



Government of India

Ministry of Road Transport & Highways

National Highways Infrastructure Development Corporation Ltd.

Consultancy Services for preparation of Detailed Project Report for development of NH-54 from Km 0.0 to Km 125.0 in Mizoram to 2-lane Standards Under Phase 'B' of SARDP-NE_Package-1

FINAL DETAILED PROJECT REPORT

VOLUME - IV

Environmental Assessment Report, EMP & RAP

December, 2015



Archtech Consultants Pvt. Ltd.

11, Shakespeare Sarani
Kolkata - 700 071

CONTENTS

Chapter No.	Item	Page No.
ES	Executive Summary	ES-1 to ES-2
1	Introduction of the Project	1-1 to 1-3
2	Project Description & Legal Framework	2-1 to 2-21
3	Baseline Environmental Set up	3-1 to 3-24
4	Anticipated Environmental Impacts & Mitigation Measures	4-1 to 4-23
5	Environmental Management Plan and Institutional Arrangement	5-1 to 5-20
6	Environmental Monitoring Plan	6-1 to 6-11
7	Environmental Budget	7-1 to 7-4
8	Resettlement and Rehabilitation Budget	8-1 to 8-6

Executive Summary

EXECUTIVE SUMMARY

Widening and Upgradation of road shall have some direct impact on environment. It is necessary to undertake Environmental Impact Assessment study for the proposed project to assess the potentially critical impacts of the project on environment in order to suggest the mitigate measures. The objectives of the present Environmental Impact Assessment study are -

- 1) To establish the existing environmental settings of the project area through generation of primary data and collection of secondary data,
- 2) To evaluate potential environmental impacts from the project during pre-construction, construction and operational phases and identify appropriate mitigation measures,
- 3) To prepare an effective Environment Management Plan and to propose an Institutional Framework.

The existing environmental setting has been assessed from two perspectives, regional and local. The regional environment has been defined as a corridor of 15 km on either side of the proposed project road, while the local setting pertain to the environmental features within and adjacent to the ROW.

The Examination for "EIA/EMP for 2 - laning of NH-54 from Aizawl to Keitum has been carried out.

Road projects are generally undertaken to improve the economic and social welfare of those using the road or served by it. Increased road capacity and improved pavements can reduce travel times and lower the costs of vehicle use. Benefits include increased access to markets, jobs, education and health services, and reduced transport costs for both freight and passengers, reduce fuel consumption and exhaust emissions from the vehicle plying on the road.

The main objective of environmental screening of the proposed project is the early determination of the potential magnitude of environmental impacts due to the proposed widening of the project road.

The section of the project road (NH- 54) from the starting point at Aizawl (Km 0) to Keitum (Km 125) having a length of 125 Km is in the state of Mizoram. The project corridor lies in Seismic Zone V. Socio economic profile of the state of Mizoram along the project corridor is likely to be influenced by the widening of the road to 2 lane standard. In the meeting on 07.08.14 taken by chief Engineer (NER) / MORT&H in New Delhi it was requested to carry on the DPR work from 8.000 Km to 125.000 Km .The Draft Project Report , therefore , has been recast accordingly.

The maximum average temperature in the summer in Mizoram is 30°C, while in the winter the minimum average is around 11°C. The four months between November and February are winter time in Mizoram, which is followed by the spring. The three months from June to August are known as the rainy season. The climate is at its moderate best in the two autumnal months.

Rainy season is from May to September. The average rainfall is 250 cm per year. September and October, when the temperature moves between 19°C to 25°C.

The following environmental features are noteworthy.

- Around 15 Km of the project areas no Protected areas, National Parks, Wild life Sanctuaries Biosphere Reserve Marine Parks are found. Some wet lands or catchment areas are noticed. But there is a Planted Forest at 25th km of NH- 54 on either side of

River Tuirial. There are also some plantations (both private and Govt.) on either side of the road. Tawi Wild Life Sanctuary (60 Sq.km) is located 62 Km away from the Highway. Presence of wild animals like Tigers, Elephants, Black Bears, Bison, Langurs, Porcupines, Mongoose etc. have been reported in the jungles/sanctuary

- There are no critically polluted areas listed by Central Pollution Control Board.
- No State or International boundaries exist within 15 km of either side of the Highway.
- There are no eco sensitive zones around 15 Km of the project area.
- There is no mangrove vegetation around the site and no endangered species are found.
- The site does not have any history of Industrial pollution and so no question of any penalties levied by the Pollution Control Board.
- There are no fishing Villages around 15 Km of the site.
- There is no salt water intrusion, flooding due to sea level rise and climate change.

In the local settings, monitoring data for air, quality, water quality and noise quality have been recorded.

Infrastructure improvement associated with road projects invariably provides positive socio-economic benefits. However, the road project can produce complex negative impacts during the construction and operation stages. Since the proposed road works involves mainly widening and improving the existing road, the overall environmental and social impacts will be low. Impacts during both construction and operation phases are considered.

During up gradation of road from single lane to 2 lane standards 16992 trees of different species out of 23,596 trees shall have to be felled. Accordingly 51,000 trees shall have to be planted. In the EMP specific mitigation measures for the impacts identified are presented along with the organizations that will be responsible for implementing and monitoring the requisite measures. Environmental Management Plan associated with the following four broad categories of activities:

- ✓ Construction of road and associated structures
- ✓ Construction materials procurement storage and handling
- ✓ Construction and operation of project camps/compounds
- ✓ Operation phase

Total tentative cost calculated for implementation of EMP is in the tune of Rs. 1382 Lakhs including environmental monitoring during construction phase and operational phase. The cost of such programmes may be shared by the MORT&H, Government of India, and Mizoram Pollution Control Boards.

