

# GOVERNMENT OF MIZORAM PUBLIC WORKS DEPARTMENT



## DETAILED PROJECT REPORT FOR WIDENING TO 2- LANE OF NH 54 BETWEEN KM 431/00 TO KM 562/00 IN THE STATE OF MIZORAM



### DETAILED PROJECT REPORT

#### VOLUME - I: MAIN REPORT

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**CM ENGINEERING & SOLUTION**

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**MULTI MODAL PROJECT DIVISION-I**

**GOVERNMENT OF MIZORAM  
PUBLIC WORKS DEPARTMENT**

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**DETAILED PROJECT REPORT FOR WIDENING TO 2-LANE OF NH 54 BETWEEN  
KM 431/00 TO KM 562/00 IN THE STATE OF MIZORAM**

Name of Road :NH-54 within Mizoram (KM 431+00 TO KM- 562+00)

Length of road : 122.636 Km

**VOLUME - I  
MAIN REPORT  
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## EXECUTIVE SUMMARY

### 1. INTRODUCTION

Recognizing the current inadequate transportation infrastructure facility of the country and the vital role transportation sector plays in the accelerated economic growth of the country, the Government of India has placed a high priority in this sector's development to meet the current and future highway transportation needs.

The Ministry of Roads Transport and Highway, Govt. of India has prioritized to take up for up gradation and improvement of NH 54 from Km 431/00 to Km 562/00 to 2-lane NH Standard in Mizoram. The existing road has steep gradient and sharp curves/zigs at various stretches. It is of single lane road with formation width of 6.00 m to 6.50 m without conforming any standard / specification. As a result, the heavily loaded trucks and large sized vehicles find it difficult to pass through these stretches safely.

The Project Corridor takes off from Lunglei district near Tawipui North Village-2 at Km 431+00 and runs towards southern direction passes through a number of villages like Tawipui North-2, Tawipui North-1, Tawipui South , Thingfal , Thingka , AOC, Saika , Chawntlangpui , Sihtlangpui , Kawlchaw , Zero point , Maubawk , Theiva , Theihri , Tuipang village and Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+000 at Tuipang Village within Saiha District.

The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International Trade Road between India & Myanmar. NH 54 B is also branching from Km 519.200, which is serving as Saiha District connecting Highway and a number of villages which are located in the area adjoining to this road are also heavily dependent on this road for their social and economic development. Thus, the importance of this road and hence the role it plays for the upliftments of the region needs no more emphasis. And, its importance is further enhanced by the requirement of law and order maintenance as these areas are very remote where unlawful activities are of frequent occurrence. Over and above, being located in the fertile region, large quantities of fruits and vegetables are produced annually, which provides sustainable economy for many villagers. This is an important road and life line for the people of the Southern Districts of Mizoram. It is very essential for improvement & up-gradation of existing NH-54 conforming to National Highway Standards.

### 2. PROJECT BACKGROUND

The existing NH-54 was originally constructed as ODR Standard Road during the early part of seventies. It was constructed by the BRO. The road was constructed to provide connectivity to Southern Districts of Mizoram. The road was upgraded to the status of National Highway in the year 1980. No substantial improvement of the road other than normal renewal works have been carried out since the road was declared a National Highway. The pavement work and the permanent works of retaining wall and cross drainage structures were done at the time of construction as an ODR standard road and

the width of the cross drainage structures are also only 6.50 m. Most of the retaining wall /wing wall had been collapsed and the road formation width also breaches at many stretches.

### **3. PROJECT ROAD**

The stretches of the road under this report is between 431/00 Km to 562/00 Km of NH 54 as per existing chainage required for up gradation & improvement to standard 2 lane. In this portion of proposed highway, about 25 % length of road passes through heavily built-up areas which involve costly Land Acquisition and serious resettlement problems in the existing road. The existing alignment also passes through steep terrains which are unstable and landslide prone area at many locations which could also posed serious problems in future.

The proposed realignment of the existing road from Km 535+070 to Km 539+330 at Theiva village to avoid the sharp zig of existing road and Lawngtlai Bye Pass from Km 473+300 to Km 478+400 as per existing chainage , which include 4.40 Km stretch of Multi Model Transit Route & 1.92 Km new alignment to avoid the movement of heavy vehicle traffic & traffic conjunction within the built-up portion of Lawngtlai city.

The proposed realignment take off points are very near due to which ,it will not effected and deprived the connectivity with villages and hence, the villagers would be the beneficiaries with the proposed alignment. Therefore, the proposed re-alignment does not passes through heavily built-up area and would involve much less Land Acquisition cost as well as resettlement problem as compared to the existing alignment. The re-alignment also passes through an area with a much better topographical as well as soil conditions. Hence, apart from the reduction in distance between Lunglei and Tuipang, which would greatly benefit both the neighbouring countries in terms of vehicle operating cost and travel time, the proposed re-alignment is technically far better and financially cost effective in the long run.

#### **Land use**

As per Right of way of proposed 2 land standard alignment 210.50 Ha land is required. About 78.50% length of the road passes through land owned/developed by individuals land holders under periodic patta and LSC pass , 11.50 % length of the road passes through forest & 10.00% length of the road passes through other . This land will not be available free of cost and also compensation for plantations, crops etc. within the required corridor is to be paid to each individuals. About 24.35% length passes through habited area.

### **OBJECTIVE OF THE PROJECT AND SCOPE**

#### **a) Objective of the project :**

The stretches of the road under this report is between 431/00 Km to 562/00 Km of NH 54 as per existing chainage required for up gradation & improvement to 2 lane standard

In order to improve 131 km stretch of existing road to standard 2-lanes, some stretches of the road will have to be re-aligned whereas some existing stretches can be improved to conform to National Highway Specification in respect of its gradient, curves, super

elevations etc. Since the proposed Widening to 2-lane with geometric improvement and re-alignment of NH-54 is passing through steep terrain, gorges, nallah etc. Many number of Retaining wall, Breast Walls, Culverts etc have to be constructed.

**b) The Scope of the Project**

The scope of work includes:-

- I. Up-gradation of the existing road, having formation width of about 6.50m to a formation width of 12.0m.
- II. Geometric improvement of existing road by short relocation
- III. Realignment at the existing road from Km 535+070 to Km 539+330 at Theiva Village.
- IV. Lawngtlai Bye Pass 1.92 Km, Take of point at Km 4.40 of Multi Model Transit Route to Km 475+500 on NH 54 near BRO Camp.
- V. New construction, re-construction of cross-drainage works, protection works and side drains along the whole stretch.
- VI. New Construction of pavement on full stretch as flexible pavement (GSB+WMM+DBM+BC).
- VII. Road signs, stones, safety measures, etc along the whole stretch.

**c) Detailed project report consisting of the following:**

- Conduct surveys of the existing alignment and collect inventory data.
- Conduct detailed reconnaissance survey and collect relevant data as well as the remote sensing data.
- Conduct detailed topographical, geotechnical / geological, hydrological and environmental surveys on selected alignment.
- Carry out detailed survey for construction materials
- Preparation of detail alignment drawings and geometric designs and prepare cost estimates
- Analyse the traffic census collected by the Department and conduct economic evaluation of various alternatives
- Analyse various alternatives and recommend the most appropriate for detailed design.
- Prepare Detailed Project Reports covering the following :
  - Main Report
  - Design Report
  - Cost Estimate
  - DPR Drawing
  - Land Acquisition & Utility Shifting Details.

#### **4. ENGINEERING SURVEYS AND INVESTIGATIONS**

Detailed engineering surveys and investigation have been carried out along the selected alignment of the project road and major findings are as given below:

**a) Terrain:**

The alignment of the project road passes through mountainous and steep terrain exceeding 30 % ground slope across the alignment.

**b) Rainfall:**

The proposed road is in heavy rainfall area. Monsoon period is between May and September when construction work is practically impossible.

**c) Topographical Survey:**

The topographical survey was conducted with Total Station and Auto Level Bench Marks were established at every kilometer and cross-section levels were recorded at 20m intervals in straight portions in general and at closer intervals at curves and where required. The topo-survey information was then translated into digitized topographical map using suitable mapping software.

**d) Alignment & Road Design:**

The general alignment of the road under this project is as:

NH 54 Highway from Km 431 /000 to 553/604 Km as per design Chainage

Existing alignment : 120.026 Km

Re-alignment : 2.610 Km

Total length of proposed road : 122.604 Km

Lawngtlai Bye Pass : 1.92 Km

Total Length of project road :

Road is designed for 2-Lane (12.00 m roadway with 7.00 m carriageway).

Gradient, being the most important parameter, has been the guiding factor. Ruling gradient less than 5.0% has been achieved in most point of the road and the maximum gradient being 7.0 % at few selected unavoidable stretch.

**e) Realignment of existing road:**

For improvement of existing road some stretches relocation and re-grading are proposed due to which traffic movement on existing road would be disturbed. Permanent diversion will be included in the design as to minimizing the structure damage, reducing cost of resettlement and easy and faster movement of vehicles. Details of re-alignment is as follows

Sr. No.	Name of Village	Design Chainage		Existing Chainage		Length in Km
		From	To	From	To	
1	Theiva village	530+470	533+080	535+070	539+330	2.610
<b>Total</b>						<b>2.610</b>

**f) Bye Pass of Existing Road for Lawngtlai City:**

The proposed Lawngtlai Bye pass take off from Km 470+50 of NH 54 and merging with NH 54 at Km 475+550 near BRO Camp. Lawngtlai Bye pass, which include 4.40 Km stretch of Multi Model Transit Route & 1.92 Km new alignment to avoid the movement of heavy vehicle traffic & traffic conjunction within the built-up portion of Lawngtlai city. Lawngtlai is the district headquarters of Lawngtlai district in the state of Mizoram . It is also the headquarters of Lai Autonomous District Council. Lawngtlai city spread is about 5.0 Km stretches length along the NH 54 both side. Within the city most of the stretches width of the existing road formation are varies from 9.0 m to 8.0 m. & nos of sub standard

curve .Entire lawngtlai city markets, prominent building, Church & residential builds are along the NH 54. Therefore within the city, improvement of road geometry for NH 2 lane standard is practically impossible because it will be raise up huge Compensation, rehabilitation & settlement issue. However with available formation width of existing road within city will be possible for minor improvement of existing road geometry & carriage way for 2 lane standard with cover drain. So that commercial passenger vehicle & Light vehicle will be smoothly plying within city, which will benefit for commercial & social development of Lai Autonomous District Council. The proposed Bye pass will be used for heavy vehicle traffic & through traffic and to traffic conjunction within city.

**g) Soil:**

The soil along the alignment of the project is fairly homogenous in nature and character. Soil types vary from silty clay to sandy clay of medium plasticity, plasticity index varying from 7 to 18.The soaked CBR value ranges from 6 to 8.

**h) Construction Material and Stones:**

The rock deposits are available along or the vicinity of the project road alignment. Besides, cobbles, pebbles and sand deposits are available in the rivers or streams crossing the main alignment. Construction materials for GSB, Cross drainage & Masonry R/Wall etc. works, will be available at local quarry within the project corridor and WMM, DBM & BC material from Tuipui River at Kawlchaw on NH 54 at Km 506 and Liapha on Multi Model Transit Route .Water Absorption and AIV of these quarries are within the limit of the Ministry's Specifications. Bitumen will have to be taken from Guwahati, steel and cement from Aizawl.

## 5. TRAFFIC SURVEY, ANALYSIS & FORECAST

This is to assess the capacity requirements, pavement design, identify present and likely future traffic conditions and to have provisions for future improvements.

From traffic volume counts the following observations are made,

Location	Average daily traffic intensity (PCU)	Average daily traffic intensity (CVD)	peak Hour Traffic Nos/PCU	Peak Hour Traffic ratio in %	Time of Peak Traffic
Lawngtlai	1166	312	462/569	7.31	09-10
Zero Point	813	228	367/451	8.47	09-10

- (i) There are large numbers of Cars and Auto Rickshaw using the road (42.00%).
- (ii) Traffic is dominated by the passenger vehicles (cars and two wheelers).
- (iii) The heavy vehicle traffic (19.88%) as compared to the passenger traffic (42.00%).

Capacity analysis is fundamental to the planning, design and operation of roads and provides among other things the basis for determining the carriageway width to be

provided at any point in a road network with respect to the volume and composition of traffic. It is also a valuable tool for evaluation of the investments needed for future road construction and improvements and for working out priorities between competing Projects. The NH road has been considered for two lanes.

- Therefore, No of commercial vehicles per day for design taking into consideration 7.5% per annum growth rate and a pavement life of 15 years
- After 15 years design life PCU per day : 4956
- Design road capacity (Service volume ) for hill road for high curvature ( above 200 degrees per Km) for 2 lane ,greater than 4500 PCU
- Hence existing road need to be upgrade for 2 lane standard

## 6. SALIENT FEATURES OF THE PROJECT

### Salient Features

Salient features based on design are as below:

- Length of Project Road Sector 122.636Km
- The road has a ROW of 24.00 m at open area & 20.00 m at built up area
- The formation width is 12.0m
- The Highway is designed for 2-lane carriageway of 7.0 m width.
- The Highway is designed with flexible pavement
- Paved shoulders of 2.50 m are provided both sides.
- All structures are matching to 2 lane NH roadway standard.
- Route Alignment: The Project Corridor Takes off from Lunglei district near Tawipui North Village-2 at Km 431+00 then passes through the 13 Nos of villages & Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+000 at Tuipang Village within Saiha District.
- Lawngtlai Bye Pass 1.92 Km, Take of point at Km 4.40 of Multi Model Transit Route to Km 475+550 on NH 54 near BRO Camp.
- Drains: Lined Drain.
- Landslide : 40 Nos.
- Junction – 45 Nos., Major Junction – 6 & Minor Junction – 39 Nos
- Bridges – 1 Nos. Existing PSC Bridge over Tuipui River at Kaulchaw
- Items for Road Safety, Roadside Amenities and Road Furniture are provided.

#### a) Cross Section Elements:

The design standards of relevant Indian Roads Congress for Roads and Bridges are adopted for cross section designs of the project road. The earlier items of construction may involve construction of the road formation, cross-drainage works including construction of major bridges for 2-lane standard and protection works. The later stage of the



construction will cover the construction of Pavement for double lane (7.00 m wide) NH standard. The proposed cross section element with dimensions is shown in table below:

Sl.No.	Design elements	Dimensions
1	Roadway width	
	At roads and culverts*	12.00 m & 10.80m
	At bridges**	10.50m
2	Carriageway width	7.00 m
3	Cross slopes/Camber at straight reaches	2.5%

\*Roadway width is inclusive of side drain and parapet wall/crash barrier (IRC SP: 48)

\*\*Roadway width is exclusive of kerbs

#### b) Road Geometry:

The project corridor passes through steep and mountainous terrain. The design speed adopted is 30km/hour (IRC SP: 48). Along the proposed alignment, there will be no hair-pin bend. However minimum design speed has been considered on technical grounds. The vertical and horizontal alignments of the proposed road can be summarized as shown in table below:

Project Road length	No. of Curves with Design Speed in km/h				No. of Curves with Radius (m)		
	<30	30-40	40-50	>50	<30	30-50	>50
122.636 km	308	904	215	72	27	716	756
1.92 km	5	12	2	2	0	10	11

Project road length	Length Distribution (km) and Gradient Class				
	<4%	4%-5%	5%-6%	6%-7%	7%-8%
122.636 km	77.376 Km	22.750 Km	13.170 Km	9.200 Km	0.140 Km
1.92 km	-	-	-	1.920 Km	-

#### c) Design of Embankment / Hill Cutting

Considering the physical features, particularly the terrain, soil classification and hill slope line, typical cross-section (Type 1F to Type 49F) have been developed for hill road cutting / embankment building.

Concept Plan of the design of the embankment / hill cutting (stretch-wise) has been developed with specific mention of the formation building methodology / type to be adopted.

There are 2 Nos. of ridge line in proposed alignment  
Km 449+400 to Km 449+800 and Km 475+300 to Km 475+600

#### d) Land Slide Prone Area

Major land slide prone areas were not noticed during the field visit to the project stretch. However some minor land slide was noticed in following locations

Km 463+052 to Km 463+247, Km 507+800 to Km 507+870, Km 539+510 to Km 539+530 and Km 540+980 to Km 541+060

#### e) Hard Rock Area for Blasting

Geological and geo- technical investigation indicate that proposed road alignment is passing through hard rock area from Chainage 436580 to 436610 , 437130 to 437200 , 437640 to 437665 , 441070 to 441110 , 441420 to 441500 , 459300 to 460280 , 461160 to 461260 , 461540 to 461780 , 461920 to 462010 , 462200 to 462270 , 462800 to 463190 , 465550 to 465620 , 465830 to 465860 , 465950 to 466010 , 466120 to 466160, 466220 to 466310 , 467640 to 467700 , 468430 to 468490 , 469655 to 469760 , 474440 to 474470 , 476870 to 477090 , 477580 to 477650 , 478640 to 478710 , 484200 to 484230 , 484300 to 484360 , 484445 to 484525 , 484540 to 484580 , 485290 to 485325 , 487145 to 487400 , 487480 to 487560, 487720 to 487920 , 488000 to 488100 , 488665 to 488700 , 494430 to 494580 , 502360 to 502470 , 502660 to 502790 , 509010 to 509035 , 512730 to 512755 , 513020 to 513045 , 513115 to 513160 , 521400 to 521490 , 524670 to 525120 , 525170 to 525415 , 528340 to 528390 , 538870 to 538950 and 550885 to 550920. To widen the road in these stretch needs control blasting to avoid the damage of cultivated land on downhill side & nearby built area.

#### f) Dumping area identified on the Proposed Road

It has been estimated that about 43.2 million cum of spoil will be generated due to widening of this road. Only 5.00% of the spoil will be reused during construction of the road rest will be disposed off in an environmental friendly manner. Consultant has identified 62 disposal sites but which are not sufficient to accommodate the spoil. More sites need to be identified based on consultation with communities.

This remaining earth shall be disposed off in an environmentally suitable manner. Certain guidelines for debris disposal are given below.

- The debris generated shall be disposed of within designated areas only.
- The filled up area shall be used for designated purposes such as: Play ground, Truck Lay-by, short relocation & realignment portion.

#### There are 62 No. of dumping areas on the Proposed Road

Sr. No.	Chainage	Side	Sr. No.	Chainage	Side	Sr. No.	Chainage	Side	Sr. No.	Chainage	Side
1	431890	RHS	17	462970	RHS	33	506770	LHS	49	530670	RHS
2	433060	RHS	18	466900	RHS	34	507500	LHS	50	533250	RHS
3	435850	RHS	19	476810	RHS	35	509330	LHS	51	534840	RHS
4	438950	RHS	20	477420	RHS	36	509580	LHS	52	535800	RHS
5	439320	RHS	21	479820	RHS	37	510600	LHS	53	536750	RHS
6	441300	RHS	22	482280	RHS	38	514080	LHS	54	540500	RHS
7	443380	RHS	23	484120	LHS	39	515860	LHS	55	542500	RHS
8	444230	RHS	24	486850	LHS	40	517710	LHS	56	543900	RHS
9	445270	LHS	25	488180	LHS	41	518090	LHS	57	544970	RHS
10	448360	LHS	26	491080	LHS	42	519830	LHS	58	546100	RHS
11	450650	LHS	27	492600	LHS	43	520830	LHS	59	547670	RHS
12	453310	LHS	28	494480	LHS	44	522660	LHS	60	549250	RHS
13	455000	LHS	29	495960	LHS	45	524600	RHS	61	550120	RHS
14	456780	LHS	30	499330	LHS	46	526400	RHS	62	551060	RHS
15	457330	LHS	31	500950	LHS	47	526830	RHS			
16	460150	RHS	32	502200	LHS	48	528740	RHS			

### g) Pavement Design

It is based upon CVD-312, CBR-6%, Traffic msa -10, Design period – 15 years, VDF-1.5, Annual Growth of traffic rate 7.5% and Design speed 30.00 Km/h. However the proposed pavement composition is based on CBR-5% and msa -20. Pavement composition is designed as under:

Proposed pavement.

