2 nos. bus bays with passenger shelter shall be proposed at 1 location. Following Flexible Pavement thickness shall be considered on the existing as well as new/ widening portion.

Design Chainage (Km)		Length (km)	MSA for 20 years design period	Design CBR	Type of Pavement	Pavement Thickness over Existing and New/Widening Portion (mm)				Sub-grade in new/widening portion (CBR=10%)
From	To					BC	DBM	WMM	GSB	
75+000	87+350	12.350	20	10%	Flexible	40	70	250	200	500
87+350	109+494	22.144	20	10%	Flexible	40	70	250	200	500

Retaining Wall of length 9883 m, Breast wall of length 3307 m shall be considered as protective works on valley and hill side. Application of hydro seeding has been considered on the cut portion of hill side slope. Provision of Traffic Guidance and Safety (like road signs, marking, metal beam crash barrier, Parapet Wall, lighting, landscaping, tree plantation etc.) has been kept for improvement of the project road.

Civil Cost with per km cost is given below:

Package: IIIA

(a) Civil Cost including 3% escalation cost: Rs. 105.21 Cr. (Rs. 8.52 Cr. / Km)

Following charges are added over Civil Cost to derive Total cost of Construction of the project as follows:

- (b) Maintenance cost-2.5% of (a)
- (c) GST @ 12% of (a)
- (d) Contingencies- 2.8% of (a)
- (e) Supervision charges- 3% of (a)
- (f) Agency Charges-3% of (a)
- (g) Escalation cost-2.5% during construction period

Therefore, total Construction Cost for Package-IIIA comes out as

Package: IIIA

Rs. 132.37 Cr. (Rs. 10.72 Cr. / Km)

Adding Various Departmental Costs, the total capital cost comes out as

Package: IIIA

Rs. 145.27 Cr. (Rs. 11.76 Cr. / Km)

Civil Cost with per km cost is given below:

Package: IIIB

(h) Civil Cost including 3% escalation cost: Rs. 205.81 Cr. (Rs. 9.29 Cr. / Km)

Following charges are added over Civil Cost to derive Total cost of Construction of the project as follows:

- (i) Maintenance cost-2.5% of (a)
- (j) GST @ 12% of (a)
- (k) Contingencies- 2.8% of (a)
- (l) Supervision charges- 3% of (a)
- (m) Agency Charges-3% of (a)
- (n) Escalation cost-2.5% during construction period

Therefore, total Construction Cost for Package-IIIB comes out as

Package: IIIB

Rs. 258.91 Cr. (Rs. 11.69 Cr. / Km)

Adding Various Departmental Costs, the total capital cost comes out as

Package: IIIB

Rs. 283.49 Cr. (Rs. 12.80 Cr. / Km)