As regards, the Rehabilitation Action Plan (RAP), this has been prepared to mitigate all unavoidable negative impacts caused due to the Project, resettle the displaced persons and restore their livelihoods. The full resettlement Plan has been prepared on the basis of census survey findings and Consultation with various stakeholders. Adequate attention has been given during feasibility and detailed project design phases of project preparation to minimise adverse impacts on land acquisition and resettlement impacts. With available options, best engineering solutions have been adopted to avoid large scale land acquisition and involuntary resettlement impacts. The plan complies with JICA policy for involuntary resettlement and rehabilitation. The total cost of R&R come to 10,574 Lakhs.

Chapter - 1

Introduction of the Project

CHAPTER - 1

INTRODUCTION OF THE PROJECT

MORT&H has been entrusted with the task of development, maintenance and management of National Highways. The programme essentially envisages strengthening, widening and upgrading of National Highways.

As a part of this programme, Archtech Consultants Pvt. Ltd (ACPL) has been awarded by MORT & H the work of consultancy Services for preparation of Detailed Project Report for widening the existing single/intermediate lane road to 2 lane configurations from Aizwal to Keitum (NH-54) and strengthening of the existing road. The letter to proceed with the work is RW/GHT/N.54 (1)/MZ/2009dt 28.05.09 issued by RO, Guwahati /MORT&H.

Mizoram, a state of India is unique in character as a border state with two international boundaries on its eastern and western fronts with the neighboring countries of Myanmar & Bangladesh respectively. Mizoram, as such, enjoys a very special status from the point of view of strategic importance.

NH- 54 is the vital road corridor of the state of Mizoram linking its capital Aizawl to Tuipang point. The road was taken over by Border Roads Organization, when it was a single lane road. It was widened to intermediate/two lane in places. In order to cater to the present day needs, improvement of this strategically important road was over due. This route is also very important from the point of view of tourist attraction to the state of Mizoram.

1.1 Project Objective

Road projects are generally undertaken to improve the economic and social welfare of those using the road or served by it. Increased road capacity and improved pavements can reduce travel times and lower the costs of vehicle use. Benefits include increased access to markets, jobs, education and health services, and reduced transport costs for both freight and passengers, reduce fuel consumption and exhaust emissions from the vehicle plying on the road.

The main objective of environmental screening of the proposed project is the early determination of the potential magnitude of environmental impacts due to the proposed widening of the project road.

1.2 Project Approach

The basic approach adopted for conducting the environmental study for the project will closely follow the prevailing institutional and legislative setup of the Government of India (GoI) and in conformity with MORT &H policy on this subject. The main approach are-

- ✓ Identification, assessment and distinction between positive and negative impacts, direct and indirect impacts, and immediate and long-term impacts likely to result from the proposed project;
- ✓ Identification of unavoidable or irreversible impacts;
- ✓ Description of the impacts quantitatively, in terms of environmental costs and benefits, if possible;

- ✓ Characterization of the extent and quality of available data;
- ✓ Identification of significant information deficiencies;
- ✓ Identification as well as estimation of any uncertainties associated with predictions of impacts;
- ✓ Identification of un-mitigated negative impacts;
- ✓ Exploration towards the opportunities for environmental enhancement; and
- ✓ Identification of feasible and cost effective mitigation measures to minimize negative impacts and enhance positive impacts by incorporating in the preliminary engineering design.

1.3 Project Location

The section of the project road (NH- 54) from the starting point at Aizawl (Km0) to Keitum (Km 125) having a length of 125 Km is in the state of Mizoram. The project corridor lies in Seismic Zone V. Socio economic profile of the state of Mizoram along the project corridor is likely to be influenced by the widening of the road to 2 lane standard.

In the meeting on 07.08.14 taken by chief Engineer (NER) / MORT&H in New Delhi it was requested to carry on the DPR work from 8.000 Km to 125.000 Km .The Draft Project Report , therefore , has been recast accordingly.

1.4 Project Methodology

There are several steps involved in preparation of EIA / EMP report. The steps are right from reconnaissance survey to data generation to data analysis to prediction of impacts. The different steps that should be taken in preparation of EIA/EMP report are as follows.

1. A *preliminary review or reconnaissance survey* has to be carried out along the project corridor in order to decide the kind of survey to be taken up and what key impacts, issues and alternatives to be consider.
2. Relevant *parameters (primary data)* are selected for describing the environmental component and gauging the impacts of the project, which are not readily available for the area. These includes – ambient air quality, noise levels, water quality – surface and ground, road condition, traffic levels, tree inventory along the project corridor, road side amenities, cultural and historical details, etc.
3. Collection of *secondary information* from appropriate sources. These include geology, geohydrology, geomorphology, soils, meteorology, flora and fauna, forest cover, agricultural activities, drainage congestion, etc. The aim of primary data generation and secondary data collection is to assess the value of the baseline environment; provide data needed to predict likely changes resulting from the proposed development; and provide a baseline for monitoring the components during and after construction of said road.
4. The results of the baseline survey are analyzed, and *description and evaluation of the baseline environmental systems* has to be carried out.