BC	:	40 mm
DBM	:	100 mm
WMM in 2-layers	:	250mm
GSB in 2-layers	:	300 mm
Total	:	690 mm

### h) Shoulder Design

The carriageway width of 7m and paved shoulder width of 1.5 m on each side shall have the same pavement as the carriageway. The remaining 1.0m on each side shall be used to accommodate side drain on hill side or parapet/soft shoulder on valley side. In the hill side, depending on the total width of side drain, there is a small width remaining between the wall of side drain and paved shoulder, therefore it is also paved to avoid erosion by surface water

### i) Culverts:

The project road traverses through mountainous and steep terrains with several natural drainages such as deep gorges, depressions, etc., where perennial water and rain water runoff are collected. Sometimes the storm runoff is accompanied by large quantities of debris from upstream side of the nallahs. Cross-drainage structures/culverts are required at these locations. From the field survey and investigations and geometric design of alignment the requirement of culverts for the whole length of the project have been identified.

Sr. No.	Type of culvert	Description	Span X Depth	NH 54	Lawngtlai Bye Pass
1	Type -1	Pipe Culvert	1.2 D	59	1
2	Type - 2	Pipe Culvert	1.2 D	112	10
3	Type – 1	Box Culvert	2.0 X 2.0	467	
4	Type – 2	Box Culvert	3.0 x 3.0	11	
5	Type – 3	Box Culvert	4.0 x 4.0	7	
6	Type - 4	Box Culvert	6.0 x 4.0	2	
			Total	658	11

### i) Slope Protection works:

Adequate Protective structures are proposed for retaining of cut/fill slopes to ensure stability of the road formation at locations where required. The proposed type and length of each structure are shown in the table below:

Sr. No.	Type of Structure	Unit	Quantity		Remarks
			NH 54	Lawngtlai Bye Pass	
1	Retaining Wall	Rm	19400.00	390.00	Height varying between 3.0m to 6.0 m
2	Breast Wall	Rm	720.00	100.00	Height varying between 2.0m to 3.0 m
3	Gabion Wall	Rm	2790.00		Height varying between 2.0m to 3.0 m
4	Toe Wall	Rm	13490.00	100.00	Height varying between 2.0m to 3.0 m
5	Reinforced Earth Wall	Rm	750.00		Height varying between 7.0 m to 10.0 m
6	Cut Slope Wall	Rm	70000.00		Height upto 3.0 m
7	Gabion Wall (1:0.3)	cum	10428.00		
8	Rock fall Prevention Wall (H=3m)	Rm	9647.50		
9	Rock fall Prevention Fence (H=2m)	Rm	2410.00		
10	Hydro seeding (t=5cm)	sqm	5377.00		
11	Seeding and Mulching (Soil Cut Slope)	sqm	448043.00		
12	Vegetation Mat (Steep Slope)	sqm	1237.00		
13	Crib Work (F300)	sqm	1756.16		
14	Crib Work (F500)	sqm	3510.00		
15	Earth Removal	cum	12970.00		
16	Groundwater Drainage Work	Rm	9924.00		
17	Anchor Work	Rm	3072.00		
18	Rock-bolt Work	Rm	702.00		
19	Bamboo crib wall	Rm	22320.00		Height 1.5 m at Embankment & disposal location.

### k) Drainage Design

Pavement Drainage includes camber / cross fall of 2.50%.

Slope 3.5 % has been considered for drainage of shoulders.

Roadside drains are designed: Lined drains in case of soils

Sr.No.	Type	Length	Remarks
1	Type-1	97404.00	Ordinary Soil stretch Rocky & Steep Stretch & Catch water drain at box cutting portion
2	Type-2	29466.00	Built up area

Chutes of the culverts form part of the culvert structure to lead the discharge to the catch-pit or to natural drainage channel.

### l) Road Sign, Markings and Furniture

The project design includes (a) Mandatory / Regulatory Signs, (b) Cautionary / Warning Signs and (c) Information Signs.

Route Marker Signs are provided.

KM Stones are included as per type design.

**m) Street Furniture**

Traffic Safety Posts and Parapet Walls are included.  
Traffic Signs Marking & other Road Appurtenances

**n) Roadside Amenities**

The continuous long distance travel on highways at speed is liable to cause fatigue as also mental tension to the road users. Moreover, the monotony of driving over long sections in the rural areas with no likelihood of any cross traffic brings sense of complacency in many drivers and such distractions could result in serious accidents.

Sr.No.	Description	Nos.	Location
1	Public Toilet	15	Tawipui North -2,Tawipui North-1,Tawipui South
2	Bus Shed	30	,Thingfal ,Thingka ,AOC, Lawngtlai City, Saika,
3	Bazar Shed	15	Chawntlangpui ,Sihtlangpui ,Kawlchaw ,Zero point, Maubaw ,Theiva ,Theihri & Tuipang village

## 7. DIVERSION OF EXISTING ROAD DURING CONSTRUCTION

For improvement of existing road some stretches localized, relocation and re-grading are proposed. Due to which traffic movement on existing road will be hamper .Therefore temporary diversion of existing road is very much necessary during construction period.

## 8. MAINTENANCE OF EXISTING ROAD:

The existing road is the main route to provide connectivity between district headquarters and International boarder of Indo Myanmar for international trading but also for Southern part of Mizoram. The minimum construction time provided for completion of the project is 4(four) years during which maintenance by the PIU will be no longer convenient as the site possession is resorted to hand over to the contractor till completion of the project. Under this circumstance, it is inevitable to keep provision for yearly maintenance of the existing road during construction and hence a provision of Rs.78.60 lakhs per year is made to make the road playable for all type of vehicles without serious interruption of the traffic flow throughout the year.

### Scope of Maintenance:

- 1) Maintenance of Earthen Shoulder (filling with fresh soil).
- 2) Filling Pot- holes and Patch Repairs with open - graded Premix surfacing, 20mm.
- 3) Hill Side Drain Clearance.
- 4) Land Slide Clearance in soil/ rock
- 5) Clearing Grass and Removal of Rubbish.
- 6) Maintenance/repair of culvert/Retaining wall.
- 7) Clearance of culvert before monsoon
- 8) Removal of land slide

## 9. ENVIRONMENTAL IMPACT ASSESSMENT

The proposed up-gradation of NH 54 from Km 431+00 to Km 553.60 in Mizoram will serve southern belt of Mizoram state. The preliminary Environmental Impact Assessment

does not envisage any Negative Impact. The preliminary study suggests numerous beneficial impacts on the environment.

As there is no new alignment that passes through forest areas, there are no endanger species both in plants and animals, the project will not attract the provision of Forest (Conservation) Act 1980 vide Govt. of India. Ministry of Environment & Forest No. 4-1/97-FC Dt. 18.2.1998.

Nevertheless, all possible measures will be taken to mitigate any adverse environmental impact the project may cause to the environment.

The air pollution due to emission/effluents from the construction machineries will also be negligible. The stream pollution due to spillage from the construction machineries will also be negligible. As the construction work involves widening of existing road formation, no adverse effect will occur on aquatic life system.

The alignment has been adjoined by private land and households, there will be damage to private crops and plantation, further private house will be affected, and hence relief and rehabilitation scheme shall be required and included in the project.

## **10. LAND ACQUISITION PLANS AND FOREST CLEARANCE**

### **a) Land Acquisition Plans**

The alignment passes through private lands, households, gardens and other properties. Up-gradation of this road by widening the formation width and diversion of the alignment, improving the geometry (including gradient) is going to occupy private properties, crops, plantation, houses, etc. Hence, compensation will be provided for the above properties, as well as relief and rehabilitation wherever the local populations are displaced due to dismantling of their houses. For this matter, required fund shall be required for compensation or relief & rehabilitation.

Notification had been issued by Government of Mizoram under Land Acquisition Act 1894 verification of land , building, crops etc likely to get damaged due to the proposed construction of the road will be verify by the Deputy Commissioner, Lunglei , Lawngtlai & Saiha District. Representative of Revenue Deptt. And representative of State PWD jointly carried out the assessment and based on the assessment carried out; acquisition estimate will be framed and submitted later on.

### **b) Forest Clearance**

The Mizoram State Forest authorities conducted a detailed survey of the alignment and the following is the findings of that survey:

- 1) That the proposed road alignment does not form part of National Park, wild life sanctuary, biosphere reserve, tiger reserve, elephant corridor, etc.
- (2) No rare/endangered/unique species of flora and fauna are found in the area.
- (3) No protected archeological/heritage site /defense establishment or any other important monument is located in the area.
- (4) The requirement of forest land as proposed by the user agency is unavoidable and barest minimum for the project. No alternative for the project exists.
- (5) No work in violation of the Forest Act has been carried out.

The road passes through private holdings like pisciculture, horticulture and habitation. As per Right of way of proposed 2 land standard alignment 193.16 Ha land is required. About 78.50% length of the road passes through land owned/developed by individuals land holders under periodic patta and LSC pass , 11.50 % length of the road passes through forest & 10.00% length of the road passes through other . This land will not be available free of cost and also compensation for plantations, crops etc. within the required corridor is to be paid to each individuals. About 24.35% passes through habited area.

After due verification and assessment, the Estimate for Net Present Value and Compensatory Afforestation will be duly framed by the concerned Environment and Forest Department. Process for obtaining forest clearance is in the hand of the concerned authority of Government of Mizoram which will be then submitted to the Ministry of Environment and Forests, Government of India shortly under clause 2.5 of forest clearance 1980.

## 11. MATERIALS, LABOURS AND CONSTRUCTION EQUIPMENTS:

### a) Materials:

The rock deposits are available along or the vicinity of the project road alignment. Besides, cobbles, pebbles and sand deposits are available in the rivers or streams crossing the main alignment. Construction materials for GSB, Cross drainage & Masonry R/Wall etc. works, will be available at local quarry within the project corridor and WMM, DBM & BC material from Tuipui River at Kawlchaw on NH 54 at Km 506 and Liapha on Multi Model Transit Route .Water Absorption and AIV of these quarries are within the limit of the Ministry's Specifications.

Major constructional materials such as Bitumen, Cement, Steel and POL etc., will be taken through NH-54 from outside the state mostly from Assam state.

### Source of Quarry Material

Sr.No.	Name of Source	Type of Material	Location	Quantity
1	Kawlchaw (R.Kaladan)	Sand, GSB,WMM,DBM,BC & Stone aggregates	On NH 54 at Km 506+650	Plenty
2	Liapha (R.Kaladan)	Sand, GSB,WMM,DBM,BC & Stone aggregates	NH-54 at Km 473+300 on Multi Model Transit Route at 37 Km then 5 km earthen road	Plenty
3	Rulkual Quarry	Masonry Stone ,DBM,BC & Stone aggregates	NH-54 at Km 486+900 on NCV Road at 18 Km surface road	Plenty
4	Thingkah Quarry	Masonry Stone	On NH 54 at Km 469+700	Plenty
5	Paithar Quarry	Masonry Stone	NH-54 at Km 486+900 on NCV Road at 8 Km surface road	Plenty
6	Near Saika Village	Masonry Stone	On NH 54 at Km483+450	Plenty
7	Near Zero point	Masonry Stone	On NH 54 at Km 517+000	Plenty
8	Near Maubawk village	Masonry Stone	On NH 54 at Km 529+500	Plenty

**b) Labour:**

Local labourers skilled & unskilled are available in plenty. However, where required, imported labourers will also be engaged for road construction works. Since the area is malaria infested, medical assistance with qualified practitioners will be required during the execution of the project. Comparatively higher wages (from the National average) and incentives have to be paid to labourers for the work. It is envisaged that equipment / machine-intensive method would be adopted for proposed construction works.

**c) Equipment:**

Heavy Machineries like Bull dozers, Excavators, Loaders, Air compressors, Vibratory / Static Road Rollers, Wet-mix plants, Electric generator sets, Motor Graders, Tractor-Rotavators, Hot/batch-mix plants, Paver-finishers, etc. as required for the execution of the work will be arranged by the contractor executing the project.

**12. UNIT RATES AND COST ESTIMATES:**

The cost estimate for the proposed construction work has been based on the quantities worked out from the design drawings.

**a) Unit Rate:**

The unit rates for arriving at cost of different components of works are based on Mizoram PWD Schedule of Rates 2014 (for National Highways). For those items of works which are not available in the SOR, separate Analysis of Rates have been carried out and incorporated in this DPR.



The general conditions of Contract will be as per Standard Bidding Document of Ministry of Shipping, Road Transport and Highways, Government of India, works.

The total cost of the which covers costs for formation work, Slope protection and cross drainage works, construction of bridges and pavement works. Construction period of 42 months has been proposed, considering the quantum of activities to be performed including mobilization period needed and four intervening rainy seasons in between.

The project is proposed for commencement during the financial year 2016-2017 with target completion by the year end of 2019-2020. Since the project will be executed through a period of four years there will be cost escalation during the period of construction. Considering the rate of price escalation at an average rate of 5% per annum compounded annually after the initial year, the cost of construction and physical and financial phasing of the project is given in the table below:

Sr.No	Year	Cumulative Physical Target (%)
1	2016 -17	15
2	2017 -18	45
3	2018 -19	80
4	2019 - 20	100

## 12. TENDER DOCUMENTS:

### a) General Conditions of Contract:

The general conditions of Contract will be as per Standard Bidding Document of Ministry of Shipping, Road Transport and Highways, Government of India, works.

### b) Technical Specifications:

The Technical Specifications shall be the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS" FIFTH REVISION 2013, of the Ministry of Road Transport and Highways, Government of India.

### c) Project Drawings:

The Project Drawings as produced in Volume -IV of this Detailed Project Report.

Sub Divisional Officer, PWD  
Multi Modal Project Sub Division – I,  
Lawngtlai: Mizoram

Executive Engineer, PWD  
Multi Modal Project Division – I,  
Lawngtlai: Mizoram













Superintending Engineer, PWD  
Multi Modal Project Circle,  
Lawngtlai: Mizoram

Chief Engineer, PWD  
Highway,  
Aizawl: Mizoram

## TRIPURA



## LEGEND

State Boundary	:	
International Boundary	:	
S.A.R.D.P Double Lane	:	
S.A.R.D.P Single lane	:	
Completed N.E.C Road	:	
Kaladan Multi Modal Project Route	:	
11th Plan N.E.C Road	:	
N.L.C.P.R	:	
PMGSY	:	
PMGSY ( Ongoing )	:	
Any Other Road	:	
River	:	

## SECTION - 1

### INTRODUCTION

#### 1.1 INTRODUCTION

The Ministry of Roads Transport and Highway, Govt. of India has prioritized to take up for upgrading and improvement of NH 54 from Km 431/00 to Km 562/00 to 2-lane NH standard in Mizoram. The existing road has steep gradient and sharp curves/zigs at various stretches. It is of single lane road with formation width 6.00 m to 6.50 m without conforming any standard / specification. As a result, the heavily loaded trucks and large sized vehicles find it difficult to pass through these stretches safely.

The Project Corridor takes off from Lunglei district near Tawipui North Village-2 at Km 431+00 and runs towards southern direction passes through a number of villages like Tawipui North-1, Tawipui South, Thingfal, Thingka, AOC, Saika, Chawntlangpui, Sihtlangpui, Kawlchaw, Zero point, Maubaw, Theiva, Theihri, Tuipang village and Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+000 at Tuipang Village within Saiha District.

The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International trade road between India & Myanmar. NH 54 B is also branching from Km 519.200, which is serving as Saiha District connecting Highway and a number of villages which are located in the area adjoining to this road are also heavily depending on this road for their social and economic development. Thus, the importance of this road and hence the role it plays for the upliftments of the region needs no more emphasis. And, its importance is further enhanced by the requirement of law and order maintenance as these areas are very remote where unlawful activities are of frequent occurrence. Over and above, being located in the fertile region, large quantities of fruits and vegetables are produced annually, which provides sustainable economy for many villagers. This is an important road and life line for the people of the Southern Districts of Mizoram. It is very essential for improvement & up-gradation of existing NH-54 conforming to National Highway Standards.

#### 1.2 PROJECT BACKGROUND

The existing NH-54 was originally constructed as ODR Standard road during the early part of seventies. It was constructed by the BRO. The road was constructed to provide connectivity Southern Districts of Mizoram. The road was upgraded to the status of National Highway in the year 1980. No substantial improvement of the road other than normal renewal works have been carried out since the road was declared a National Highway. The pavement work and the permanent works of retaining wall and cross drainage structures were done at the time of construction as an ODR standard road and the width of the cross drainage structures are also only 6.50 m. Most of the retaining wall / wing wall had been collapsed and the road formation width also breaches at many stretches.

### 1.3 SCOPE OF THE PROJECT

Up-gradation of the existing road, having formation width of about 6.50m, to a formation width of 12.0m, construction of pavement work for the entire length, culverts and permanent works at essential places, widening and improvement of blind curve portion, realignments at the portions where steep gradients have to be avoided, construction of pucca side drains at needy stretches, and installation of traffic/informatory sign and Kilometre.

### 1.4 PROJECT ROAD

The stretches of the road under this report is between 431/00 Kmp to 562/00 Kmp of NH 54 as per existing chainage required for up gradation & improvement to standard 2 lane. In this portion of proposed highway about 25 % length of road passes through heavily built-up areas which involve costly of Land Acquisition and serious resettlement problems in the existing road. The existing alignment also passes through steep terrains which are unstable and landslide prone area at many locations which could also posed serious problems in future.

The proposed realignment of the existing road from Km 535+070 to Km 539+330 at Theiva village to avoid the sharp zig of existing road and Lawngtlai Bye Pass from Km 473+300 to Km 478+400 as per existing chainage , which include 4.40 Km stretch of Multi Model Transit Route & 1.92 Km new alignment to avoid the movement of heavy vehicle traffic & traffic conjunction within the built-up portion of Lawngtlai city.

The proposed realignment take off points are very near due to which ,it will not effected and deprived the connectivity with villages and hence, the villagers would be the beneficiaries with the proposed alignment. Therefore, the proposed re-alignment does not passes through heavily built-up area and would involve much less L.A cost as well as resettlement problem as compared to the existing alignment. The re-alignment also passes through an area with a much better topographical as well as soil conditions. Hence, apart from the reduction in distance between Lunglei and Tuipang, which would greatly benefit both the neighbouring countries in terms of vehicle operating cost and travel time, the proposed re-alignment is technically far better and financially cost effective in the long run.

The topographical area of the road under this report i.e. from Km431+00 to Km553.604 is divided into seven segments depended upon terrain condition of hill.