5. The *proposed project and alternatives* has to be described in relation to the environmental components.
6. Potential *impacts of the project on the component* will be predicted and evaluated. These may include – direct (primary) impacts; indirect (secondary) impacts and All such impacts may be positive or negative, short, medium, or long term, reversible or irreversible, and permanent or temporary.
7. *Mitigation measures* have to be proposed to avoid or minimize the adverse impacts of the project and at the same time proposed the enhancement proposals.
8. An environmental management plan will be prepared as part of the EIA. The environmental management plan will identify all mitigation and impact minimization measures during and after the construction period. Management plan will also be addressed the during construction and operation phase monitoring programme.

Structure of the Report

Chapter 1: Introduction, Project Objective, Project Approach, Project Location, Project Methodology.

Chapter 2: Project Description and Legal Frame Work.

Chapter 3: Baseline Environmental Set up

Chapter 4: Anticipated Environmental Impacts and Mitigation Measures.

Chapter 5: Environmental Management Plan and Institutional Arrangements.

Chapter 6: Environmental Monitoring Plan

Chapter 7: Environmental Budget

Chapter 8: Resettlement and Rehabilitation Budget

Chapter - 2

Project Description & Legal Framework

CHAPTER - 2

PROJECT DESCRIPTION & LEGAL FRAMEWORK

2.1 EXISTING SCENARIO

2.1.1 GENERAL

The Project Road under cover of the Consultancy Services for Feasibility Study and Detailed Project stretches from Aizawl (Km 0.00) to Keitum (Km 125.00) in the state of Mizoram of NH-54.

The road is being maintained by BRO.

The road is intermediate / single lane and at some places it is even less. Due to rapid growth of tourism industry in Mizoram and insufficient lane width, there is a need for improvement / widening of this road.

This road will also carry traffic from Myanmar in near future.

The project road falls in the districts of Aizawl & Serchhip in the state of Mizoram. The road is fully in hilly terrain having hills on left. The road has lot of sub-standard curves including hairpin bend. As per the provisions of TOR and Design Standards as adopted, Deficiencies of the existing geometrics and sub-standard curves have been improved to the extent possible to match NH standard specified for hill road relevant to hilly terrain.

2.1.2 TOPOGRAPHY

This stretch of road runs along the foothills of Lusai Mountain, which is quite young and has typical character of varied composition and stability problems of slides and sinking. Major part of the road is situated in the hilly terrain. The entire road runs through the high rainfall region. Because of topography and terrain, innumerable Jhoras have crossed the road at various locations.

The road is located between longitude 92-20° E, and 93°29' E, and latitude 20.20° N and 24.27° N. The existing road is mainly an intermediate / single lane highway having formation width ranging from 6m to 8m and carriageway width varying between 3.66m to 7m with roadside drain on the hillside. At places, the drains on the hillside are not lined. The overall condition of the drains is fair.

2.1.3 ENVIRONMENT AND LAND USE

It lies within the high rainfall areas with lot of trees and vegetation growth along the road. The maximum rainfall takes places during the months from May to September. The configuration of mountains also has an impact on the strong moisture laden monsoon wind and causes variation in rainfall. The average annual rainfall is 2540 mm/year.

The Climate in this region is generally cool and is cold during winter months.

All along the road, lot of matured trees of various girth have been found abutting the road. Many of these trees need to be felled to accommodate the widening scheme of 2 lane carriageway. Environmental screening around the project road has been carried out in details as per norm.

2.1.4 RIGHT OF WAY (ROW), BUILT-UP AREAS & ENCROACHMENT

The ROW from Aizawl (0 Km) to Keitum (Km 125.0) in the state of Mizoram is varying. This information regarding ROW has been verified from BRO, Project Pushloak. They have reported that average ROW is 36.58m. But this is not so. There are some built-up areas like semi-urban/villages spread over the length of the project road and limited stretches of the road also pass through agriculture area. The important semi-urban/villages in this stretch are listed below.

Sl. No.	Name of urban / semi-urban / villages	Existing Km.
1	Bawangkawn	02-03
2	Thuampui	05
3	Zemabawk	06, 07, 08
4	Tuirail	25
5	Seling	40, 41
6	Thingsulthliah	45, 46
7	Darlawng	57
8	Tlungvel	59, 60
9	Phulmawi	65
10	Khumtung	67
11	Chingchip	81, 82
12	Chhishtlang	99, 100
13	New Serchhip	107, 108
14	Serchhip	110, 111, 112
15	Keitum	125

2.1.5 CARRIAGEWAY & PAVEMENT

The existing road surface was fair to good with places of visible pavement distress. Recently, BRO has taken up the work of new bituminous surfacing. The carriageway width varies between 3.66m and 7.00m with average pavement thickness of 350mm comprising one layer of hill slope materials used as granular sub-base of thickness 150mm, WBM 200mm and bituminous P.C. layer of 25mm thick on top of it. The Road Inventory and Pavement condition Survey have also been carried out as per norms and are furnished.

The average CBR of sub-grade soil varies from 6% to 10%. For design of overlay on the existing pavement Benkelman Beam Deflection Technique has been used. The field data and analysis thereof have been used for the purpose of pavement design. The findings are as under:

On Existing Pavement	On New / Widened Pavement
<p>Overlay:</p> <p>BM = 75 mm</p> <p>DBM = 50 mm</p> <p>BC = 50 mm</p>	<p>GSB = 230 mm</p> <p>WMM = 250 mm</p> <p>BM = 75 mm</p> <p>DBM = 50 mm</p> <p>BC = 50 mm</p>

2.1.6 PROTECTIVE WORK AND ROADWAY DRAINAGE

RETAINING WALLS & BREAST WALLS

The stretches of the hill by the side of the road consist of soft rock, ordinary soil mixed with boulder. The hill slopes are protected by Breast Walls and Retaining Walls of varying heights on hillside to protect the hill face and ensure stability of hills. On the valley side, protection of the bench is done by the retaining walls of different heights and also to maintain the proper geometrics of the road. The Inventory and Condition Survey of Breast & Retaining Walls are furnished.

DRAINAGE

Site reconnaissance and Investigation at the site indicate very little drainage problem of the roadway surface in the rural areas, except in the built-up areas, where the drainage condition is poor. In some of the built up areas, roadside drains have been provided, but their drainage capacity is not adequate. In some of the built-up areas, proper drains have also not been provided causing local drainage problem and associated distress of the pavement surface.

In tune with the topography and terrain, roadside drains have been provided on the hillside will be dismantled. Provision has been made for construction of new drains on the hillside of the widened roadway. Since drainage is one of the most vital and important components of hill roads, due care has been taken to provide adequate drains with suitable outlet into the cross-drainage structure including protective works on the valley face, as required. The data regarding Inventory & Condition survey of drains have been included.

2.1.7 BRIDGES & CROSS-DRAINAGE STRUCTURES

The project stretch comprises of Aizawl to Keitum (Km 0.00 to Km 125.00). In all, there is one major bridge and there are 464 nos culverts of different size in this stretch. Inventorisation and condition survey of these cross-drainage structures have been done by a team of experienced Bridge Engineer and Hydrologist and the reports have been furnished. The conditions of the bridge is, in general, satisfactory and no major distresses in the bridge has been noticed during the condition survey. The structures are as under:

Major Bridge	-	1
Slab Culverts	-	28
Box Culverts	-	200
H. P. Culverts	-	236

2.1.8 TRAFFIC

Various types of Traffic Surveys as outlined by NHAI in the T.O.R. and indicated / detailed by Consultant in the Quality Assurance Plan have been undertaken during August 2009.

Types of Surveys:

Classified Traffic Volume, O-D, Axle Load, Speed & Delay, Turning Count, Truck Terminal, Pedestrian Counts etc. have been undertaken and analysed.

The Highway:

The total project road is from Aizawl to Keitum. For the purpose of homogeneity of development & assessing traffic thereof, the project has been divided into two homogeneous sections:

- a) Section I - Km. 0.00 to Km. 42.00 - 42 Km
- b) Section II - Km. 42.00 to Km. 125.00 - 83 Km

Classified Traffic Volume:

This mid-block count survey has been undertaken at 4 places as detailed below:

- i) Zemabawk (Km. 7.10)
- ii) Seling (Km. 40.20)
- iii) Serchhip (Km. 109.80)
- iv) Keitum (Km. 124.30)

For this stretch of Road, results of traffic survey in the Section – I & II has been reproduced below:

Mid Block Count

Classified Traffic Volume Count

Classified Average Daily Traffic in Number

Homogenous section	Count station ID	Weightage	Fast Moving Vehicle								Slow Moving Vehicle			Total vehicles	Commercial vehicle per day
			Two wheeler	Three wheeler	Car / Jeep / Van / Taxi	LCV	Bus	Truck	Agri tractor	Total	Cycle	Cart	Total		
HS-01	MB-01	0.500	642.857	3.857	1464.571	341.286	577.000	361.571	0.000	3391.143	0.286	3.571	3.857	3395.000	1279.857
	MB-02	0.500	361.571	311.000	867.429	261.286	71.000	197.429	0.000	2069.714	19.857	92.286	112.143	2181.857	529.714
	Weighted average		502.214	157.429	1166.000	301.286	324.000	279.500	0.000	2730.429	10.071	47.929	58.000	2788.429	904.786
HS-02	MB-03	0.500	244.714	116.571	423.714	186.286	91.429	292.429	0.429	1355.571	1.571	0.000	1.571	1357.143	570.143
	MB-04	0.500	83.000	16.000	271.286	118.429	46.571	133.429	0.000	668.714	2.286	39.000	41.286	710.000	298.429
	Weighted average		163.857	66.286	347.500	152.357	69.000	212.929	0.214	1012.143	1.929	19.500	21.429	1033.571	434.286

Classified Average Daily Traffic in PCU

Homogenous section	Count station ID	Weightage	Fast Moving Vehicle								Slow Moving Vehicle			Total vehicles
			Two Wheeler	Three wheeler	Car / Jeep / Van / Taxi	LCV	Bus	Truck	Agri tractor	Total	Cycle	Cart	Total	
HS-01	MB-01	0.500	321.429	3.857	1464.571	511.929	1731.000	1084.714	0.000	5117.500	0.143	10.714	10.857	5128.357
	MB-02	0.500	180.786	311.000	867.429	391.929	213.000	592.286	0.000	2556.429	9.929	276.857	286.786	2843.214
	Weighted average		251.107	157.429	1166.000	451.929	972.000	838.500	0.000	3836.964	5.036	143.786	148.821	3985.786
HS-02	MB-03	0.500	122.357	116.571	423.714	279.429	274.286	877.286	1.929	2095.571	0.786	0.000	0.786	2096.357
	MB-04	0.500	41.500	16.000	271.286	177.643	139.714	400.286	0.000	1046.429	1.143	117.000	118.143	1164.571
	Weighted average		81.929	66.286	347.500	228.536	207.000	638.786	0.964	1571.000	0.964	58.500	59.464	1630.464

The projected design traffic for flexible pavement after 10 yrs, 15 yrs & 20 yrs are 9.00 msa, 16.00 msa & 25 msa respectively.