**Table: Project road segment**

Sr.No.	Design Chainage		Name of River along / across	Location	Type of Terrain
	From	To			
1	431000	445980	Mengpui Lui	Tawipui North -2 ,Tawipui North -1 & Tawipui South Village	Mountainous to Steep
2	445980	459350	Kamhuai Lui & Ngengrual Lui	Thingfal village	Mountainous & Saddle from 449+400 to 449+800
3	459350	470220	Servapui Lui	Thingka village & Aoc village	Steep
4	470220	475700	Sahri Lui & Chengkawl Lui	Lawngtlai city	Mountainous
5	475700	483730	Tuiphal Lui	Saika village	Steep
6	483730	523070	River Tuipui	Chawntlangpui,Sihtlangpui ,Kawlchaw , Zero point & Maubawk village	Mountainous to Rolling near Tuipui river.
7	523070	553604	Kawlchaw Chava	Theiva ,Theihri & Tuipang village	Mountainous to Steep

Segment	Remarks	Drainage System
Segment-I	In this segment the general topography are Mountainous to Steep terrain .Most of the stretches in this segment are built up. Catchment area is very high. Most of the stretch sandstone types & numbers of small quarry are available at road site. Few stretches are exposed weathered disintegrated rock Therefore to obtain the formation width blasting will be required to widen the existing road.	Mengpui Lui
Segment-II	In this segment the general topography are Mountainous terrain. Most of the stretch siltstone & shale types. Few stretches are exposed weathered disintegrated rock .From Km 449+400 to Km 449+800 proposed road passing through the ridge line. Catchment area is very small because almost entire road passing through small hill lock or hill top / ridge line.	Kamhuai Lui & Ngengrual Lui
Segment-III	In this segment the general topography is Steep terrain. Catchment area is medium because almost entire road passing through high structure hill. Most of the stretch soil types are mixed soil boulder with sandstone & two nos small quarry is available at road site	Servapui Lui
Segment-IV	In this segment the general topography are Mountainous terrain. Almost entire road passing through medium structure hill. Most of the stretch siltstone & shale types. Most of the stretches in this segment are built up. Few stretches are sinking within Lawngtlai City.	Sahri Lui & Chengkawl Lui

Segment-V	In this segment the general topography is that the Steep terrain & most of the stretches passing through the soil mixed boulder & highly weathered sandstone. Catchment area is very high because almost entire road passing through high structure hill.	Tuiphal Lui
Segment-VI	In this segment the general topography is that the Mountainous to rolling terrain to Tuipui River flood plain & most of the stretches passing through the cultivated land. Most of the stretch soil types are mixed soil boulder, siltstone & shale types. Proposed road passing through the high hill structure. Catchment area is very high.	River Tuipui
Segment-VII	In this segment the general topography is that the Mountainous terrain to steep terrain & most of the stretches passing through the cultivated land. Most of the stretch soil types are mixed soil boulder & siltstone & shale types. Proposed road passing through the medium hill structure. Catchment area is very high.	Kawlchaw Chava

All above drainage systems are distributory of Tuipui River. The altitude of the road at various locations varies from 585 m near Tawipui North Village-2 to 1335.0 m near Tuipang Village above mean sea level (MSL). Lowest MSL along the project is at Kawlchaw River Bridge 140.00 m.

### 1.5 THE NAME OF VILLAGE ALONG PROJECT ROAD:

The name of the villages, located nearby the project road corridor, which will be directly influenced by the project road are listed below –

Sr.No	Existing Chainage		Village Name	District
	From	To		
1	432800	434750	Tawipui North village-2	Lunglei
2	435250	438150	Tawipui North village-1	Lunglei
3	444100	447250	Tawipui South village	Lunglei
4	459700	461100	Thingfal village	Lunglei
5	469550	470700	Thingka village	Lawngtlai
6	471550	473400	AOC village	Lawngtlai
7	473400	478900	Lawngtlai city	Lawngtlai
8	486800	487100	Saika village	Lawngtlai
9	498300	499000	Chawntlangpui village	Lawngtlai
10	501050	502550	Sihtlangpui village	Lawngtlai
11	506250	509350	Kawlchaw village	Saiha
12	518800	519900	Zero point	Saiha
13	525200	526850	Maubaw village	Saiha
14	536000	538000	Theiva village	Saiha
15	544950	546000	Theihri village	Saiha
16	558600	561200	Tuipang village	Saiha

## 1.6 REPORT STRUCTURE

The Detail Project Report is presented in the following format

### VOLUME I - MAIN REPORT

		Executive Summary
Section 1	:	Introduction
Section 2	:	Socio-Economic Profile
Section 3	:	Engineering Surveys and Investigations
Section 4	:	Design Standards and Specifications
Section 5	:	Engineering Designs and Construction Proposals
Section 6	:	Environmental Impact Assessment
Section 7	:	Materials, Labours and Equipments
	:	
Section 9	:	Implementation Programme.
Section 10	:	Maintenance of Existing Road

### VOLUME II - DESIGN REPORT

Section -1	:	Design of Road Features, Pavement Composition, Cross Drainage Structures and Slope Protection Works.
Section 2	:	Hydrology and Drainage Study
Section 3	:	Soil Investigation Report
Section 4	:	Traffic Study and Survey
Section 5	:	Inventory Survey

### VOLUME IV - PROJECT DRAWINGS

### VOLUME V - LAND ACQUISITION AND UTILITY RELOCATION DETAILED



## SECTION - 2

### SOCIO ECONOMIC PROFILE

#### Project Road

The proposed widening to 2-lane, re-alignment and geometric improvement of NH 54 under this report is from Km 431+00 to Km 562+000 of existing chainage in Mizoram. This road will serve as connectivity between two Southern District Headquarter. The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International trade road between India & Myanmar for economic and culture transformation . The project road corridor runs through Lunglei , Lawngtlai & Saiha District. The area is mountainous and steep. Existing road is single lane road with formation width about 6.5 m without conforming any standard / specification.

#### Project Location:

- Country : India
- State : Mizoram
- District : Lunglei - Lawngtlai-Saiha District
- Road Name : The Project Corridor Takes off from Lunglei district near Tawipui North - 2 at Km 431+00 and runs toward southern direction passes through Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+00 at Tuipang Village within Saiha District.
- Project Road Length : 122.604 Km.

#### Project Country: India

India occupies a strategic position in Asia, looking across the seas to Arabia and Africa on the west and Burma, Malaysia and the Indonesian Archipelago on the east. Geographically, the Himalayan ranges keep India apart from the rest of Asia.

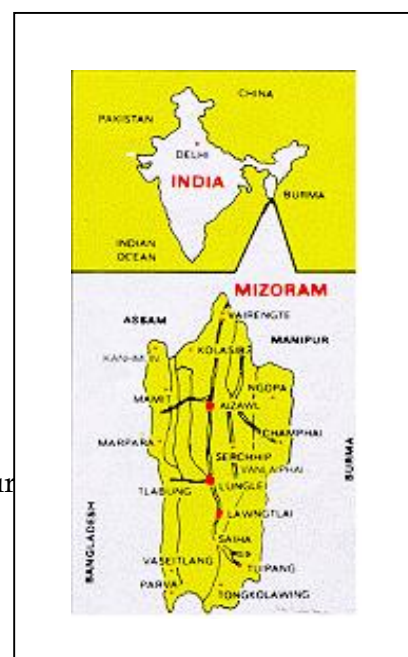
#### Project State: Mizoram

Mizoram State is bordering Myanmar in the east & south and Bangladesh in the West.

#### The Location Map of Project road:

#### Mizoram at a glance

<b>Name of the State</b>	: Mizoram
<b>State Capital</b>	: Aizawl
<b>Area</b>	: 21,087 Sq.km
(a) North South	: 277 kms
(b) East-West	: 121 kms
<b>Inter State Border</b>	: Assam, Tripura and Manipur (284 Km)
<b>International Border</b>	: Myanmar and Bangladesh (722 Km)
<b>No. of Districts</b>	: 8



No. of Autonomous Dist Councils : 3

No. of Sub Divisions : 23

No. of R.D Blocks : 26

Means of communication

By Air : Lengpui Airport

By Road : Via Silchar

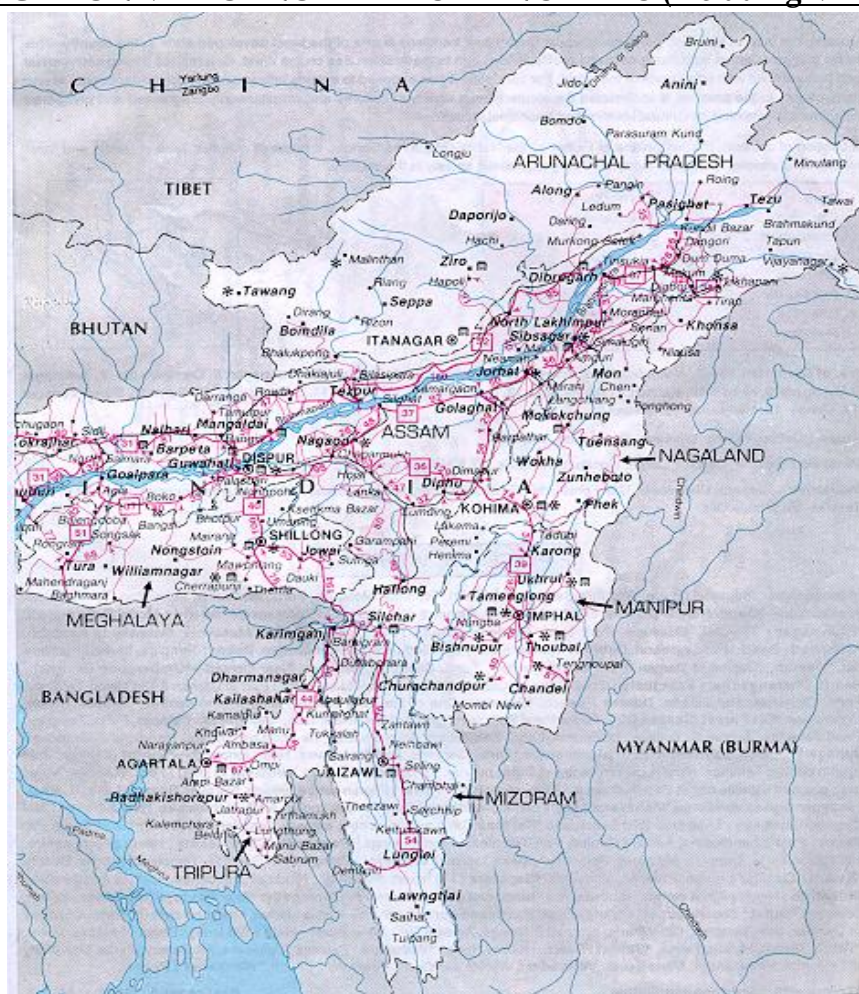
Major Festivals : Chapchar Kut, Pawl Kut, Mim Kut, Christmas & New Year

Major Dances : Cheraw, Khuallam, Parlam, Sarlamkai, Chailam, Rallulam, Chheihlam

Other Statistics

- Population (2011) 10,97,206
- Languages Mizo
- Literacy (2011) 91.33%
- Per Capita income Rs 54,689 during 2011-12
- Roads length 7437 Km

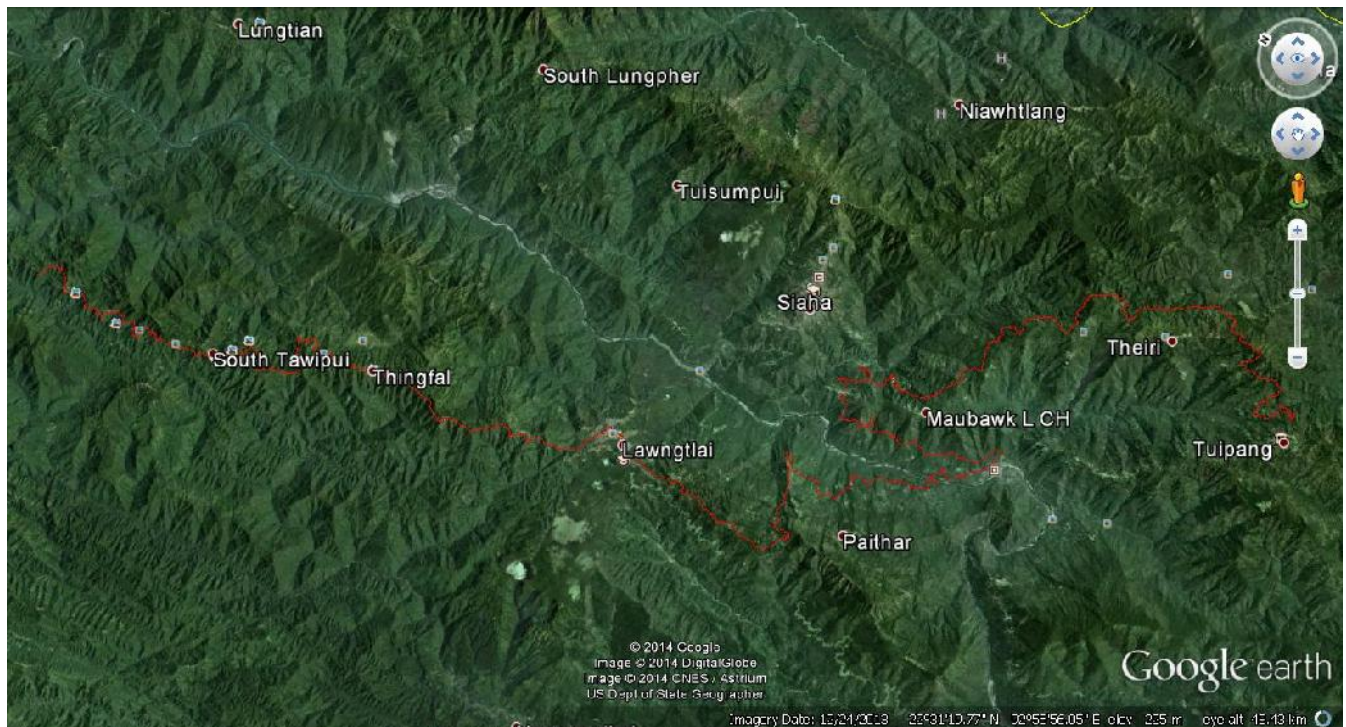
#### LOCATION MAP OF NORTH-EASTERN STATES (including Mizoram)





**Land:** Mizoram is a mountainous region, which became the 23rd State of the Indian Union in February 1987. It was one of the districts of Assam till 1972 when it became a Union Territory. Sandwiched between Myanmar (Burma) in the east and south and Bangladesh in the west, Mizoram occupies an area of great strategic importance in the northeastern corner of India. It has a total of 630 miles boundary with Myanmar (Burma) and Bangladesh.

**Terrain:** Mizoram has the most variegated hilly terrain in eastern part of India. The hills are steep and are separated by rivers, which flow either to the north or south creating deep gorges between the hill ranges. The average height of the hills is about 900 m. The highest peak in Mizoram is the Blue Mountain (Phawngpui) with a height of 2210 m.



**Mizoram: Road in Hilly Terrain**

**Climate:** Mizoram has a pleasant climate. It is generally cool in summer and not very cold in winter. During winter, the temperature varies from 8° C to 21°C and in the summer it varies between 20°C and 35°C. The entire area is under the direct influence of the monsoon. It rains heavily from May to September and the average rainfall is 2540 mm. per annum. The average rainfall in Aizawl is 2080 mm and Lunglei in Southern Mizoram has 3500 mm. Winter in Mizoram is rain-free and is very pleasant; the skies are wonderfully blue, and in the morning the mist formed between the hills gives an enchanting view of wide stretches of a vast lake of cloud.

**Flora and Fauna:** Mizoram has great natural beauty and an endless variety of landscape and is very rich in flora and fauna. Almost all kinds of tropical trees and plants thrive in Mizoram. The hills are marvelously green. Some of the common trees and shrubs grown in the forest of the project area are Teak, Putli, Khair, Shingle Tree, Red Wood, Goat Weed, Australian Wattle etc. The state has a wide forest resource and it is also exported to various parts of the country for various purposes.

**People:** The word, Mizo is a generic term and is used to mean hillmen or highlanders. The Mizos are a distinct community and the social unit was the village. Around it revolved the life of a Mizo. In olden days, Mizo village is usually set on top of a hill with the chief's house at the centre and the bachelor's dormitory called Zawlbuk, prominently located in a central place.

In a way the focal point in the village was the Zawlbuk where all young bachelors of the village slept. Zawlbuk was the training ground, and indeed, the cradle wherein the Mizo youth was shaped into a responsible adult member of the society.

**Social Life:** The fabric of social life in the Mizo society has undergone tremendous changes over the years. Before the British moved into the hills, for all practical purposes the village and the clan formed units of Mizo society. The Mizo code of ethics or Dharma moved round "Tlawmngaihna" an untranslatable term meaning on the part of everyone to be hospitable, kind, unselfish and helpful to others. 'Tlawmngaihna' to a Mizo stands for that compelling moral force which finds expression in self-sacrifice for the service of others. Mizos are a close-knit society with no class distinction and no discrimination on grounds of sex. 80% of them are cultivators and the village exists like a big family. Birth of a child, marriage in the village and death of a person in the village or a community feast arranged by a member of the village are important occasions in which the whole village is involved.

**Administration:** The Capital of Mizoram is Aizawl. Mizoram is divided into 8 districts -Aizawl District with headquarters at Aizawl, Lunglei District with headquarters at Lunglei and Saiha District with headquarters at Saiha, Lawngtlai District with headquarters at Lawngtlai, Serchhip District with headquarters at Serchhip, Mamit District with headquarters at Mamit, Champhai District with headquarters at Champhai, Kolasib District with headquarters at Kolasib.

**Connectivity:** Aizawl, the Capital of Mizoram is 180 Kms. from Silchar, which is the nearest railhead. The bus journey from Silchar to Aizawl usually takes about 6 hours. Mizoram State Transport Buses ply between Aizawl and Silchar daily. There is daily Air Service between Calcutta and Aizawl and between Guwahati and Aizawl.

**Logistic - Road Distance:** The road distance of important places in N.E. Region from Aizawl are as given below:

Place	Distance in Kms
Shillong	423
Agartala	440
Dibrugarh	751
Dhuburi	808
Diphu	372
Dispur	523
Haflong	260
Imphal	307
Jorhat	591
Jowai	370
Kohima	430
Nagaon	443
Silchar	180

**Mizoram Road Network :** It consists of 7437.128 kms (2011) with road categories mentioned below:

Road Category	Length (kms)
National Highway	886.03
State highways	699.64

Major District roads	935.65
Other District Roads	1384.90
City Road	355.487
Town & Satellite Town Road	591.645
Village Road	1108.981
Others Road	1474.795
Total	7437.128
No of district	8 Nos

As per the economic survey 2011 -2012, the increase in the population of vehicles has been 11.68%, the transport has observed tremendous increase. The heavy traffic pressures on the deficient roads are rendering the quality of pavement very poor.