2.1.9 GEOMETRIC FEATURES AND DEFICIENCIES

Geometrics of the existing road from Aizawl to Keitum (Km 0.00 to Km 125.00) does not fully match with the NH standard relevant to hill roads. Over the entire stretch of 125 Km of road, the degree of curvature is around 614°/Km. (In HS-01 it is 553°/Km & HS-02 it is 675°/Km.)

The existing road constructed long back was widened to present day width in stages without much improvement of geometrics. As such, the road has several geometric deficiencies with respect to present day NH standards i.e. deficient reversal of superelevation corresponding to minimum design speed of NH specified in IRC:52-2001.

In places of reverse curves, proper space needs be provided to accommodate reversal of superelevation for safe and comfortable journey. The deficient curves have been corrected as far as possible while finalizing the horizontal alignment for 2-laning. In certain cases some realignments and Bypasses have been proposed for easing deficient curves.

2.1.10 SLIDING/SINKING AREA

Border Roads Organisation (BRO), who are in charge of maintenance and improvement of the instant project road from Aizawl to Keitum, have since then identified two major slide areas along the project road and have got geological investigations done through the organizations like GSI and CRRI to find out long term solution to the perennial problem of slides. The brief history and causative factors, as identified, are enumerated in subsequent paras :

Sinking / Sliding areas at Km.13-14 & Km.61-62 : Causative factors :

- Adverse Slope Morphology (Slope greater than 60^0);
- Weathered and fractured interbonded rocks;
- Decrease in shear strength of the rocks due to ingress of water through cracks & fissures and subsequent change of pore pressure;

2.1.11 UTILITIES, ROAD FURNITURE AND TRAFFIC SIGNS

UTILITIES

There are various utilities of different nature all along the project corridor. Those falling within the proposed widened corridor need be shifted / relocated properly, so that the road can be widened without hindrance. The utilities like Electric Posts, Telephone Posts, Light Posts, Optical Fibre Cable and Transformer etc. required to be shifted. They have been shown in Relocation drawing.

ROAD FURNITURE

There are bus stops all along the road at the specified points for the buses, which ply regularly from Aizawl to Keitum. Some Bus Bays and Truck Lay Bys have been proposed in addition.

SIGNAGES & CAUTIONARY BOARDS

The signages and information/cautionary boards are existing along the project road. These are, however, inadequate considering NH standards and the more need for safety on hill roads. The increases numbers have been provided in BOQ.

2.2 WIDENING PROPOSAL

2.2.1 IMPROVEMENT PROPOSAL

The existing project road NH-54 from Aizawl to Keitum is generally having 7.00m/5.50m/3.66m wide carriageway for almost the entire length. Widening of the existing road to 2-lane standard has been done from Km 8.000 to Km 125.000 including Bypasses & realignment.

2.2.2 CROSS SECTIONAL FEATURES

Since the project road is situated in hilly terrain, the different elements have been provided giving due consideration to the topography, existing site constraints keeping in view the provisions of IRC:52-2001 applicable for Hill Road :-

(2-lane Road with Soft Shoulders)

i)	Parapet on the valley side	1×0.450	-	0.450mm
ii)	Unpaved shoulder adjoining parapet	1×1.100	-	1.100mm
iii)	Paved shoulder	2×1.500	-	3.000mm
iv)	Main Carriageway		-	7.000mm
v)	Hill side drain	1×0.450	-	0.450mm
	Total Roadway Width			12.000mm

2.2.3 BRIDGES AND CROSS DRAINAGE STRUCTURES

In the project length the numbers are as under :

Major Bridge	-	1
Slab Culvert	-	28
Box Culvert	-	200
H.P. Culverts	-	236
Causeway	-	1

1.2.3.2 RECONSTRUCTION OF BRIDGES

There is no such case.

Reconstruction of a bridge on a hill road is a difficult and in some cases an impartial task. Apart from cost involved, the three stages of reconstruction viz. provision of a suitable diversion, dismantling of the existing bridge and finally completing the new construction, will create prolonged disruption of road service. This road being the life-line to Mizoram, maintenance of traffic movement is of paramount importance and must be given due consideration.

1.2.3.3 CULVERTS

There are 464 nos culverts in this Section. All the HP culverts require replacement while the remaining ones have to be dismantled & reconstructed to match with the 2-lane road width.

Additional Measures

It is proposed to provide some additional Box culverts at suitable locations in order to cater to the drainage congestion likely to occur in future. This, along with suitable and adequate drainage facilities, will certainly help in reducing the occurrence of land slides in hill / valley faces and also sinking of the road surface.

2.2.4 GEOLOGICAL REPORT ON FEASIBILITY

The folded structure of the Mizoram ranges are at the junction of two moving tectonic plates, (Indian and Burmese Desi Kachar 1974). The folded hilly or mountainous North South belts, with perpendicular faults, comprise sediments of the Surma, Barail, Tipam groups and Aluvium in river beds consisting of deposits of argillaceous and arenaceous sandstones, shale, siltstones and mudstones and greywacke. The rock system is weak unstable, weathered and prone to seismic and weather influence producing landslides. The soft, black to grey rock is used locally for building materials and for low trafficked road construction work. There are no useful minerals of economic significance apart from clays in the River Tlawng beds.

Typical soils are sandy loam, clay loam that have been heavily leached due to the high slopes leaving it porous and lacking in minerals or humus.

A number of oil and gas exploration activities have taken place due the geographical condition with which Mizoram has been formed, leading to the possibilities and high expectation that reserves would be confirmed. France, Russia and Cyprus as well as several Indian companies have already signed a 12% oil and 10% gas royalty arrangement with proceeds going direct to Mizoram state on any production (April 2009).

2.2.5 SOIL AND MATERIAL INVESTIGATIONS

The soil and material investigation work on existing pavement subgrade was performed along the highway from km 0.00 to km 125.00 of NH-54. The investigations were performed by conducting in-situ tests and supplemented by Laboratory tests. Field data for condition survey of Shoulder and Embankment are furnished.

The in-situ tests consisted of determination of density of the subgrade soil and the corresponding field CBR values as determined by DCP tests based on TRRL method. The laboratory tests were performed on bulk soil samples as collected from each test pit locations. The tests in the laboratory consisted of determination of particle size distribution and atterberg limits, modified proctor density tests and related CBR values.

In addition to above, borrow materials such as fine and coarse aggregates were tested in the laboratory for evaluation as to their suitability for use in construction of the proposed highway.

In general test data reveal that the in-situ field dry density at the existing pavement subgrade varies in the range of 1.52 to 1.89 gms/cc and the corresponding CBR values are in the order of 8% to 13% based on field DCP tests, whereas the laboratory CBR values vary in the range of 6% to 10% in 4-days soaked condition. However, 7% CBR value has been adopted.

2.2.6 IMPROVEMENT OF GEOMETRICS

While designing the horizontal alignment due consideration has been made to adopt the design standards already specified elsewhere. Based on the design standards adopted for steep terrain the deficient curves have been improved to NH standard as far as possible. As it appears that the existing curvature is high i.e. 553⁰/km in HS-01 & 675⁰/km in HS-02. The project corridor being in hilly terrain, these were improved much and this attracted some hill cutting.

In a meeting the CE/NH/Mizoram on 10.02.10 in his chamber, the question of a bypass of Aizawl was discussed. The proposal of CE/NH could not be covered in this Agreement. However, in a meeting taken by CE(NER)/MORT&H on 07.08.14 in New Delhi, it was decided that DPR may be done from km 8.000 to km 125.000 to avoid Aizawl Bypass.

2.2.7 JUNCTIONS

There are in all 04 nos. important road junctions along the total length of the project road of NH-54. These junctions will be improved to the extent possible in accordance with the relevant I.R.C. standards for smooth flow of traffic.

2.2.8 TOLL PLAZA

There is no such case.

2.2.9 TRUCK LAY BYES

In a hilly terrain due to site constraints as well as on consideration of safety of vehicles parking of heavy vehicles like trucks are not permitted to park anywhere except at specified locations. In the instant package truck lay bye has been proposed at 7 km away from Aizawl towards Silchar in the outskirts of town and near end of Serchhip Bypass at 114th existing km.

2.2.10 BYS BAYS

There is no such case. But there will be three Bus Bays at the following places

- i) Existing km 10.000 (Near Zemabank)
- ii) Existing km 38.250 (Near Seling)
- iii) Existing 97th km (Near Serchip)

2.2.11 RETAINING WALLS & BREAST WALLS

In the existing road, Breast Walls and Retaining Walls have been found to exist at many places. The condition of existing breast walls is generally fair to good. Retaining Walls, wherever existing, are found to be fair. Since the road will be widened on the hill side only, all the breast walls will have to be dismantled to facilitate hill cutting. In the locations, where breast walls have already been provided, the hill abutting the road was found to consist of soft disintegrated and weathered rock, ordinary soil mixed with boulders.

Suitable breast walls of adequate dimension have been proposed to be erected to protect the hill slope on consideration of stability.

2.2.12 SHIFTING OF UTILITIES

All the electric / telephone poles and lines including underground OFC lines within the existing ROW will be shifted as per guidelines given in IRC: 98-1997. Proper headroom for crossing of HT lines will be kept. The relocation strip plan is prepared for the purpose of submission as per provision of TOR.

2.2.13 Road furniture

Traffic safety is the most important part in geometric design. Drivers of all categories as well as other road users must be informed well ahead of time regarding compulsion they have to maintain for their own as well as others' safety, the necessary information to satisfy their query relating to locality, distance covered, distance of important places ahead, distance of destination, directions showing adjacent areas etc.

Traffic Signs:

Traffic signs of the following categories (i) Mandatory, (ii) Cautionary and (iii) Informatory types have been assessed to meet the site conditions and provision has been made for retro reflective type as per IRC:67 and ISTM Std E:810 standard in the cost estimate.

Markings :

Markings on road is very essential, particularly at night in a hilly terrain. The edge marking with yellow continuous line in thermoplastic paint of specified standard ensures the driver to manoeuvre the vehicle safely while broken white lines along the centre line will ensure smooth flow of disciplined traffic. Provision for such markings has been made.

Other Road Appurtenances :

200-metre, Kilometre and 5th Kilometre stones are to be provided all along the road as per IRC standard. Boundary stones are to be provided to establish the ROW and this should be incorporated in the as-built drawings for future use.

Road delineators used to provide visual assistance to drivers particularly at night, have been incorporated where necessary.

Concrete crash barriers are essentials required at bridge approaches, near edges of the road particularly at curves.

Guard rails are essential in built up areas to check pedestrian infiltration and to guide pedestrian crossing at defined locations marked by zebra crossing.

The existing provisions in respect of some of the components of road furniture are totally inadequate and in some cases not existing at all. Necessary provision are being made for adequate numbers with new provisions of missing components.