Important roads in the State of Mizoram are given below:

Sn	Name of Some Important Road Sectors	Length in Km
01	Aizawl-Thenzawl-Lunglei	163.60
02	Kawnpui-Aizawl via Lungdai	44.290
03	Bairabi-Zamuang	28.00
04	Lawngtlai-Saiha Feeder road	25.00
05	Seling-champhai	150.300
06	Seling-tipaimukh	140.00
07	Sairang-Tuipuibari	154.00
08	Champhai-N. Vanlaiphai-Keitum	155.00
09	Kawlkulh-Ngopa-Tuivai	96.00
10	Serchhip - thenzawl - Bungmun	126.00
11	Hnahthial-South Vanlaiphai-sangau-Saiha	142.750
12	Lunglei-Tlabung	91.00
13	Kanhmun-Zamuang-Tuilutkawn	96.00
14	Tut-Mamit-Tuidam-R. Langkaih	78.00
15	Serkhan-Bhaga Bazar	117.00
16	W. Phaileng-Phuldungsei-Marpara	80.00
17	Tuipuibari-W. Kawnpui	18.00
18	Lawngtlai-Diltlang	269.130
19	Lawngtlai-Nalkawn-Chamdur valley (NCV)	60.00
20	Marpara-Tlabung	41.400
21	Demagiri-Borapansury-Parva	120.00
22	Vairente-Phainuam-Saiphai	24.00
23	Bilkhawthlir-Saiphai-Saipum	35.00
24.	Vairengte-Phaisen-Buchangphai	20.00
25	Bilkhawthlir-Buhchangphai-Kolasib	35.00
26	Kawlkulh-Lungpho-serchhip	110.00
27	Champhai-Sasaiphai-Vaphai-Farkawn-Khawbung	140.00
28	Haulawng-Chhipphir-Pangzawl	60.00
29	Muallungthu-Khumtung	35.00
30	Keitum-N. Vanlaiphai-Thingsai-Bualpui-S. Vanlaiphai	140.00
31	Leite-Mualthuam-Thingfal	110.00
32	Lungsen-Chawngte	48.00

Sn	Name of Some Important Road Sectors	Length in Km
33	Bairabi-Mamit	36.00
34	Rawpuichhip-Buarpui	89.000
35	Buarpui-Lunglei	75.00
36	Chawngte-Borapansury	32.00
37	Aibawk-Darlung	33.00
38	Aizawl-Tlawng-Reiek-W.Lungdar	37.00
39	Hnathial-Thingsai Road	57.720
40	Saiha-Chhualung-Siata-Tuipang	122.00
41	Kawlchaw-Phura-tawngkolong-Berami-Khopai-Zawngling	160.00
42	Chawngte-Diltlang	32.00
43	Zobawk-Haulawng	35.00
44	Kawnpui-Hortoki	20.00
45	Khawzawl-Rabung-Lamzawl-Ngopa	64.00
46	Saitual-Phullen-E.Phaileng	135.00
47	Phairuang-Bunghmun	69.00
48	Kawlchaw-serkawr-Phura	44.00
49	Thenzawl-Chhipphir	22.500
50	Lunglei-Nghasih	10.00
51	Aizawl-Samtlang-Lungleng	20.00
52	Khawzawl-Biate	60.00
53	Chekkawn-Artahkawn	9.00
54	Champhai-Hnahlan-Mimbung	120.00
55	E. Phaileng - Suangpuilawn - Phullen	80.00
56	New vervek - Sakawrdai - Tuivai	20.00
57	Sakawrdai - Zohmun	14.00
58	Ratu - Suangpuilawn	40.00
59	Chhingchhip - Hmuntha	27.461
60	Khawzawl - Phaisen	10.00
61	Champhai - Hmunhmeltha - N. Khawbung	30.00
62	Ngopa-Mimbung	52.500
63	Kolasib-N. Hlimen	40.00
64	Road within Towns	82.00

The map showing road network of Mizoram is shown below.



#### **Project Road: NH 54 from 431/000 KM to 553/604 KM**

- The proposed widening to 2-lane, re-location and geometric improvement of NH -54 in Mizoram. This road will serve as connectivity between two Southern District Headquarter. The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International trade road between India & Myanmar for economic and culture transformation.
- Altitude of alignment varies from 585.0 m at take off point and 1335.0 m at end point above the MSL
- The list of the habitations along the road Tawipui North-2, Tawipui North-1, Tawipui South, Thingfal, Thingka, AOC, Saika, Chawntlangpui, Sihtlangpui, Kawlchaw, Zero point, Maubaw, Theiva, Theihri, Tuipang village and Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+000 at Tuipang Village within Saiha District.

#### **General Project Area**

The alignment of the project passes through Lunglei –Lawngtlai-Saiha District in Southern direction. The whole length of the project will be partly fresh cutting of mountainous to steep terrain with broken contours as well as widening of the existing road. The alignment of the project road is habited area.

Man power needed for the project implementation will be taken from the area nearby the project. However, skilled labour will have to be taken from other towns and cities. Moreover, the working season for road project work is clash with the harvesting season of the people in the area more man power may also be needed depending upon the quantum of the requirement. The project road is also a highly malaria infested area; proper medical facilities will be required.

### **Problems and Challenge Areas**

Based on the ground study, reconnaissance & survey and the data collected from BRO & other dept. Mizoram have gained appreciation of the technical and project management problems and have insight of the challenge areas of the project. The general appreciation of the thrust areas are described in the following paragraph.

#### **Accessibility:**

To visualize the problems that may be encountered in the development of road network inside, it is necessary to understand the topographical features of the State with particular reference to its location in the Indian sub-continent. The State is flanked by Myanmar on the south & East and Bangladesh on the West, thereby having deprived of the advantage of nearness to the Indian Sister States. At present NH-54 is the only main road which linked with Assam and through this road most of commodities are transported in the state.

**Seismic Effect:** The entire state of Mizoram is earthquake prone and falls under seismic Zone V with reference to IRC-6. All structures need to be designed with seismic effect as per stipulations in IRC-6.

**Land Slide:** There is no major potential land slide in the Project road ,however 40 minor slide location .

**Plantation:** There is thick growth of Bamboo vegetation along the Project road

**Stone for Road Construction:** Stone for construction work other than BC work will be available locally.

**Water:** In general, water available in the area has been found suitable for use in the road construction work. However, water is not available at all places and has to be transported from the local water points to the construction sites.

**Work Force:** Mostly local people are agriculturists. Road construction requires tradesmen of sorts, skilled labourers and unskilled labourers. Manpower may need to be brought from other part of the country. It requires planning and organization for recruitment, training, induction and maintenance including provision of campage, food supplies, medical, welfare activities, etc. Independent facilities are necessitated to cater for the increased workforce.

**Contractors:** Though small supply Contractors are available in this part of Mizoram, the bulk of the requirement is initially to be augmented from outside. The stone crushers have to be installed for meeting the project requirements.



## SECTION - 3

### ENGINEERING SURVEYS AND INVESTIGATIONS

#### 3.0 ENGINEERING SURVEYS AND INVESTIGATIONS

#### 3.1 TOPOGRAPHICAL SURVEY

##### a) General

Topographical survey was performed in order to set up a digital terrain model of the area. The survey covered a strip of 30-40 m width with cross sections taken at 20 m intervals.

Topographical surveys included the following:

- Control Point Survey
- Traversing
- Cross-section Survey
- Establishing Bench Mark

##### b) Methodology for Topographical Survey

Topographical survey was carried out with Total Station, Auto level and checked with GPS, state-of-the art instruments. The survey methodology involved the following sequential steps:

Control Points: Establishing control points in the form of temporary bench marks (TBM) at 1 km intervals (approx.) on ground and running traverse along tentative alignment using Total Stations. Reference Pillars consisting cement concrete pillars with central nail point; have been fixed at every 200m to 250m intervals depending upon safe site location.

Traversing: Connecting all control points with one or more Benchmarks using precision Auto Level and Total Station.

Cross-section: Taking detailed cross sections at 20 m interval using Total Station. The main features captured in the cross-sections were:

- all natural ground break-point within the Right-of-Way (ROW)
- Property lines within ROW.

Cross-sections were also taken along intersecting roads to a distance of 200 m for major roads and 50 m for minor roads. 3-point cross-sectional data 100 m upstream and downstream of waterways were also gathered.

The data for each survey point were recorded in terms of Northing and Easting and Elevation to an accuracy of 1 mm.

Establishing Bench Mark: Due to non-availability of Survey of India reference bench mark, bench mark elevation was carried from Lengpui Airport BM pillar. Based on this reference BM, TBMs were established along the proposed road alignment, using auto levels and double leveling method.

In addition, all TS stations were also leveled. Permanent cement concrete pillars were established at 1 km interval.

Chainage Marking : The project road has been marked with chainages on center of pavement at 50 m apart in straight and at 10 m in curve portions. The chainage marking on the road enabled proper inventory of all the items required for design and act as reference points for cross sections.

### c) Topographical Survey

Based on the Control / traverse station fixed along the stretch for horizontal and vertical control, surveys using total station were carried out to collect co-ordinate data (Northing and Easting) of all topographical points. The details covered included:

- Road centerline of regrading stretch and trace-cut centerline of re-alignment stretches.
- Left and right edges of existing road pavements
- Connecting roads
- Ground points on both sides of Road centerline and trace-cut centerline for exact computation of quantity.
- Trace-cut in hard rock area is for reference as the alignment points were not approachable due to vertical rock formation.

All man-made features have been surveyed including:

- Water sources including hand pumps, wells, etc.
- CD structures including culverts, bridges, etc
- Slope protection structures such as Retaining wall and Breast walls
- Buildings, huts, boundary walls, etc
- Electric pole, telephone poles , mobile tower etc.

All natural topographical features have been surveyed both in regrading and realignment stretches:

- Streams, channels and water sources
- Ponds and water bodies

### Survey for Cross Sections

In order to provide proper design and quantity estimation, cross section survey has been carried out. The cross section survey included collection of elevation and other relevant heights in the corridor width. It contained the topographical survey which is utilized to create a proper Digital Terrain Model (DTM) so as to enable design of road geometrics, plan and profile, cross sections and quantity computations for various items including earth work, sub-grade and pavement.

### Plan and Profile

The plan shows the recommended centerline of the regrading and realignment stretches, existing and proposed carriageway structures, drainage courses, intersections, electric and telephone poles, control traverse stations, proposed location of CD works in regrading and realignment stretches. Hill valley sides along with all the villages and habitats coming in proposed route.

The longitudinal section shows the average existing ground level (left and right), the existing centerline levels, the proposed road level, the gradient, details of horizontal alignment and location of cross drainage structures along with cross roads, etc.

### 3.2 TRAFFIC SURVEYS

In order to establish the traffic characteristics of the project roadway the following traffic surveys were carried out:

- i) Classified Traffic Volume Count
- ii) Intersection Turning Movement Count Survey
- iii) Origin-destination Survey

The methodology of traffic surveys and analysis of results have been presented in “Traffic Surveys and Analyses” in Volume II.

### 3.3 GEOTECHNICAL INVESTIGATION

Investigation was undertaken to characterise the soil forming the sub-grade by collecting samples by digging pits along the proposed road. Information regarding the top soil strata along the new proposed alignment was also collected.

Laboratory investigations were performed on collected soil samples, according to relevant Indian Standards to determine the engineering properties, namely:

- i) Particle size distribution
- ii) Atterberg limits
- iii) Field density
- iv) Field moisture content
- v) Compaction characteristics
- vi) 4-day soaked CBR

Soil investigation results and analyses have been presented in detail in “Design Report” section.

### 3.4 MATERIALS INVESTIGATION

Material survey of the area around the project road was conducted to identify the sources of suitable materials which can be used for construction. Samples collected from various sources were tested for their engineering properties and assessed for their suitability to be used in new construction.

Field investigations were performed to gather following information:

- i) Identification of suitable sources of granular material for base course.
- ii) Testing of physical properties of collected material for granular materials.
- iii) Testing of engineering properties for stone aggregates for use in WMM, DBM, BC and cement concrete.

### **3.5 HYDROLOGICAL INVESTIGATION**

Hydrological investigations were carried out for economical design of cross drain structures. These investigations included performance of existing structures, assessment of discharge, HFL and other data as required for design.

Local enquiries were also made regarding HFL and watermarks were observed. For detailed study, site conditions, survey data, meteorological data were studied. Survey for taking cross sections, long sections of existing rivers and drains were carried out as per IRC code requirements.

### **3.6 ROAD -SIDE GEOTECHNICAL INVESTIGATION**

Trial pits were excavated at 5 km intervals in a staggered manner to carry out investigation of field density and moisture content, in-situ CBR, laboratory CBR under control condition and sub grade soil properties.

### **3.7 ALIGNMENT OPTIONS**

#### **3.7.1 Introduction**

The objective of the Route alignment study is to determine various alternative alignment options and to identify relative acceptable and preferable alignment. With a view to appreciate the feasibility and relative strength, weakness of the alternative proposals marked on the topo-sheets, and site evaluation of the same have been carried out. This was manifested through identifying the problems, shortcomings along with probable route.

The Project Road from Km 431.0 to Km 562.0 has road geometrics is not upto NH Standards. For the up-gradation of the road to the National Highway Standards, the existing gradients & radius have to be improved for safe and smooth flow of traffic. However, in many stretches, the gradients are very steep and the road has to be realigned. Based on the reconnaissance and other surveys, it is identified that more or less the complete road has to be reshaped. In this effort, there are two situations for improvement of the road geometric:

- Realignment Sections
- Regrading Sections

#### **Re-alignment Sections**

The existing road geometric in certain stretches cannot be brought within the permissible level of the road geometric of the National Highway Standards due to several considerations. In view of that, the realignment has been resorted to. We have studied a number of options before finalizing the realignment sections.

#### **Re-grading Sections**

The balance portion of the road after realignment is to be regraded in order to remove kinks, undulations, unevenness and fast changing gradients so as to bring the geometrics to the parameters of the National Highway Standards. Efforts have been made to adopt the existing road level in stretches. However, it is to bring it within the parameters of the

prescribed geometric standards. In view of that the existing road is to be adopted by cutting, filling and widening as well as by relocation more or less in the same area.

### 3.7.2 Critical Factors in Alignment Selection

The critical factors to be considered in the selection of the alignment are as follows:

The alignment should meet the geometric standards, particularly the gradients and curvature.

It should avoid acquisition of commercial and residential establishments.

It should avoid costly land acquisition.

It should be as directional as possible, i.e. least distance.

It should facilitate smooth traffic dispersal.

It should be environment friendly.

It should have minimum provision of structures.

During the detailed topographical survey, the existing road centre line has been marked on the ground and details surveys have been obtained on the existing road. However, in hard rock and hazardous areas the trace-cut is serving as reference line only.

### 3.7.3 METHODOLOGY

**The Methodology Adopted Is Described As Follows :**

#### **Step - 1: Contour Map Study**

Contour sheets are very important for fixing the alignment of the road and to design the road geometric, particularly in the hill road. Based on the contours, approximate alignment options have been studied taking into account the level difference between take-off and the terminal points. This exercise was done with a view to have an approximate understanding of the alignment options. The alignment marked on the contour sheets are planned to achieve the required length

#### **Step-2: Satellite Image Study**

Satellite image is very useful for fixing of the new alignment. Satellite image gives three dimension picture of the project area. Based on the contours, clear view of water channel & terrain condition, approximate alignment option has been studied. This exercise was done with a view to have a better understanding of the alignment option.

#### **Step-3: Fly Level Survey**

After the detailed study of the contour sheets and the available data, fly level survey of the entire road was carried out by using Auto Levels and the support instruments in order to generate the road profile. The gradients of various alignment options were generated in the shape of strip plan showing gradient of proposed road

## SECTION - 4

### DESIGN STANDARDS AND SPECIFICATIONS

#### DESIGN PHILOSOPHY

Up-gradation of the existing road, having formation width of about 6.50m, to a formation width of 12.0m, construction of pavement work for the entire length, construction of culverts and permanent works at essential places, widening and improvement of blind curve portion, realignments at the portions where steep gradients have to be avoided, construction of pucca side drains at needy stretches, and installation of traffic/informatory sign and Kilometer stones.

The project road will have two-lane carriageway facility. The design philosophy that will be followed embodies the following:

- The facility should be of National Highway Standards
- The facility must meet the needs for development activities in the region.
- Travel should be safe, with in-built engineering features
- The facility should be aesthetically pleasing and should not be visually intrusive
- The facility should meet the environmental conditions

Design Standards for the highway requirements have been framed for providing the desirable level of service and safety. For this Project it is proposed to follow Design Standards given in IRC Standards, Codes, Guidelines and Special Publications besides MORT & H circulars and specifications as applicable to National Highways.

#### GEOMETRIC DESIGN STANDARDS

For this Highway Project, Geometric Design Standards shall be as per the following:

- IRC: 73-1980 shall be generally followed.
- IRC: SP: 19-2001: Manual for survey, investigations and preparation of road projects.
- IRC: 52: Recommendations about the Alignment survey and Geometric Design of Hill Roads (Second Revision).
- IRC-SP-48-1998: Hill Road Manual

#### Altitude of the road

Altitude of the Project Road lies between 585.0 m to 1335.0 m above the MSL

- **Terrain Classification:**

Terrain as pertinent to the road structure is classified as given in the following table:

Terrain	Cross Slope (%)
Plain	0 - 10
Rolling	> 10 upto 25
Mountainous	> 25 upto 60
Steep	> 60

This Road Corridor is generally in mountainous terrain.

### Design Speed:

Sr/No	Mountainous Terrain		Steep Terrain	
	Ruling	Minimum	Ruling	Minimum
1.	50	40	40	30

The ruling design speed should generally be the criterion for correlation of the various design features.

Minimum design speed may be adopted in sections where site conditions or economic do not permit a design based on the ruling design speed. The adopted design speed is 30 Km/hr.

### Cross Section Elements:

- **Right of Way (ROW)**

IRC: 73-1980 Table recommends the following land width for National Highways:

#### ROW Width

Sn	Road Classification	Mountainous and Steep Terrain	
		Open areas	Built-up areas
		Normal	Normal
1	National & State Highways	24	20

The existing ROW along the project road is not uniform. . The width of ROW 24 m and 20 m have been adjusted to accommodated the public concerser provided. However there are stretches where the ROW has been temporarily encroached. However, for improvement of junctions, relocation, etc, design will be as per functional requirement. Additional land acquisition shall be kept to the minimum for these areas

### ➤ Roadway Details

- **Total Road Width**

Total roadway width shall be 12.00 m.

- **Carriageway Width**

The National Highway shall be designed as a 2- lane carriageway. The width of two lane shall be 7.0 m.

- **Shoulder**

By the side of the carriageway on both sides, there shall be a paved shoulder of 2.5m.

- **Cross-Slope**

Each carriageway shall have cross slope of 2.50 per cent  
The shoulder shall have a slope of 3.5 per cent.

- **Stopping Sight Distance:**

Sufficient stopping distance is made available for drivers to stop their vehicles when faced with an unexpected obstruction in the carriageway. The safe stopping sight distance, overtaking sight distance as recommended in the manual is as below:

**Minimum Recommended Sight Distances**

Speed (Km/h)	Safe Stopping Sight Distance (m)	Intermediate Sight Distance (m)
20	20	40
25	25	50
30	30	60
35	40	80
40	45	90
50	60	120

**Horizontal Alignment:**

- **Superelevation**

No super elevation is proposed when its value obtained is less than the road camber e.g. radii beyond which super elevation is not proposed are as mentioned below:

**Radius Beyond Which Superelevation Not Required**

Design Speed (km/hr)	Radii (Meters) For Camber of					
		4%	3%	2.5%	2%	1.7%
20	Proposed as per IRC: SP: 48-1998	50	60	70	90	100
25		70	90	110	140	150
30		100	130	160	200	240
35		140	180	220	270	320
40		180	240	280	350	420
50		280	370	450	550	650

- **Radius**

Radii for horizontal curves corresponding to ruling minimum and absolute minimum design speeds are as given below:

**Minimum Radius for National Highways**  
(As per IRC: SP: 48-1998)



Mountainous Terrain		Steep Terrain	
Ruling Min Radius (m)	Absolute Minimum Radius (m)	Ruling Min Radius (m)	Absolute Minimum Radius (m)
80	50	50	30

There will be corresponding speed limit in case the radii are less than the above due to hill physical features and economic consideration.