2.3 The Legal Framework

The Government of India (GoI) has laid down various policy guidelines, acts, rules and regulations pertaining to sustenance of environment. The Environment (Protection) Act, 1986 provides Umbrella Legislation for the protection of environment. As per the Act, the responsibility to administrate the legislation has been jointly entrusted to the Ministry of Environment and Forest (MoEF) and the Central Pollution Control Board/ State Pollution Control Board (SPCB). In addition, the Land Acquisition Act of 1894 is applicable in case of acquisition of land for the project development during implementation. The lists of all applicable GoI regulations and acts are provided in Table 2.3.

Table 2.3: Summary of Applicable Regulations

Applicable GoI Statutes	Year	Objective	Reason for Applicability
Environmental (Protection) Act	1986	This provides for the protection and improvement of environment and for matters connected therewith, and the prevention of hazards to human beings, other living creatures, plants and property. 'Environment' includes water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property.	Environment in general
Air (Prevention and Control of Pollution) Act as amended in 1987	1981	This provides for prevention, control and abatement of air pollution. 'Air Pollution' means the presence in the atmosphere of any 'air pollutant', which means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.	Air Pollution
Water (Prevention and Control of Pollution) Act and Cess Act of 1977 as amended in 1988	1974	This provides for the prevention and control of water pollution and the maintaining and restoring of wholesomeness of water. 'Pollution' means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms.	Water Pollution
EIA Notification of MoEF dt. 14.09.2006	2006	The EIA Notification, under sub-rule (3) of Rule 5 of the Environment (Protection) Rules, 1986 for imposed certain restrictions and prohibitions on new projects or activities, or on the expansion or modernization of existing projects or activities based on their potential environmental impacts as indicated in the Schedule to the notification, being undertaken in any part of India, unless prior environmental clearance has been accorded in accordance with the objectives of National Environment Policy as approved by the Union Cabinet on 18th May, 2006 and the procedure specified in the notification, by the Central Government or the State or Union territory Level Environment Impact Assessment Authority (SEIAA)	The Schedule of EIA Notification includes new / expansion of National Highways as applicable projects if it exceeds the defined threshold limits. This is applicable for screening of National Highways project and subsequent EIA process if exceeds threshold limits.
Indian Forest (Conservation) Act, as amended in 1988	1980	An Act to provide for the conservation of forests and for matters connected therewith or ancillary or incidental there to.	Tree cutting and or forest land diversion

Applicable GoI Statutes	Year	Objective	Reason for Applicability
Ancient Monuments and Archaeological sites & Remains Act	1958	Conservation of Cultural and Historical remains found in India.	If chance finding occurred during construction.
Noise Pollution (Regulation and Control) Rules 2000	2001	Noise pollution regulation and controls.	Control of Noise pollution
Public Liability Insurance Act	1991	This provides for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling hazardous substances and for matters connected herewith or incidental there to. Hazardous substance means any substance or preparation, which is, defined as hazardous substance under the Environment (Protection) Act 1986, and exceeding such quantity as may be specified by notification by the Central Government.	Health and Safety
Explosive Act, The Explosive Rules	1884 1983	Safe and protective use and management of explosive.	Health and Environment Safety
Hazardous waste (Management and Handling) Rules	1989	Safe and protective use, handling and management of hazardous waste.	Health and Environment Safety
The CRZ Notification, 19.2.1991 and Amendments	1991	Coastal area classification and development regulations.	Restriction of activities within CRZ, if applicable.
Land Acquisition Act and amendment of 1894	1894	This Act may be called the Land Acquisition Act, 1894. and it extends to the whole of India except (the state of Jammu and Kashmir). Acquisition of land through a defined public purpose. Appropriate compensation calculation and disbursement o the compensation through the government machinery to the concerned persons/department/ etc. before the civil works on any project is initiated.	In case of land acquisition (both private and public). Generally in case of private land acquisition the process under this act is followed, for government land acquisition it is generally transfer of land from one department to the implementing or executing department, as required.
Wetlands (Conservation and Management) Rules, 2008 (Draft)	2008	Rules will be applicable to wetlands identified and notified by the competent authority	Conservation of wetland to non-wetland use; reclamation of wetland; dumping of solid waste and disposal of liquid waste

The following environmental and forestry related statues are not applicable to this project:

- Biological Diversity Act 2000 - as the project does not involve any biodiversity related activity.
- The CRZ Notifications 1991 and amendments – as the project does not fall under coastal regulation zone.

2.3.1 Cross Section Laws

There are a number of laws that are cutting across all sectors and development process of the country. Some of these are directly relevant especially during the construction stage are listed in the Table 2.3.1.

Table 2.3.1: Cross Section Policies

Applicable GoI Acts	Year	Objective	Applicability
Minimum Wages Act	1948	Grossly misused Act 1948, most important as far as the poverty ridden local people are concerned. For role of Social welfare department and labour department, a more effective mechanism needs to be developed.	Direct
Child Labour (prohibition and regulation) Act 1986	1986	Grossly misused Act, effective mechanism need to be established to abolish this from the highways system permanently.	Direct
Labour Act	1988	The health and safety of workers employed in construction work etc	Direct
The Factories Act	1948	Health and Safety considerations for workers (Need to extend the provisions to highways)	Direct
The Right to Information Act (Very important Umbrella Act)	2005	One of the most important Acts, which will strengthen the right to freedom of speech and expression Act.	Direct

After several years of negligence, Government of India now decided to strictly apply the Child Labor Act to all sectors, which are exploiting the children's at their younger age for personal, economic and other benefits. According to this law children's are for primary education till the age of 14 and then up to the age 18 years, children if employed should not be engaged in the Hazardous working conditions.