### Widening of Pavement at Curves

At sharp horizontal curves, it is necessary to widen the carriageway to facilitate safe passers of vehicle. Extra width to be provided on horizontal curve is given below (refer clause 6.8.5 of IRC: SP: 48: 1998).

Radius of Curve (m)	Upto 20°	20° to 40°	41° to 60°	61° to 100°
Extra width (m) 2 Lane	1.5	1.5	1.2	0.90

Wherever the radius is less than the specified minimum design speed, the transition curve, superelevation and pavement widening will be introduced. This will minimize the intrusion of vehicles on to adjacent lanes, tend to encourage uniformity of speed and increase vehicle speed at the curves.

- **Transition Length**

Transition length is given in Table below:

**Transition Length of Curve**  
(As per IRC: SP: 48-1998)

Curve Radius (m)	Design Speed Km/h				
	50	40	30	25	20
15				NA	30
20				35	20
25			NA	25	20
30			30	25	15
40		NA	25	20	15
50		40	20	15	15
55		40	20	15	15
70	NA	30	15	15	15
80	55	25	15	15	NR
90	45	25	15	15	
100	45	20	15	15	
125	35	15	15	NR	
150	30	15	15		
170	25	15	NR		
200	20	15			
300	15	NR			
400	15				
500	NR				

NA-Not Applicable and NR- Transition not required

### Vertical Alignment:

- Codal Provisions**

The gradients to be maintained in the design are as per following guidelines:

Codal Reference	Clause No.
IRC : SP-48 – 1998, Hill Road Manual	12.2.1
IRC : SP-52-2001, Recommendations about Alignment Survey and Geometric Design of Hill Roads	6.9.1.3

- Gradients for Different Terrain**

SL. No	Terrain	Ruling Gradient	Limited Gradient	Exceptional Gradient
1	Steep terrain up to 3,000 m height above mean sea level	6 % (1 in 16.7)	7 % (1 in 14.3)	8 % (1 in 12.5)

- Gradients upto the ruling gradient may be used as a matter of course in design (Ref. Clause No. 6.9.1.4 of IRC-SP: 48 – 1998).
- The limiting gradients may be used where the topography of a place compels this course or where the adoption of gentler gradients would add enormously to the cost. In such cases, the length of continuous grade steeper than the ruling gradient should be as short as possible. (Ref. Clause No. 6.9.1.5 of IRC-SP:48 – 1998).
- Exceptional gradients are meant to be adopted only in very difficult situations and for short lengths not exceeding 100 m at a stretch. Successive stretches of exceptional gradients must be separated by a minimum length of 100 m having gentler / flatter gradient (Ref. Clause No. 6.9.1.6 of IRC-SP:48 – 1998).

- Vertical Curves**

**Minimum length of Vertical Curve (As per IRC: SP: 48-1998)**

Design speed km/h	Maximum Grade Change (Percent) Not Requiring A Vertical Curve	Minimum Length Of Vertical Curve (m)
35	1.5	15
40	1.2	20
50	1.0	30

The actual length for the vertical curve shall however be provided as per IRC: 73-1980

## GEOTECHNICAL DESIGN

### Earth Embankment

- The fill material, compaction and other requirements shall conform to IRC: 36-1970. Where these specifications are in variance with the MORT&H specifications, the later shall govern and accordingly followed.

- ii) Side slope of 2:1 is provided

#### **Side Slopes Formation in Cutting**

The following values are adopted as per IRC: SP: 48:1998 Clause 7.4.

#### **Side Slope in Cutting**

<i>Sl.No.</i>	<i>Item</i>	<i>Slopes of Cutting</i>
1	Ordinary Soil / Heavy Soils	1 : 2
2	Ordinary / Soft Rock	1 : 4
3	Hard rock	80° to 90°

(Explanation: The slope 1: 2 signifies 1 in the horizontal direction and 2 in the vertical)

#### **4.4 ROAD FURNITURES**

##### **Km Stones :**

Km Stones, 200m stones and 5<sup>th</sup> km stones shall be provided as per Codal provisions.

##### **Road Signs:**

All signs shall be placed on the valley side of the road. Where extra emphasis is warranted, they may be duplicated on the right hand side as well as per IRC: 67-1977. The extreme edge of the sign shall be not less than 2 m from the edge of the carriageway.

##### **Road Marking:**

Provisions shall be made for center line marking with ready mixed road marking paint conforming to IS: 164

##### **Safety Barriers:**

Guardrails shall be provided on approaches to bridges.

#### **4.5 PAVEMENT DESIGN**

Design for flexible pavement has been carried out in accordance with the latest version of IRC: 37-2001.

##### **Drainage**

- An effective drainage system for drainage of road shall be designed as per stipulations of IRC SP: 42-1994.

- The road side channel will be trapezoidal and V shape of adequate capacity to carry 100% surface runoff of drainage area of highway ROW. It will be drained to the nearest available natural water course. We propose to adopt semi trapezoidal section as space is a not a constraint and it is more efficient and economical. This will be lined drain to drain out in the open field or to the defined outfall points. Semi trapezoidal shaped lined drain will also be adopted in the hard rock hill sections.
- The superstructure of bridges shall be drained with suitable drainage spouts.

### Traffic Safety Measures

The design layout and materials chosen for the safety barrier shall suitably blend with the surrounding and shall further conform to MORT&H circulars and shall be finalized in consultation with and approved by PWD.

### Culverts

- All Cross- Drainage structures shall be classified as culverts, minor bridges & major bridges depending on the length of the structure as per IRC standards. Structures up to 6m length fall into the category of culverts, more than 6m but up to 60m in length as minor bridges and beyond 60m length as major bridges.
- The deck width is required to be kept the same as that of the roadway for 2-lanes
- The bridge components shall be designed at least carry one lane of Class 70R for every two lanes with one lane of Class A for the remaining lanes, if any, or one lane of Class A for each lane.
- Entire project area falls under Zone-V of seismic zone as provided in IRC: 6-2000 Clause 222
- The list of IRC codes given below but not limiting to shall be referred during formulation of the design and drawings of bridges.

#### List of IRC Codes

IRC: 5-1998	Standard Specification & Code of practice for Road Bridges. Section - I General Features of Design (Seventh Revision)
IRC: 6-2010	Standard Specification & Code of practice for Road Bridges. Section - II Loads & Stresses (Fourth Revision)
IRC: 18-2000	Design Criteria for Pre-stressed Concrete Road Bridges (Post- Tensioned Concrete) (Third Revision)
IRC: 21-1997	Standard Specification & Code of practice for Road Bridges. Section - III Cement Concrete Plain & Reinforced (Second Revision)

IRC: 22-1986	Standard Specification & Code of practice for Road Bridges. Section – VI Composite Construction (First Revision)
IRC: 24-2001	Standard Specification & Code of practice for Road Bridges. Section – V Steel Road Bridges (Second Revision)
IRC: 45-1972	Recommendations for Estimating the Resistance of soil below the maximum Scour Level in the Design of Well Foundations of Bridges.
IRC: 73-1980	Geometric Design standards for Rural (Non-Urban) Highways.
IRC: 78-1983	Standard Specification & Code of practice for Road Bridges. Section – VII Foundation & Substructure (First Revision)
IRC: 83-1987	Standard Specification & Code of practice for Road Bridges. Section – IX Bearings, Part-II Elastomeric Bearings
IRC: 83-1987	Standard Specification & Code of practice for Road Bridges. Section – IX Bearings, Part-II POT,POT CUM PTFE, PIN Bearing
IRC: 89-1997	Guidelines for Design & Construction of River training & control works for road bridges.
IRC:SP:33-1989	Guidelines on supplemental Measures for Design, Detailing & Durability of Important Bridge Structures.

### Design loads

- **Dead Loads:**

Apart from all the actual dead loads, irrespective of the type of wearing coat and crash barrier proposed, the structure shall be designed to allow for

- Wearing coat load = 2 kN/m<sup>2</sup>.
- RCC Railing as per Standard Drawing

- **Live Loads:**

The bridge shall be designed to carry one lane of Class 70R for every two lanes with one lane of Class A for the remaining lanes, if any, or one lane of Class A for each lane.

- **Seismic Effects:**

- Basic horizontal seismic co-efficient - As per zone V  
(Table 5 & fig 11 of IRC: 6-2000)
- Importance Factor - 1.5  
Reinforcement detailing of structures shall conform to the provisions of IS 13920

Loading due to RCC Railing: **As per Standard Drawing**

- **Temperature Effect:**

- (i) Temperature stresses to be worked out as per Clause 218 of IRC: 6 – 2000.

For design of structure the temperature range to account for temperature effect shall be:

In the present case  $t = \pm 25^{\circ} \text{C}$

- (ii) The superstructures shall also be designed for effects of distribution of temperature across the deck depth. For calculation of thermal forces effect of 'E' value of concrete should be taken as 50% of the instantaneous value as to account for effects of creep on thermal strains.

- **Differential Settlement:** 6 mm with instantaneous E value of concrete. This will be deemed to cover lifting of superstructure also.

#### TECHNICAL SPECIFICATIONS

The work will be executed as per MORT&H Specifications for Road & Bridge Works 5<sup>th</sup> Revision 2013

## SECTION - 5

### ENGINEERING DESIGN AND CONSTRUCTION PROPOSALS

#### 5.1 GENERAL

This chapter deals with detailed design of various elements of project road, based on the findings of survey and investigations and design standards in the preceding chapters. The proposals include provision for the major items as given in Table.

**Project Proposals - Major Items**

Sl No.	Item
1	Site Clearance
2	Earthwork
3	Pavement Works
4	Slope Protection Works
5	Culverts
6	Miscellaneous Works
7	Facilities for Engineers
8	Provision for land Acquisition & Forest Clearance

#### 5.2 CROSS SECTION ELEMENTS & ALIGNMENT

##### a) Cross Section Elements

Hill road cross-section has the usual components of carriageway, shoulder and longitudinal drain and parapet/railing requirements. The carriageway and shoulder widths are governed by the traffic volume expected on the road. Other components are functions of traffic safety and surface run-off requirements. Roadway, however, is defined as the total width of carriageway and shoulder.

**Design Standards for Cross-section Elements**

Sl. No.	Design Elements	Dimension in m
1.	Roadway width (including culverts)*	12.00 & 10.8
2	Roadway width at Bridges **	12.90
3	Carriageway width	7.00
4	Cross-slopes / camber (%)	2.5

\* Roadway width are including width of side drain and parapet wall

\*\* Roadway width is Overall Width between outermost faces of the railing.

##### b) Geometric Design

The general alignment of the road under this project is as:

NH 54 Highway from Km 431 /000 to 553/604 Km as per design Chainage

Existing alignment : 120.026 Km

Re-alignment : 2.610 Km

Total length of proposed road : 122.636 Km

Lawngtlai Bye Pass : 1.92 Km

Total Length of project road :

Road is designed for 2-Lane (12.00 m roadway with 7.00 m carriageway).

Gradient, being the most important parameter, has been the guiding factor. Ruling gradient (less than 5.0%) has been achieved the maximum gradient being 7.0 % at few selected stretch.

**c) Realignment of existing road:**

For improvement of existing road some stretches, relocation and re-grading are proposed due to which traffic movement on existing road would be disturbed. Permanent diversion will be included in the design as to minimizing the structure damage, reducing cost of resettlement and easy and faster movement of vehicles.

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Sr. No.	Name of Village	Design Chainage		Existing Chainage		Length in Km
		From	To	From	To	
1	Theiva village	530+470	533+080	535+070	539+330	2.610
<b>Total</b>						<b>2.610</b>

**d) Bye Pass Of Existing Road For Lawngtlai City:**

The proposed Lawngtlai Bye pass take off from Km 470+50 of NH 54 and merging with NH 54 at Km 475+550 near BRO Camp. Lawngtlai Bye pass, which include 4.40 Km stretch of Multi Model Transit Route & 1.92 Km new alignment to avoid the movement of heavy vehicle traffic & traffic conjunction within the built-up portion of Lawngtlai city. Lawngtlai is the district headquarters of Lawngtlai district in the state of Mizoram . It is also the headquarters of Lai Autonomous District Council. Lawngtlai city spread is about 5.0 Km stretches length along the NH 54 both side. Within the city most of the stretches width of the existing road formation are varies from 9.0 m to 8.0 m. & nos of sub standard curve .Entire lawngtlai city markets, prominent building, Church & residential builds was along the NH 54. Therefore within the city improvement of road geometry for NH 2 lane standard is practically impossible because it will be raise up huge Compensation, rehabilitation & settlement issue up. However with available formation width of existing road within city will be possible for minor improvement of existing road geometry & carriage way for 2 lane standard with cover drain. So that commercial passenger vehicle & Light vehicle will be smoothly plying within city, which will benefit for commercial & social development of Lai Autonomous District Council. The proposed Bye pass will be used for heavy vehicle traffic & through traffic and to traffic conjunction within city.

**e) Horizontal Alignment**

The project corridor passes through steep and mountainous terrain. The design speed adopted is 30km/hour (IRC SP: 48). Along the proposed alignment, there will be no hair-pin bend. However minimum design speed has been considered on technical grounds. The vertical and horizontal alignments of the proposed road can be summarized as shown in table below:



Project Road length	No. of Curves with Design Speed in km/h				No. of Curves with Radius (m)		
	<30	30-40	40-50	>50	<30	30-50	>50
122.636 km	308	904	215	72	27	716	756
1.92 km	5	12	2	2	0	10	11

#### f) Vertical Alignment/Gradient

Gradient, being the most important parameter, has been the guiding factor. Ruling gradient (less than 5.0%) has been achieved, the maximum gradient being 7.0% at few selected stretch.

Summary of Proposed Vertical Alignment

Project road length	Length Distribution (km) and Gradient Class				
	<4%	4%-5%	5%-6%	6%-7%	7%-8%
122.636 km	77.376 Km	22.750 Km	13.170 Km	9.200 Km	0.140 Km
1.92 km	-	-	-	1.920 Km	-

### 5.3 Traffic Design Capacity

The width of a pavement is decided on the basis of the traffic volume it can efficiently carry. Traffic studies have been carried out in the vicinity of the project road and produced in this report. As the project road is going to serve as trade route between Tripura & Mizoram and later on with Bangladesh, the road is proposed to be of double-lane NH standard.

### 5.4 Design of Embankment / Hill Cutting

Considering the physical features, particularly the terrain, soil classification and hill slope line, typical cross-section (Type 1F to Type 49F) have been developed for hill road cutting / embankment building.

Concept Plan of the design of the embankment / hill cutting (stretch-wise) has been developed with specific mention of the formation building methodology / type to be adopted.

#### Compaction of disposal material

Spreading & Compaction of Roadway cutting and excavation from drain and foundation of other structures surplus material in layers not exceeding 300mm thickness at selected disposal location by Dozer at least four passes including construction of approach road to dumping site.

### 5.5 Pavement Proposal

The provision for pavement includes different layers of sub-base, base, and surfacing course as appropriate throughout the whole stretch of the road.

# Granular Sub-base (GSB): 300mm thick sub-base layer of crushed stone aggregate has been proposed. The sub-base course has been extended up to full width of the formation.

# Extra quantities for widening at curves, major and minor junction locations are calculated separately and final quantities are worked out.

#Wet Mix Macadam Base (WMM): 250mm thick base layer of Wet Mix Macadam is proposed for 7.0m width.

#Dense Bituminous Macadam of 100 mm thick and 40mm thick of Bituminous Concrete as surfacing course has been proposed.

## 5.6 Pavement Design

It is based upon CVD-312, CBR-6%, Traffic msa -10, Design period – 15 years, VDF-1.5, Annual Growth of traffic rate 7.5% and Design speed 30.00 Km/h. However the proposed pavement composition is based on CBR-5% and msa -20.

Pavement composition is designed as under:

Proposed pavement.

BC	:	40 mm
DBM	:	100 mm
WMM in 2-layers	:	250mm
GSB in 2-layers	:	300 mm
Total	:	690 mm

## Shoulder Design

The carriageway width of 7m and paved shoulder width of 1.5 m on each side shall have the same pavement as the carriageway. The remaining 1.0m on each side shall be used to accommodate side drain on hill side or parapet/soft shoulder on valley side. In the hill side, depending on the total width of side drain, there is a small width remaining between the wall of side drain and paved shoulder, therefore it is also paved to avoid erosion by surface water

## 5.7 Culverts:

The project road traverses through mountainous and steep terrains with several natural drainages such as deep gorges, depressions, etc., where perennial water and rain water runoff are collected. Sometimes the storm runoff is accompanied by large quantities of debris from upstream side of the nallahs. Cross-drainage structures/culverts are required at these locations. From the field survey and investigations and geometric design of alignment the requirement of culverts for the whole length of the project have been identified.

Sr. No.	Type of culvert	Description	Span X Depth	NH 54	Lawngtlai Bye Pass
1	Type -1	Pipe Culvert	1.2 D	59	1
2	Type - 2	Pipe Culvert	1.2 D	112	10
3	Type - 1	Box Culvert	2.0 X 2.0	467	
4	Type - 2	Box Culvert	3.0 x 3.0	11	
5	Type - 3	Box Culvert	4.0 x 4.0	7	
6	Type - 4	Box Culvert	6.0 x 4.0	2	
			Total	658	11

### 5.8 Slope Protection works:

Adequate Protective structures are proposed for retaining of cut/fill slopes to ensure stability of the road formation at locations where required. The proposed type and length of each structure are shown in the table below:

Sr. No.	Type of Structure	Unit	Quantity		Remarks
			NH 54	Lawngtlai Bye Pass	
1	Retaining Wall	Rm	19400.00	390.00	Height varying between 3.0m to 6.0 m
2	Breast Wall	Rm	720.00	100.00	Height varying between 2.0m to 3.0 m
3	Gabion Wall	Rm	2790.00		Height varying between 2.0m to 3.0 m
4	Toe Wall	Rm	13490.00	100.00	Height varying between 2.0m to 3.0 m
5	Reinforced Earth Wall	Rm	750.00		Height varying between 7.0 m to 10.0 m
6	Cut Slope Wall	Rm	70000.00		Height upto 3.0 m
7	Gabion Wall (1:0.3)	cum	10428.00		
8	Rock fall Prevention Wall (H=3m)	Rm	9647.50		
9	Rock fall Prevention Fence (H=2m)	Rm	2410.00		
10	Hydro seeding (t=5cm)	sqm	5377.00		
11	Seeding and Mulching (Soil Cut Slope)	sqm	448043.00		
12	Vegetation Mat (Steep Slope)	sqm	1237.00		
13	Crib Work (F300)	sqm	1756.16		
14	Crib Work (F500)	sqm	3510.00		
15	Earth Removal	cum	12970.00		
16	Groundwater Drainage Work	Rm	9924.00		
17	Anchor Work	Rm	3072.00		
18	Rock-bolt Work	Rm	702.00		
19	Bamboo crib wall	Rm	22320.00		Height 1.5 m at Embankment & disposal location.

### 5.9 DRAINAGE DESIGN

Pavement Drainage includes camber / cross fall of 2.50%.

Slope 3.5 % has been considered for drainage of shoulders.

Roadside drains are designed as Lined drains

Length of drain					
Sr.No.	Chainage in m		Length	Type	Remarks
	From	To			
1	431000	432700	1700.0	Type-1	Soil Mixed Boulder
2	432700	434600	1900.0	Type-2	Village portion
3	434600	435100	500.0	Type-1	Soil Mixed Boulder
4	435100	437900	2800.0	Type-2	Village portion
5	437900	443400	5500.0	Type-1	Soil Mixed Boulder
6	443400	446400	3000.0	Type-2	Village portion

7	446400	457850	11450.0	Type-1	Soil Mixed Boulder
8	457850	459250	1400.0	Type-2	Village portion
9	459250	467000	7750.0	Type-1	Soil Mixed Boulder
10	467000	468100	1100.0	Type-2	Village portion
11	468100	468900	800.0	Type-1	Soil Mixed Boulder
12	468900	470600	1700.0	Type-2	Village portion
13	470600	476000	5400.0	Type-2	Village portion
14	476000	483750	7750.0	Type-1	Soil Mixed Boulder
15	483750	484050	300.0	Type-2	Village portion
16	484050	494750	10700.0	Type-1	Soil Mixed Boulder
17	494750	495450	700.0	Type-2	Village portion
18	495450	497400	1950.0	Type-1	Soil Mixed Boulder
19	497400	498900	1500.0	Type-2	Village portion
20	498900	502600	3700.0	Type-1	Soil Mixed Boulder
21	502600	505600	3000.0	Type-2	Village portion
22	505600	514800	9200.0	Type-1	Soil Mixed Boulder
23	514800	515900	1100.0	Type-2	Village portion
24	515900	520900	5000.0	Type-1	Soil Mixed Boulder
25	520900	522400	1500.0	Type-2	Village portion
26	522400	531300	8900.0	Type-1	Soil Mixed Boulder
27	531300	532030	730.0	Type-2	Village portion
28	532030	538600	6570.0	Type-1	Soil Mixed Boulder
29	538600	539400	800.0	Type-2	Village portion
30	539400	551100	11700.0	Type-1	Soil Mixed Boulder
31	551100	553636	2536.0	Type-2	Village portion
<b>LAWNGTLAI BYE PASS ROAD</b>					
32	0	1920	1920.0	Type-1	Soil Mixed Boulder
		<b>Total</b>	<b>124524.00</b>		
<b>Summary</b>					<b>Length of drain in m</b>
Length of drain on Hill side				=	124524.0
Length of drain on Valley side at Box Cutting portion				=	13260.0
Length of bridge				=	300.0
Catch water drain				=	2450.0
Culvert catchpit opening				=	1862.8
<b>Net length of line drain</b>				=	<b>138071</b>
	<b>Type-1</b>	<b>108637</b>	<b>Type-2</b>	<b>29434</b>	

Sr.No.	Type	Length	Remarks
1	Type-1	97404.00	Ordinary Soil stretch Rocky & Steep Stretch & Catch water drain at box cutting portion
2	Type-2	29466.00	Built up area

Chutes of the culverts form part of the culvert structure to lead the discharge to the catch-pit or to natural drainage channel.

## 5.10 ROAD SIGN AND MARKINGS

The project design includes (a) Mandatory / Regulatory Signs, (b) Cautionary / Warning Signs and (c) Information Signs , Route Marker Signs are provided .KM Stones are included as per type design.

## 5.11 STREET FURNITURE

Traffic Safety Posts and Parapet Walls are included.  
Traffic Signs Marking & other Road Appurtenances

## 5.12 DIVERSION OF EXISTING ROAD DURING CONSTRUCTION

For improvement of existing road some stretches localized, relocation and re-grading are proposed. Due to which traffic movement on existing road will be hamper .Therefore temporary diversion of existing is very much necessary during construction period.

## 5.13 MAINTENANCE OF EXISTING ROAD:

The existing road is the main route to provide connectivity between district headquarters and International boarder of Indo Myanmar for international trading but also for Southern part of Mizoram. The minimum construction time provided for completion of the project is 4(four) years during which maintenance by the PIU will be no longer convenient as the site possession is resorted to hand over to the contractor till completion of the project. Under this circumstance, it is inevitable to keep provision for yearly maintenance of the existing road during construction and hence a provision of Rs.78.60 lakhs per year is kept to make the road payable for all type of vehicles without serious interruption of the traffic flow throughout the year.

### Scope of maintenance:

- 1) Maintenance of Earthen Shoulder (filling with fresh soil).
- 2) Filling Pot- holes and Patch Repairs with open - graded Premix surfacing, 20mm.
- 3) Hill Side Drain Clearance.
- 4) Land Slide Clearance in soil/ rock
- 5) Clearing Grass and Removal of Rubbish.
- 6) Maintenance/repair of culvert/Retaining wall.
- 7) Clearance of culvert before monsoon
- 8) Removal of land slide

## 5.14 ROADSIDE AMENITIES

The continuous long distance travel on highways at speed is liable to cause fatigue as also mental tension to the road users. Moreover, the monotony of driving over long sections in the rural areas with no likelihood of any cross traffic brings sense of complacency in many drivers. and such distractions could result in serious accidents.

Sr.No.	Description	Nos.	Location
1	Public Toilet	15	Tawipui North -2,Tawipui North-1,Tawipui South ,Thingfal ,Thingka ,AOC, Lawngtlai City, Saika, Chawntlangpui ,Sihtlangpui ,Kawlchaw ,Zero point, Maubawk ,Theiva ,Theihri & Tuipang village
3	Bus Shed	30	
4	Bazar Shed	15	

## 5.15 DESIGN OF INTERSECTION/JUNCTIONS

Based on the survey there are junctions/ intersections as mentioned below:

### Road Junction.

Provisions have been made for the improvement of road junctions along the project road.  
Based on the survey there are 45 junctions/ intersections as mentioned below:-

S/N	CHAINAGE	SIDE	SHAPE	DESCRIPTION	LOCATION	TYPE
1	433340	LHS	Y	Village Link Road	Tawipui North -2	Minor
2	433500	LHS	Y	Village Link Road	Tawipui North -2	Minor
3	433525	RHS	X	Village Link Road	Tawipui North -2	Minor
4	433865	LHS	Y	Village Link Road	Tawipui North -2	Minor
5	433895	LHS	Y	Village Link Road	Tawipui North -2	Minor
6	434230	LHS	Y	Village Link Road	Tawipui North -2	Minor
7	435950	LHS	Y	Village Link Road	Tawipui North -1	Minor
8	440200	RHS	Y	Agricultural Link Road		Minor
9	440670	LHS	Y	Agricultural Link Road		Minor
10	445000	RHS	Y	Village Link Road	Tawipui South	Minor
11	445290	RHS	Y	Village Link Road	Tawipui South	Minor
12	450990	RHS	Y	BPL COMPANY		Minor
13	459150	LHS	Y	Village Link Road	Thingfal	Minor
14	467280	LHS	Y	Village Link Road	Thingka	Minor
15	467360	LHS	Y	Village Link Road	Thingka	Minor
16	470550	RHS	Y	Multi Model Road	Lawngtlai city	Major
17	472360	LHS	Y	Bungtlanga Road	Lawngtlai city	Major
18	472850	RHS	Y	City Link Road	Lawngtlai city	Minor
19	473060	LHS	Y	City Link Road	Lawngtlai city	Minor
20	473070	RHS	Y	City Link Road	Lawngtlai city	Minor
21	473450	RHS	Y	City Link Road	Lawngtlai city	Minor
22	474200	RHS	Y	City Link Road	Lawngtlai city	Minor
23	474770	RHS	Y	City Link Road	Lawngtlai city	Minor
24	475000	RHS	Y	City Link Road	Lawngtlai city	Minor
25	475500	RHS	Y	Multi Model Road	Link road	Major
26	475610	LHS	Y	PWD Complex Link Road	Lawngtlai city	Minor
27	478130	LHS	Y	Village Link Road		Minor
28	483800	RHS	Y	Village Link Road	Saika	Major
29	490650	RHS	Y	Village Link Road	Kawlchaw	Minor
30	503430	RHS	Y	Village Link Road	Kawlchaw	Minor
31	503720	LHS	Y	Village Link Road	Kawlchaw	Minor
32	503850	LHS	Y	Village Link Road	Kawlchaw	Minor
33	515170	LHS	Y	NH 54 B takeoff point	Zero Point	Major

34	523050	RHS	Y	Agricultural Link Road		Minor
35	530470	LHS	Y	Diversion start	Theiva	Minor
36	531480	RHS	Y	Village Link Road	Theiva	Minor
37	532020	RHS	Y	Village Link Road	Theiva	Minor
38	533080	RHS	Y	Diversion end	Theiva	Minor
39	536440	RHS	Y	Agricultural Link Road		Minor
40	538700	LHS	Y	Village Link Road	Theihri	Minor
41	539040	LHS	Y	Village Link Road	Theihri	Minor
42	552410	RHS	Y	Village Link Road	Tuipang	Minor
43	552830	RHS	Y	Village Link Road	Tuipang	Minor
44	553604		X	Village Link Road	Tuipang	Minor
45	Lawngtlai Bye Pass		Y	MM Road Junction	Lawngtlai City	Major

These Junctions needed major improvement as compared

Sr. No.	Chainage in m	Design
1	470+550	Junction with Multi Model Transit Route Take off
2	472+360	Junction with Bungtlanga BRO Road
3	475+500	Merging of Lawngtlai Bye Pass with existing NH-54
4	483+800	Junction with NCV road
5	515+170	Junction with NH- 54 B serves as Approach road Saiha District
6	0+00	Take of point of Lawngtlai Bye Pass from Multi Model Transit Route at Km 4.40.
7		Other link road need to be improved by proper grading, widening & black topping.

### 1.0 Junction at Ch. 470+550

Location	:	Junction with Multi Model Transit Route Take off
Shape	:	Y-Shape
Design	:	This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is considered suitable.

### 2.0 Junction at Ch. 472+360

Location	:	Junction with Bungtlanga BRO Road
Shape	:	Y-Shape
Design	:	This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is not considered suitable.

### **3.0 Junction at Ch. 475+500**

Location	:	Merging of Lawngtlai Bye Pass with existing NH-54
Shape	:	Y -Shape
Design	:	This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is not considered suitable.

### **4.0 Junction at Ch. 483+800**

Location	:	Junction with NCV road
Shape	:	Y -Shape
Design	:	This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is considered suitable.

### **5.0 Junction at Ch. 515+170**

Location	:	Junction with NH- 54 B serves as Approach road Saiha District
Shape	:	Y-Shape
Design	:	This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is not considered suitable.

### **6.0 Junction at Ch. 0+00**

Location	:	Take of point of Lawngtlai Bye Pass from Multi Model Transit Route at Km 4.40.
Shape	:	Y-Shape
Design	:	This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is not considered suitable.

### **7.0 Other Junction**

Location	:	Other link road , Junctions to be improved
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## SECTION: 6

### ENVIRONMENTAL IMPACT ASSESSMENT

#### 6.1 INTRODUCTION

The environmental assessment process endeavors to mitigate and prevent undesirable impacts of developmental activities. It is in no way intended to hamper socio-economic development but to guide project proponents in making the right investment in land, manpower, technology and mitigation measures to ensure that projects have the least possible impacts on the environment.

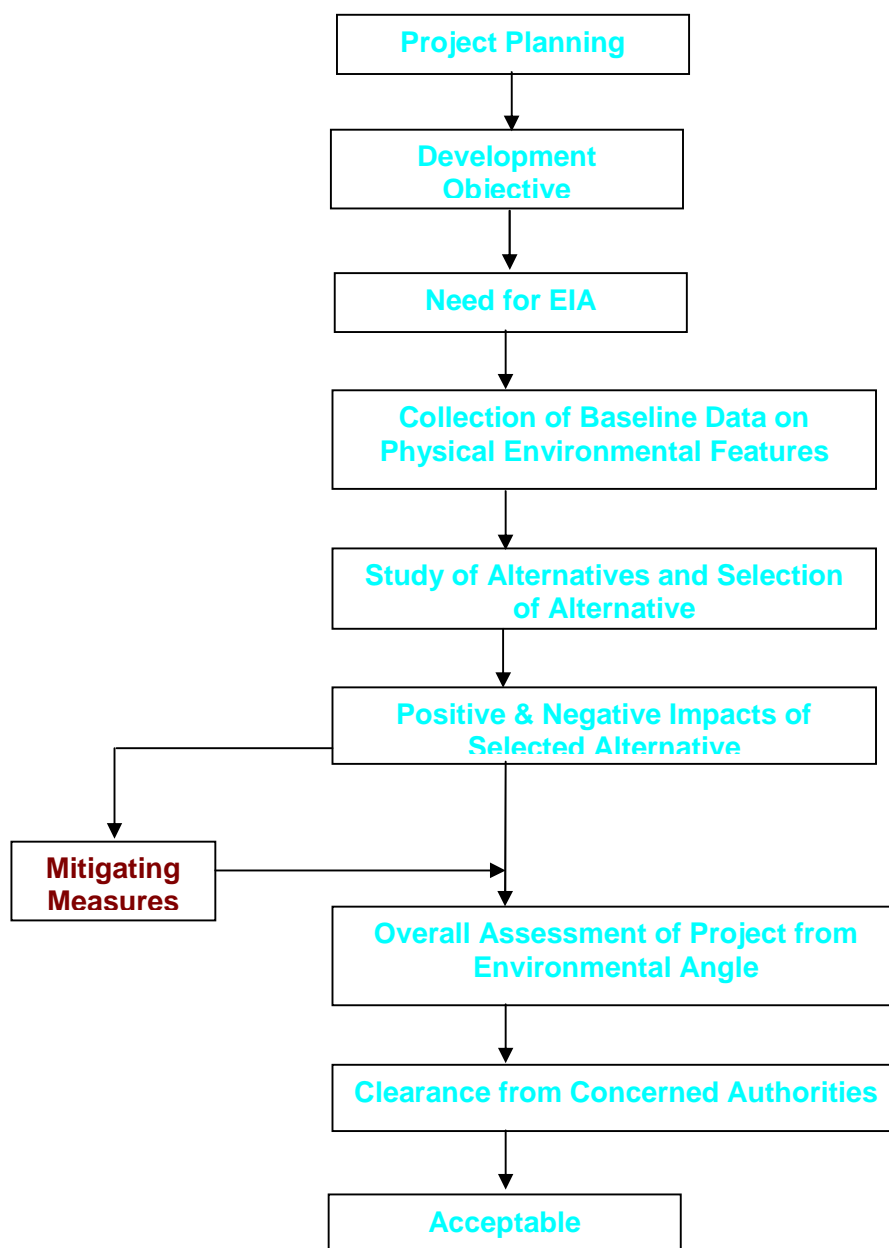
Environmental study for road projects involves several steps, starting from clear understanding of the development objectives, collection of base line data, and evaluation of alternatives to overall assessment of the environmental impact of the selected alternative. The involved activities are:

- Collection of base line data and physical environmental features
- Study of alternatives and selection of alternative
- Positive and negative impacts of selected alternative
- Mitigation measures
- Overall assessment of project from environmental angle
- Filing of application for environmental clearance
- Clearance from the concerned authorities
- Project implementation

The above activities are given in the flow diagram of environmental assessment of the project.

#### **Salient features are extracted hereunder:**

- Baseline data collection
- Physical and Environmental features
- Beneficial Impact
- Negative Impacts
- Some Environmental Parameters Associated with the Project
- Initial Environmental Assessment



**Flow Diagram for Environmental assessment of Road Projects**

## 6.2 NEED FOR ENVIRONMENTAL STUDY

The proposed widening to 2-lane, re-alignment and geometric improvement of NH 54 under this report is from Km 431+00 to Km 562+000 of existing chainage in Mizoram. This road will serve as connectivity between two Southern District Headquarter. The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International trade road between India & Myanmar for economically and culturally. This work will include improvement of gradient, re-alignment, pavement, retaining walls, culverts etc. In order to improve the gradient of this road, some stretches of the road will have to be re-aligned whereas some existing stretches can be improved to conform to single lane specification in respect of its gradient, curves, super elevations etc.

In view of the above, there is a requirement to have the environmental study of the project road which contains the following elements:

- Preliminary Or Initial Examination And Environmental Analysis
- Environmental Impact Assessment
- Environmental Management Action Plan

The Environmental Assessment and Environmental Management Action Plan are applicable in case the initial environmental examination indicates that there is potential to determine the environmental impact and thereby to have the environmental design.

### 6.3 COLLECTION OF BASELINE DATA

#### Data Collection during Reconnaissance

The data collection to be conducted during reconnaissance period which includes road factors, terrain and traffic factors, land-use, environmental factors. The data collection proforma has been developed and the information is below mention

#### *Data Collection during Reconnaissance*

1	Climatic / Meteorological Data <ul style="list-style-type: none"> <li>• Rainfall</li> <li>• Temperature max &amp; minimum</li> <li>• Humidity</li> <li>• Wind speed &amp; wind direction</li> </ul>	<ul style="list-style-type: none"> <li>• 2540 mm per year</li> <li>• 28° C to 8° C</li> <li>• Moderate</li> <li>• Moderate</li> </ul>
2	Land use in the area	Frequently cultivated jhum land
3	Cut and fill sections	Cut section only
4	Vegetation in the area	Growth rapid
5	Nearby ecological sensitive area - forest, reserve forest, wild life sanctuary, wet land	Ref. forest clearance
6	Geology of the area	Soil to Hard rock
7	Religious structure near the alignments	Ref. L.A. Plan
8	Heritage Cultural, Historical Structure In Nearby Area	Not Available
9	Community structure - near the alignment - Community Well, Hand Pump, Community Pond, Panchayat Bhawan, etc.	Nil
10	School, College, Hospital In The Nearby	Nil

	Area	
11	Traffic on the road & traffic projection	Traffic survey Data
12	Connectivity of the alignment – tourist importance, connected to industrial, towns & cities, school, college, hospital, markets. and port	It will serve one of the major International trade routes between India and Myanmar for economic and culture transformation.
13	Report of HIV & AIDS in the area	Not noticed in the Area
14	Source of stone, cement, sand, etc.	Refer quarry chart
15	Source of construction water	Available
16	Status of surface water bodies – pond, river, stream in the nearby area	Not affected
17	Status of groundwater	Very deep being hilly area
18	Disposal area / sites near the alignment to accommodate surplus earth	Disposal sites available
19	Selection of borrow area in the nearby area	Not required
20	Is the alignment acting as embankment in between agricultural lands	No
21	Source of fly ash for road construction in the area	N.A.
22	Population (Direct & Indirect) served by the road	-
23	Importance of the road to the connecting habitations	For providing economical upliftment.
24	Analysis of alternatives for alignment selection	Suitable and best alignment selected
25	Analysis of alternatives for selection of material for road construction	Materials lead surveyed
26	Air quality in the area	Good
27	Water quality in the area	Good
28	Road safety analysis	Cautionary/ inforatory boards have been considered for provision crash barriers at sharp or blind curves, parapets over retaining walls
29	Road drainage	Culverts of different spans and side drains provided
30	Soil quality	Ordinary Soil and soil mixed with Boulders to Hard Rock
31	Nature of terrain	Mountainous to steep

32	Any flood hazard	Nil
33	Erosion potential	Erosion potential taken care of by providing Breast wall and vegetation turfing
34	Demarcation of Land slide prone areas	Nil
35	Major & minor rivers – Hydrology	Nil
36	Land to be acquired	Ref L.A
37	Nature of the land	Government Land
38	Displacement of house holds	Ref. L.A. Plan
39	Population composition – demography	Mizo , Lia,Mara & Chakma

### Physical and Environmental Features

In order to have a complete assessment of the project, the physical and environmental features are brought out as follow

#### Physical and Environmental Features

Sn	Particulars	Selected Alternative
1	Length (Kms)	
	• Improvement of Existing Road to Single - lane	120.026 Km
	• Re alignment of Existing Road	2.610Km
2	Terrain (Plain rolling / hilly)	Hilly
3	Land width Proposed (m)	15 m /12 m
4	Category of land proposed to be acquired (ha	
	• Forest Land	22.21 Ha
	• Agricultural land	120.50 Ha
	• Habited area	50.45 Ha
	• Swampy land	Nil
5	Displacement of households (Nos)	125
6	Cut Sections	
	• Length in cut (Km)	122.524 Km
	• Maximum depth of cut at centre line(m)	17.50 m
7	Fill Sections	
	• Length in fill (Km)	2.00 Km
	• Maximum height of fill (m)	3-6 m
8	Vegetation : No. of trees exceeding 30 cm in girth to be cut	Ref. forest clearance

9	Flood hazard (encroachment on flood plain)	Nil
10	Erosion potential	Ref. Sl.No. 33 of table -1
11	Landslide potential	Nil
12	Stretch in geologically unstable area	Nil
13	Drainage and adverse impact on water flow	Adequate provision has been made
14	Number of major river crossings (exceeding 60 m)	Nil
15	No. of road intersections	45
16	No. of railway crossings	Nil
17	Schools, colleges, hospitals falling enroute	Ref. L.A. Plan
18	Number and type of utilities requiring relocation	Ref. L.A. Plan
19	Possibility of providing wayside amenities	nil
20	Air quality (very poor, poor, fair, good)	Good
21	Noise level	Good

### Beneficial Impact for Highway Project

The beneficial Impact for the proposed Project is given as follows. It is observed that the analysis of the Environmental Impact indicates that this project road has much positive impact on the socio-economic aspects and the development of the region.

Beneficial Impacts for Highway Project :	
Employment Opportunity to People	Yes. Project offers good employment opportunity to skilled / unskilled workers
Enhancement of Local Industry, Agriculture and Handicrafts	Yes. Good reduction in vehicle operating cost and time of communication will have positive impact.
Income from Visitors and Taxes	Yes. Passenger and freight traffic will increase to enhance income and taxes
Enhancement of Rural Development through quick and easy transportation of building materials	Yes.
Transporting, Processing and Marketing of agricultural products	Yes. Fast and economical movement of products
Opening up of opportunities for new occupations	Yes. Fast and economical movement will open opportunity for new occupations.
Approach to quick services and safety	Yes.

	Time saving due to short length and improved road geometric.
Improved quality of life for people and so on	Yes. Project will substantially contribute to improvement in the quality of life in Lunglei – Lawngtlai - Saiha district.

### Negative Impact

Environmental Study with respect to the Negative Impact has also been considered and an analysis is placed as follows. There is no visible negative impact of this project road on spoiling and destroying environmental issues and features of the region and the project influence area.

<i>Negative Impacts for Highway Project:</i>	
Erosion and sediment discharge	No. Proposed Road mostly passes through stable hill slope, soft & hard rock area which will keep in control the erosion and sediment discharge.
Poor drainage resulting in rail / road / highway damage and leading to flooding problems and degradation of water resources. Formation of new gullies	No. Adequate provision has been made for drainage and quick discharge of run-off. There are 606.00 culverts.
Increase in concentration of runoff causing surface water pollution	No Route alignment is made in a manner to ensure quick discharge of run-off. There will be no ponding up or any surface water pollution
Clearing of roadside vegetation for fire-wood, grazing, cultivation and urbanisation	There are no new village on this route and hence will not have impact of in-discriminate use of forest products. On the contrary, the road will provide LPG at cheaper rate to the existing village and deforestation will be reduced.
Increase in traffic litter, noise and dust pollution	No. There will be no dust pollution. There is no traffic concentration point to cause noise pollution.
Air quality affected by vehicular exhaust smoke with reference to SPM, NOx, CO, HC and lead	No. Air quality will not be affected as the route passes through open area.
Spill of toxic and hazardous chemicals from the carriers using the highway for transportation of such material	No
Transfer of vector diseases	No
Effect on wildlife through habitat loss and encroachment	No. The road does not pass through wildlife habitat.

***Some Environmental Parameters associated with the Environmental Project***

The basic environmental parameters have been broadly brought out and are tabulated as follow

<b>Table No. 5 : Some Environmental Parameters Associated with Transportation Sector Project</b>		
<b>Sr.No.</b>	<b>Environmental Parameters</b>	<b>Remarks</b>
1	Surface Water Quality	Good; Not going to be effected
2	Air Quality	Good; Not going to be effected
3	Seismology / Geology	Hard Rock area Good girth of vegetation in soil mixed with boulder area
4	Erosion	Nil
5	Land Quality	Fertile
6	Fisheries	Nil
7	Forests	Medium to Dense Forest mainly of bamboo forest.
8	Terrestrial Wildlife	Nil
9	Noise	No
10	Land use	Individual owned agricultural land with minor irrigation.
11	Aesthetics	Beautiful and scenic
12	Industries	Nil
13	Resettlement	Nil There is no habitation requiring relocation
14	Archaeological / Historic	Nil
15	Significance	Economical concern
16	Public Health	Not effected
17	Socio-Economic	Good prospects



## SECTION - 7

### MATERIALS, LABOURS AND EQUIPMENTS

#### 7.1 MATERIALS :

This chapter covers the details of test and investigation carried out for evaluating the characteristics of the sub-grade along the project corridor to establish the basis for the design of various elements of the road including pavement and sub grade, embankment and structures.

The main task carried out for soil and material investigation includes:

- Collection and Review of available soil data from various division of Mizoram
- Soil classification along the proposed road
- Investigation of sub grade soil
- Investigation of construction material including identification and inspection of potential source of construction material and extraction sites; testing and evaluating of construction material for suitability for project road construction.
- Geo-technical investigation for bridges and other structures.
- Pit test for foundation of structures

#### Investigations

The detailed investigations include both field and laboratory testing. Field work covered field density test, sub-grade soil sampling by excavating test pits, identification of rock sources and soil borrow sources/ quarries within reasonable short haulage distances of the project road. Test pits were also excavated wherever necessary to obtain samples for testing.

Appropriate laboratory tests were carried out on the representative samples of the soil and material obtained during field investigations to determine relevant engineering properties.

#### Standard Test Procedures

The following standard test procedures were followed for field testing, soil sampling and laboratory testing:

#### Type of Test

S. No	Type of Test	Adopted as per
1	Field Density using Sand Replacement Method	IS:2720 Part 28
2	Water Content	IS: 2720 Part 2
3	Atterberg limits	IS: 2720 Part 5
4	Sieve Analysis	
(a)	Natural Soil	IS: 2720 Part 4
(b)	Rock aggregate	IS: 2386 Part 1
5	Heavy Compaction Test	IS: 2720 Part 8
6	CBR	IS: 2720 Part 16
7	Soundness by Sodium Sulphate (Na <sub>2</sub> SO <sub>4</sub> )	IS: 2386 Part 5
8	Aggregate Impact Value	IS: 2386 Part 4
9	Specific Gravity and Water Absorption of Coarse Aggregate	IS: 2386 Part 3

#### Notations

CBR	:	California Bearing Ratio
LL	:	Liquid Limit
PL	:	Plastic Limit
PI	:	Plasticity Index
NP	:	Non – Plastic
MDD	:	Maximum Dry Density
OMC	:	Optimum Moisture Content
FMC	:	Field Moisture Content
FDD	:	Field Dry Density
DCP	:	Dynamic Cone Penetration

### Soil Classification

In case of hill road, the soil classification of the hill face (hill/ valley side) plays an important part. Soil classifications consist of the following:

- Ordinary Soil
- Soft Rock
- Hard Rock

The classification is mostly done visually. The classification is tabulated as follows:

Sr. No.	Chainage		Classification of Soil in %			Soil Classification
	To	From	Ordinary Soil	Ordinary Rock	Hard Rock	
1	431	432	40	45	15	Soil Mixed Boulder
2	432	433	39	45	16	Soil Mixed Boulder
3	433	434	36	47	17	Soil Mixed Boulder
4	434	435	37	45	18	Soil Mixed Boulder
5	435	436	36	46	18	Soil Mixed Boulder
6	436	437	38	42	20	Soil Mixed Boulder
7	437	438	36	43	21	Soil Mixed Boulder
8	438	439	35	45	20	Soil Mixed Boulder
9	439	440	36	45	19	Soil Mixed Boulder
10	440	441	38	42	20	Soil Mixed Boulder
11	441	442	35	44	21	Soil Mixed Boulder
12	442	443	37	43	20	Soil Mixed Boulder
13	443	444	36	44	20	Soil Mixed Boulder
14	444	445	36	43	21	Soil Mixed Boulder
15	445	446	39	41	20	Soil Mixed Boulder
16	446	447	37	43	20	Soil Mixed Boulder
17	447	448	41	40	19	Soil Mixed Boulder
18	448	449	37	46	17	Soil Mixed Boulder
19	449	450	37	45	18	Soil Mixed Boulder
20	450	451	35	47	18	Soil Mixed Boulder
21	451	452	43	40	17	Soil Mixed Boulder
22	452	453	41	42	17	Soil Mixed Boulder
23	453	454	42	40	18	Soil Mixed Boulder
24	454	455	46	35	19	Soil Mixed Boulder
25	455	456	42	40	18	Soil Mixed Boulder
26	456	457	46	35	19	Soil Mixed Boulder
27	457	458	43	37	20	Soil Mixed Boulder
28	458	459	35	47	18	Soil Mixed Boulder
29	459	460	33	48	19	Soil Mixed Boulder
30	460	461	38	44	18	Soil Mixed Boulder

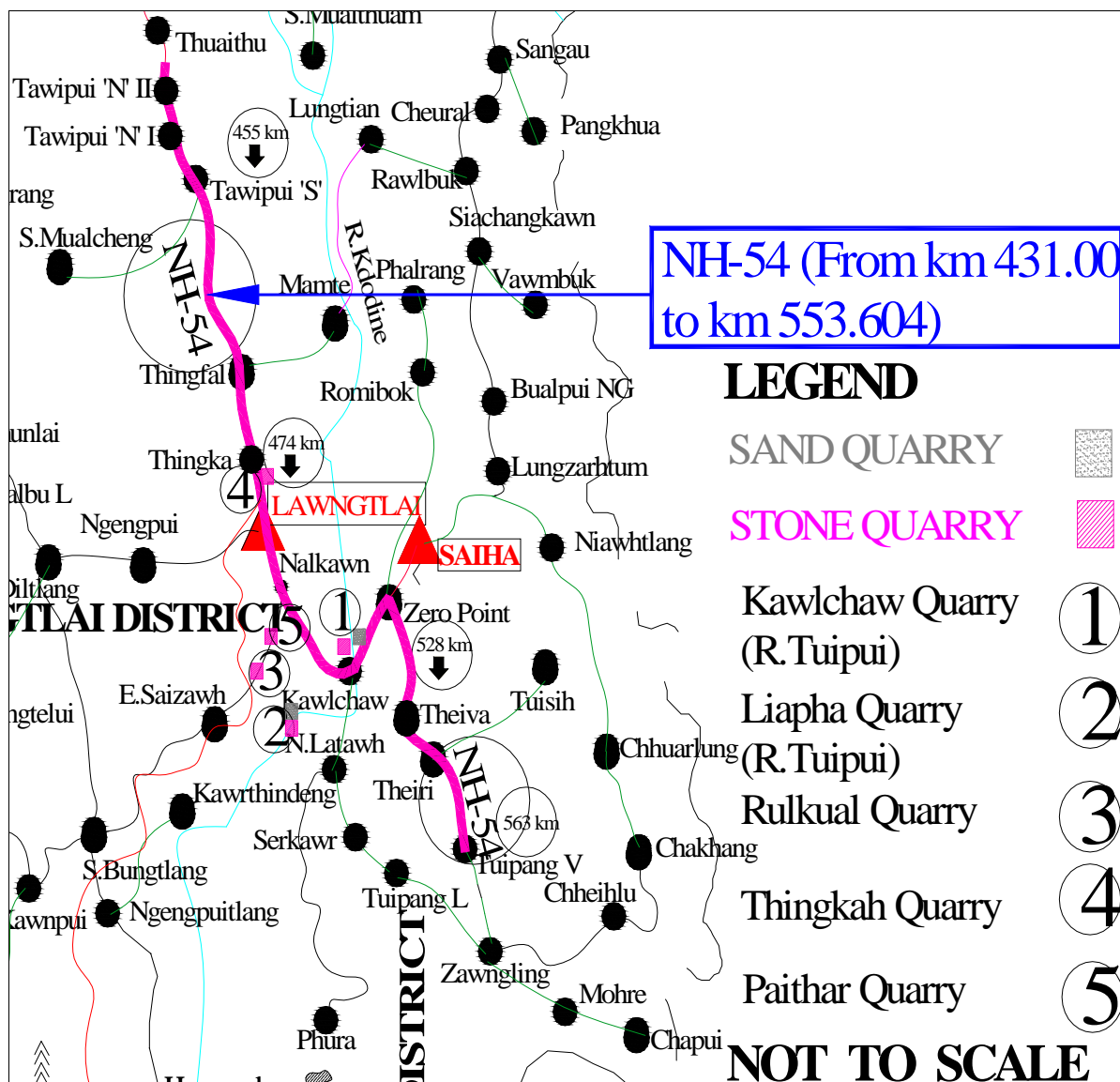
Sr. No.	Chainage		Classification of Soil in %			Soil Classification
	To	From	Ordinary Soil	Ordinary Rock	Hard Rock	
31	461	462	49	33	18	Soil Mixed Boulder
32	462	463	46	35	19	Soil Mixed Boulder
33	463	464	46	36	18	Soil Mixed Boulder
34	464	465	43	37	20	Soil Mixed Boulder
35	465	466	44	38	18	Soil Mixed Boulder
36	466	467	41	40	19	Soil Mixed Boulder
37	467	468	39	41	20	Soil Mixed Boulder
38	468	469	38	44	18	Soil Mixed Boulder
39	469	470	37	45	18	Soil Mixed Boulder
40	470	471	37	44	19	Soil Mixed Boulder
41	471	472	40	44	16	Soil Mixed Boulder
42	472	473	51	32	17	Soil Mixed Boulder
43	473	474	43	40	17	Soil Mixed Boulder
44	474	475	42	41	17	Soil Mixed Boulder
45	475	476	37	44	19	Soil Mixed Boulder
46	476	477	37	45	18	Soil Mixed Boulder
47	477	478	36	44	20	Soil Mixed Boulder
48	478	479	38	44	18	Soil Mixed Boulder
49	479	480	37	44	19	Soil Mixed Boulder
50	480	481	37	45	18	Soil Mixed Boulder
51	481	482	37	44	19	Soil Mixed Boulder
52	482	483	37	45	18	Soil Mixed Boulder
53	483	484	35	42	23	Soil Mixed Boulder
54	484	485	36	44	20	Soil Mixed Boulder
55	485	486	36	43	21	Soil Mixed Boulder
56	486	487	37	43	20	Soil Mixed Boulder
57	487	488	36	42	22	Soil Mixed Boulder
58	488	489	36	43	21	Soil Mixed Boulder
59	489	490	38	44	18	Soil Mixed Boulder
60	490	491	38	45	17	Soil Mixed Boulder
61	491	492	37	44	19	Soil Mixed Boulder
62	492	493	35	42	23	Soil Mixed Boulder
63	493	494	37	43	20	Soil Mixed Boulder
64	494	495	36	44	20	Soil Mixed Boulder
65	495	496	36	43	21	Soil Mixed Boulder
66	496	497	36	43	21	Soil Mixed Boulder
67	497	498	36	43	21	Soil Mixed Boulder
68	498	499	35	43	22	Soil Mixed Boulder
69	499	500	37	43	20	Soil Mixed Boulder
70	500	501	37	45	18	Soil Mixed Boulder
71	501	502	35	42	23	Soil Mixed Boulder
72	502	503	36	44	20	Soil Mixed Boulder
73	503	504	36	43	21	Soil Mixed Boulder
74	504	505	37	43	20	Soil Mixed Boulder
75	505	506	36	42	22	Soil Mixed Boulder

Sr. No.	Chainage		Classification of Soil in %			Soil Classification
	To	From	Ordinary Soil	Ordinary Rock	Hard Rock	
76	506	507	35	43	22	Soil Mixed Boulder
77	507	508	36	43	21	Soil Mixed Boulder
78	508	509	37	44	19	Soil Mixed Boulder
79	509	510	36	44	20	Soil Mixed Boulder
80	510	511	38	42	20	Soil Mixed Boulder
81	511	512	36	44	20	Soil Mixed Boulder
82	512	513	34	46	20	Soil Mixed Boulder
83	513	514	37	44	19	Soil Mixed Boulder
84	514	515	37	44	19	Soil Mixed Boulder
85	515	516	39	44	17	Soil Mixed Boulder
86	516	517	45	35	20	Soil Mixed Boulder
87	517	518	48	32	20	Soil Mixed Boulder
88	518	519	45	35	20	Soil Mixed Boulder
89	519	520	33	47	20	Soil Mixed Boulder
90	520	521	34	45	21	Soil Mixed Boulder
91	521	522	33	46	21	Soil Mixed Boulder
92	522	523	24	52	24	Soil Mixed Boulder
93	523	524	25	50	25	Soil Mixed Boulder
94	524	525	34	45	21	Soil Mixed Boulder
95	525	526	37	45	18	Soil Mixed Boulder
96	526	527	39	42	19	Soil Mixed Boulder
97	527	528	38	44	18	Soil Mixed Boulder
98	528	529	38	43	19	Soil Mixed Boulder
99	529	530	36	44	20	Soil Mixed Boulder
100	530	531	37	43	20	Soil Mixed Boulder
101	531	532	38	41	21	Soil Mixed Boulder
102	532	533	44	37	19	Soil Mixed Boulder
103	533	534	35	47	18	Soil Mixed Boulder
104	534	535	38	45	17	Soil Mixed Boulder
105	535	536	37	46	17	Soil Mixed Boulder
106	536	537	40	42	18	Soil Mixed Boulder
107	537	538	38	43	19	Soil Mixed Boulder
108	538	539	35	45	20	Soil Mixed Boulder
109	539	540	35	45	20	Soil Mixed Boulder
110	540	541	39	42	19	Soil Mixed Boulder
111	541	542	36	44	20	Soil Mixed Boulder
112	542	543	38	43	19	Soil Mixed Boulder
113	543	544	37	44	19	Soil Mixed Boulder
114	544	545	38	43	19	Soil Mixed Boulder
115	545	546	40	41	19	Soil Mixed Boulder
116	546	547	44	37	19	Soil Mixed Boulder
117	547	548	38	42	20	Soil Mixed Boulder
118	548	549	36	43	21	Soil Mixed Boulder
119	549	550	37	45	18	Soil Mixed Boulder
120	550	551	34	45	21	Soil Mixed Boulder

Sr. No.	Chainage		Classification of Soil in %			Soil Classification
	To	From	Ordinary Soil	Ordinary Rock	Hard Rock	
121	551	552	38	42	20	Soil Mixed Boulder
122	552	553	37	44	19	Soil Mixed Boulder
123	553	553.6	43	38	19	Soil Mixed Boulder

### Inspection of Rock Quarry Areas

The availability of the stone in rock quarries & sand quarry are indicated in the map.



The rock deposits are available along or the vicinity of the project road alignment. Besides, cobbles, pebbles and sand deposits are available in the rivers or streams crossing the main alignment. Construction materials for GSB, Cross drainage & Masonry R/Wall etc. works, will be available at local quarry within the project corridor and WMM, DBM & BC material from Tuipui River at Kawlchaw on NH 54 at Km 506 and Liapha on Multi Model Transit Route. Water Absorption and AIV of these quarries are within the limit of the Ministry's Specifications. Bitumen will have to be taken from Guwahati, steel and cement from Aizawl.

Aggregate for sub base, base, surface courses have been collected from the identified rock quarries and rock metal from the crusher under operation in the existing / potential

quarries. The location, estimated quantity and the approximate distance of each quarry from the nearest point on the Project Corridor are compiled below:

### Source of Quarry Material

Sr.No.	Name of Source	Type of Material	Location	Quantity
1	Kawlchaw (R.Kaladan)	Sand, GSB, WMM, DBM, BC & Stone aggregates	On NH 54 at Km 506+650	Plenty
2	Liapha (R.Kaladan)	Sand, GSB, WMM, DBM, BC & Stone aggregates	NH-54 at Km 473+300 on Multi Model Transit Route at 37 Km then 5 km earthen road	Plenty
3	Rulkual Quarry	Masonry Stone ,DBM,BC & Stone aggregates	NH-54 at Km 486+900 on NCV Road at 18 Km surface road	Plenty
4	Thingkah Quarry	Masonry Stone	On NH 54 at Km 469+700	Plenty
5	Paithar Quarry	Masonry Stone	NH-54 at Km 486+900 on NCV Road at 8 Km surface road	Plenty
6	Near Saika Village	Masonry Stone	On NH 54 at Km 483+450	Plenty
7	Near Zero point	Masonry Stone	On NH 54 at Km 517+000	Plenty
8	Near Maubawk village	Masonry Stone	On NH 54 at Km 529+500	Plenty

## 7.2 LABOURS:

Hilly regions are generally sparsely populated. Mizoram is also one of the lowliest populated states of India and population density in the vicinity of the project road is lowest in Mizoram.

Local as well as imported labourers will be engaged for road construction works. Since the area is malaria infested, medical assistance with qualified practitioners will be required during the execution of the project. Comparatively higher wages (from the National average) and incentives have to be paid to labourers for the work. It is envisaged that equipment / machine intensive method would be adopted for proposed construction works.

## 7.3 EQUIPMENT AND MECHANICAL RESOURCES

Taking into account the above factors and to make the construction cost-effective, the activities which can be mechanized to a great extent are given below :

- All earthwork activities to be done by using dozers and graders except earthwork in filling for embankment, which will be very little, can be done manually.
- All rock cutting works to be done by using air-compressors, wagon-drills, etc. Blasting operations to be done by adopting modern blasting techniques.
- Operations like spreading, grading in ordinary soil to be done by using appropriate type of motor graders.
- Dozers with rippers for ripping all types of soft rocks. This would minimize use of compressors and blasting material.

- e) Use of front end loaders for loading operations particularly at quarries and crusher points for increasing the utility of dump-trucks.
- f) Use of water-distributors for proper watering and moisture control of various layers formation filling, sub-base and base activities. Suitable sprinkles to be used for each activity.
- g) Use of suitable type of compactors for various activities.
- h) Centrally operated multi-output primary and secondary crushers to be adopted for operation of large quarries for better gradation, quality and production control. Suitable vibro-screens are also to be used at quarry points for production of natural granular materials to the required gradations.
- i) For bituminous works, hot mix plants, bitumen heating plants, asphalt distributors, spreaders, pavers, gritters and power operated brooms can be usefully deployed.
- j) In large scale concreting works truck mixers can be used. In case of major bridge construction activity at one location, concrete pumps can be used.
- k) For protective works backhoes, berm rollers/plate vibrators can be deployed for controlled excavation and proper compaction.

For the project road, being a trunk route leading to another country, high quality standard required to be achieved in execution of the Work. Therefore, in order to ensure high level of quality control, deployment of modern construction equipment i.e., Hot Mix Plant (HMP – 30/45 TPH), Paver Finisher with Sensor Devise and Vibratory Road Rollers, etc. have been proposed. Minimum requirement of machinery for the project has been listed in Table.

#### **LIST OF PLANT AND MACHINERY**

<b>Sn</b>	<b>Description of Machine</b>	<b>Number</b>
1	Dozer D-50-A 15	2
2	Dozer D-80-A 12	2
3	Hydraulic Excavator of 1 cum bucket	8
4	Front end Loader 1 cum bucket capacity	4
5	Motor grader	2
6	Tipper-5 cum	60
7	Road Roller	2
a	Vibratory RR Compactor	2
b	Tandem Vibratory Roller	2
c	Pneumatic Tyred Roller	2
d	Static Road Roller – 8 -10 tonne	2
e	Vibratory Earth Rammer / Plate Compactor	4
8	Primary & Secondary Crusher with Vibratory Screen (50 TPH)	2
9	Stone Crusher (6/8 TPH)	4
10	Bitumen Pressure Distributor	1
11	Water Bounded Macadam Plant	1
12	Generator Set 160 KVA	2
13	Generator Set 50 KVA	1

14	Generator Set 30 KVA	1
15	Generator Set 11.25 KVA	2
16	Portable Generator Set (1.5 KVA)	4
17	Water Tanker	10
18	Tractor	5
19	Air Compressor	8
20	Mixer for WBM	1
21	Bitumen Pressure Distributor	1
22	Hot mix Plant ( 30/45 TPH)	1
23	Mini Hot mix Plant	1
24	Paver Finisher with Sensor Device	1
25	Bitumen Boiler Oil Fired	1
26	Batch type concrete mixer of min. 200 litres capacity with automatic water measuring system and integral weigher	1
27	Concrete Pump of 30 cum capacity	N/A
28	Concrete Bucket	N/A
29	Prestressing Jack with Pump & Access	N/A
30	Grout Agitator and Pump	N/A
31	Welding Machine Sets	2
32	Oxy-acetylene Torch	2
33	Winch Machines	2
34	Grab Shackles and Clamshell buckets crane operated	1
35	Shear legs	1
36	Heavy duty dewatering pumps	N/A
37	Jack Hammer	2
38	Needle Vibrator	2
39	Plate Vibrator / Screed Vibrator	1
40	Rock Cutter	2
41	Crane of 35 ton capacity	1
42	Plate compactor	4
43	Casting truss for span construction	N/A
45	Work shop	1
46	Testing and measuring equipments for Field Laboratory	1 Lot



## SECTION - 8

### QUANTITIES AND PROJECT COSTS

#### 8.1 General

The cost estimate presented in this Section is based on the detailed proposals given in Section 6. It is envisaged that the project would involve site clearance, construction of new formation in cutting, slope protection works, cross-drainage structures and bridges, pavement and road furniture etc. The detailed cost estimate presented in this report has been worked out using quantities of different items of works derived from the detailed design, drawing and unit rates.

#### 8.2 Estimation of Quantities

In arriving at the quantities, the following items of civil works have been computed for the total length of the road :

- \* Earthwork Works
- \* Slope Protection Works
- \* Culverts Works
- \* Pavement Works
- \* Road appurtenances

Detailed estimate of quantities and costs are presented in “Volume – III: Cost Estimate” of the report. Methodology followed for various items are based on Technical Specifications of Ministry of Road Transport and Highways (MoRTH) for material laying, its quality, measurements, etc. and it has been illustrated in brief in the subsequent paragraphs.

##### a) Earthwork :

Earthwork quantities in cutting and small quantities of filling are calculated by highway design software MxRoad for the entire length of the project road. The formation cutting consists of earth cutting to get a formation width of double lane standard. Through cutting has also been proposed in some locations especially in curves where the existing alignment has been followed to ease the curves while going round spurs. Embankment s has also been proposed at some stretches.

The classification of soil in cutting has been made in three categories :

- # Soil : includes ordinary soil, hard, soil mixed with boulder
- # Ordinary Rock not requiring blasting
- # Hard Rock requiring blasting.

Locations along the road alignment passing along the above given three were noted down during field surveys and total quantities of earthwork in cutting has been worked out accordingly.

##### b) Slope Protection Works :

Quantities for retaining walls, breast walls, parapet walls, toe walls, etc. have been worked out based on the design proposals. Gabion walls have also been proposed at specified locations and quantities have been worked out.

##### c) Culverts & Bridges:

Quantities of culverts and bridges have been worked out for all the stretches of the road based on the structure proposed at each location of cross-stream or river. The proposal also includes quantity for construction of chutes to protect the adjoining areas from further erosion.

**d) Pavement :**

The provision for pavement includes different layers of sub-base, base, and surfacing course as appropriate throughout the whole stretch of the road.

# Granular Sub-base (GSB): 300mm thick sub-base layer of crushed stone aggregate has been proposed. The sub-base course has been extended up to full width of the formation.

# Extra quantities for widening at curves, major and minor junction locations are calculated separately and final quantities are worked out.

#Wet Mix Macadam Base (WMM): 250mm thick base layer of Wet Mix Macadam is proposed for 7.0m width.

#Dense Bituminous Macadam of 100 mm thick and 40mm thick of Bituminous Concrete as surfacing course has been proposed.

**e) Road Appurtenances**

Road appurtenances include provision for road signs and markings, etc.

**8.3 Unit Rates**

The unit rates for arriving at cost of different components of works are based on Mizoram PWD Schedule of Rates 2014 (for National Highways) with 5% escalation to bring it present worth of 2015. For those items of works which are not available in the SOR, separate Analysis of Rates have been carried out and incorporated in this DPR.

**8.4 Construction Cost Items**

For construction of project road, the cost items include various elements, which added together, will give the total cost. The elements of the cost considered for the project are under the following major heads :

- \* Site Clearance
- \* Earthwork
- \* Pavement Works
- \* Slope Protection Works
- \* Culverts Works
- \* Miscellaneous Works
- \* Provisional Sum

Based on the unit rate of various items as per rates adopted as mentioned earlier and quantities calculated, a detailed cost estimate has been prepared under the above mentioned major heads.

## SECTION - 09

### IMPLEMENTATION PROGRAMME AND CONTRACT PACKAGING

#### 9.1 GENERAL

The proposed widening to 2-lane, re-alignment and geometric improvement of NH 54 under this report is from Km 431+00 to Km 562+000 of existing chainage in Mizoram. This road will serve as connectivity between two Southern District Headquarter. The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International trade road between India & Myanmar for economically and culturally. The project road corridor runs through Lunglei , Lawngtlai & Saiha District. The area is mountainous and steep. It is single lane road with formation width about 6.5 m without conforming any standard / specification.

It will serve one of the major routes for southern belt of Mizoram. Up-gradation of the existing road, having formation width of about 6.50m, to a formation width of 12.0m, construction of pavement work for the entire length, culverts and permanent works at essential places, widening and improvement of blind curve portion, realignments at the portions where steep gradients have to be avoided, construction of pucca side drains, and installation of traffic/informatory sign and Kilometre.

The alignment passes through steep mountainous terrain and crosses deep gorges, streams and rivers at many locations all throughout the entire length. The entire project area experiences very heavy rainfall averaging about 2540.00 mm per year. The monsoon period also lasted about 5 to 6 months starting from May to October in a year. The available working season is very limited and is at most not more than 7 months in a year. The remaining 5 months period of the year is not suitable for working due to monsoon rain.

#### 9.2 CONTRACT PACKAGING AND PROCUREMENT STRATEGIES

The entire length of the proposed widening to 2-lane, re-alignment and geometric improvement, pavement, permanent work, road safety measures, road furniture etc is proposed to be in single packages.

Procurement of various construction materials will be within the state as well as from other state too. Cement, steel for permanent work and bitumen will be from Aizawl and Guwahati respectively. The remaining construction material is available locally.

**The whole project is divided into three packages as given below.**

Package No	Package description		Length (km)		Remarks
	From	To			
Package-1	431.00	476.00	46.92		Including 1.92Km length of Lawngtlai Bye Pass.
Package-2	476.00	515.00	39.00		This package started from end of Lawngtlai City to Zero Point, which branching point of NH54B.
Package-3	515.00	553.60	38.60		This package started from Zero Point to Tuipang.

The implementation of the project is proposed to be taken up through capable contractors through national competitive bidding adopting Ministry's Standard Bidding Document prescribed and approved for MORT&H works which will facilitate selection of experience and capable contractors.

### 9.3 IMPLEMENTATION STRATEGIES

The total cost of the project which covers costs for formation work, Slope protection and cross drainage works, construction of bridges and pavement works. Construction period of 48 months has been proposed, considering the quantum of activities to be performed including mobilization period needed and four intervening rainy seasons in between.

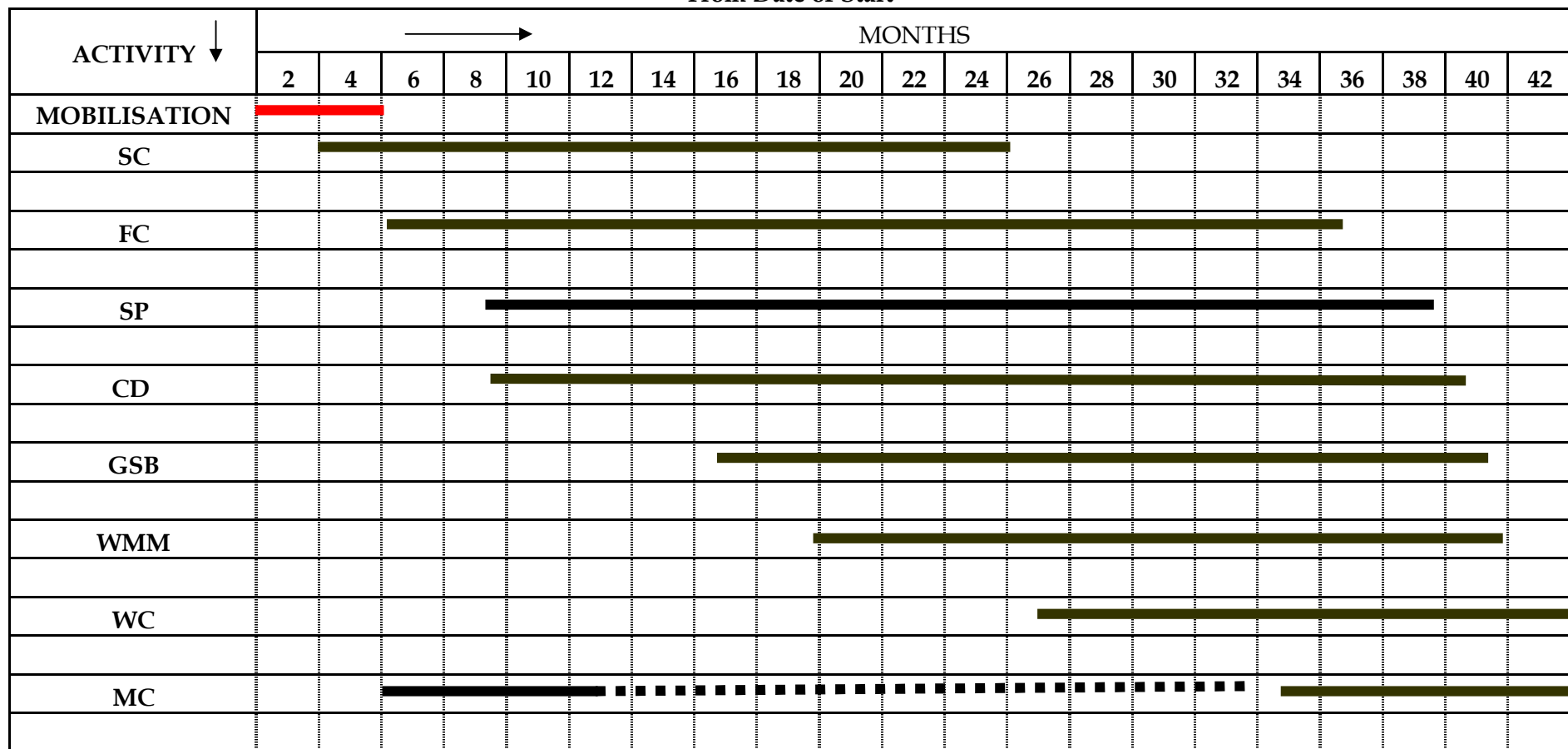
The project is proposed for commencement during the financial year 2016-2017 with target completion by the year end of 2019-2020. Since the project will be executed through a period of four years there will be cost escalation during the period of construction. Considering the rate of price escalation at an average rate of 5% per annum compounded annually after the initial year, the cost of construction and physical and financial phasing of the project is given in the table below:

Sr.No	Year	Cumulative Physical Target (%)
1	2016 -17	15
2	2017 -18	45
3	2018 -19	80
4	2019 - 20	100

Depending on the time usually taken for according necessary sanction by the Ministry, it may be possible to commence the Construction of the project by beginning of 2016 i.e. by April/2016. The projected implementation schedule is given in the form of Bar Chart in the next page.

# IMPLEMENTATION SCHEDULE (ROADS)

From Date of Start



SC = Site Clearance  
 CD = Cross Drainage Work  
 FC = Formation Cutting  
 GSB = Granular Sub Base

WMM = Wet Mix Macadam  
 WC = Wearing Coat  
 MC = Miscellaneous  
 SP = Slope protection work

## SECTION - 10

### 10.1 MAINTENANCE OF EXISTING ROAD:

The proposed widening to 2-lane, re-alignment and geometric improvement of NH 54 under this report is from Km 431+00 to Km 562+000 of existing chainage in Mizoram. This road will serve as connectivity between two Southern District Headquarter. The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International trade road between India & Myanmar for economically and culturally. The project road corridor runs through Lunglei, Lawngtlai & Saiha District. The area is mountainous and steep. It is single lane road with formation width about 6.5 m without conforming any standard / specification.

It will serve one of the major routes for southern belt of Mizoram. The minimum construction time provided for completion of the project is 3.5 (four) years during which maintenance by the PIU will be no longer convenient as the site possession is resorted to hand over to the contractor till completion of the project. Under this circumstance, it is inevitable to keep provision for yearly maintenance of the existing road during construction and hence a provision of Rs. 78.60 lakhs per year is kept to make the road payable for all type of vehicles without serious interruption of the traffic flow throughout the year.

### 10.2 SCOPE OF MAINTENANCE:

- 1) Maintenance of Earthen Shoulder (filling with fresh soil).
- 2) Filling Pot- holes and Patch Repairs with open - graded Premix surfacing, 20mm.
- 3) Hill Side Drain Clearance.
- 4) Land Slide Clearance in soil.
- 5) Clearing Grass and Removal of Rubbish.
- 6) Maintenance/repair of culvert/Retaining wall.

### 10.3 DIVERSION OF EXISTING ROAD DURING CONSTRUCTION

For improvement of existing road some stretches localized, relocation and re-grading are proposed .Due to which traffic movement on existing road will be hampering.

- 1) Formation cutting for diversion of existing road (6.0 m wide).
- 2) Sub-base course level 100 mm thick GSB Gr-1
- 3) Base course level 150 mm thick CTB
- 4) Wear course 20 mm thick MSS
- 5) Earthen shoulder.

### 10.4 SCOPE OF DIVERSION OF EXISTING ROAD DURING CONSTRUCTION :

- 1) Maintenance of Earthen Shoulder (filling with fresh soil).
- 2) Filling Pot- holes and Patch Repairs with open - graded Premix surfacing, 20mm.
- 3) Hill Side Drain Clearance.
- 4) Land Slide Clearance in soil.
- 5) Clearing Grass and Removal of Rubbish.
- 6) Maintenance/repair of culvert/Retaining wall.
- 7) Clearance of culvert before monsoon
- 8) Removal of land slide