The Right to Information Act, 2005, is an umbrella act that covers the entire constitutional laws and policies and procedures pertaining to the country and its governance.

2.3.2 International Treaties and Conventions Binding upon GoI

There are various international treaties and conventions to which India is a party and these are binding upon the country. Though, most of these treaties and environmental agreements are not directly applicable to the Project, some of the treaties and environmental agreements are discussed briefly below.

Ramsar Convention on Wetlands

The Convention on Wetlands was signed in Iran in 1971 and came into force in 1975. It is an intergovernmental treaty, which provides the framework for national action and international cooperation for the conservation, and wise use of wetlands and their resources. The broad aim of the Convention is to halt the worldwide loss of wetlands and to conserve the existing ones through wise use and

management. There are presently 152 Contracting Parties to the Convention, with 1608 wetland sites, totaling 140 million hectares, designated for inclusion in the Ramsar List of Wetlands of International Importance. India is a Party to Ramsar Convention.

Convention Concerning the Protection of the World Cultural and Natural Heritage

The Convention concerning the Protection of the World Cultural and Natural Heritage was adopted in the general conference of United Nations Educational, Scientific and Cultural Organization (UNESCO) in Paris in 1972. The Convention was adopted to establish an effective system of collective protection of the cultural and natural heritage of outstanding universal value, organized on a permanent basis and in accordance with modern scientific methods. The Convention promotes an international perspective on cultural heritage by inviting member states to submit an inventory of properties forming its national cultural and natural heritage to be included in a list of World Heritage sites. India is a member state and there are 26 World Heritage Properties in India, out of which 21 are Cultural Properties and 5 are Natural Properties.

Convention on Biological Diversity

The Convention on Biological Diversity was adopted at Rio de Janeiro Earth Summit in 1992 with 150 signatories. The Convention on Biological Diversity is dedicated to promoting sustainable development with the aim of conservation of biodiversity through sustainable use of components of biodiversity and sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable manner. The Cartagena Protocol on Bio safety is a supplementary agreement that seeks to protect biological diversity from potential risks posed by Living Modified Organisms (LMOs) resulting out of modern biotechnology. The Convention on Biological Diversity is legally binding on the signatory parties. India is a party and has ratified to the Convention on Biological Diversity on 18th 1994 and the Cartagena Protocol on 11th September 2003.

Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)

The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) is an international agreement between governments to safeguard certain species from over exploitation. The aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The text of the Convention was adopted in 1973 and it entered into force on 1st July, 1975 in Washington, DC. At present, there are 169 parties to the agreement. India is also a party to the Convention.

Millennium Development Goals

The Millennium Development Goals (MDGs) were adopted in the General Assembly of the United Nations in the year 2000 by all the countries of the world and the world's leading development institutions. The target date for achieving the MGDs by all the countries has been fixed as 2015. The MGDs are as follows:

- Eradicate extreme hunger and poverty
- Achieve universal primary education
- Promote gender equality and empower women
- Reduce child mortality
- Improve maternal health
- Combat HIV / AIDS malaria and other diseases

- Ensure environmental sustainability
- Develop a global partnership for development
- Applicability of International Treaties and Conventions:

Though the MGDs do not directly apply to the project, the mitigation measures while preparing the Environmental Management Plan and will make the project sustainable and can help achieve some of the goals in the regional context.

2.4 Institutional Set-Up for the Project

Two-tier set-up of institutions has been assigned with the responsibility for planning and implementation of the National Highways. The Ministry of Shipping, Road Transport and Highways, Government of India, or the National Highway Authority of India (NHAI), at the National level, and Public Works Departments (PWDs) at the State level. However, present project is a part of NHDP phase V (BOT) programme and will be executed by private entrepreneurs as DBFO project. In the present case, main responsibility belongs to the Ministry of Shipping, Road Transport and Highways and the NHAI. A brief description on the level of responsibilities assigned for this project is presented in the following sections.

2.4.1 The National Highways Authority of India (NHAI)

The National Highway Authority of India was constituted by an act of Parliament, "National Highway Authority of India", Act 1988. It is responsible for the planning, development, maintenance and management of National Highways and for matters connected thereof.

2.4.2 Project Implementation Unit (PIU)

The project under consideration has been initiated and is being carried out by MOT&H. Project Implementation Unit (PIU) with a Project Director an Executive Engineer in PIU office as its head have been established. The PIU would play a key role in implementation including the overall control of construction activities and implementation of contracts. The PIU will ensure that most of the environmental impact mitigation measures are readily achieved by incorporation of appropriate bid documents and construction contract provisions and that the project preparation, the designs and the estimates have duly incorporated the relevant environmental concerns in the bid document. On the basis of these documents, these provisions should be enforced and the PIU and the Contractor working under the direction of the MOT&H should have the commitment and necessary resources to do so.

2.5 Administrative Framework in the Environmental Context

The environmental regulations, legislation, policy guidelines and other control measures that are applicable / related to the project are governed by a variety of government bodies. The functions of the agencies are described in the following sections.

2.5.1 Interface with the Ministry of Environment and Forests, Government of India

Environmental protection and sustainable development is the main goal of Government of India's policy. Ministry of Environment and Forests (MoEF) has taken several policy initiatives and enacted environmental and pollution control legislations to prevent indiscriminate exploitation of natural resources and to promote integration of environmental concerns in the developmental projects. MoEF was established in 1985 and is the agency primarily responsible for the review and approval of Environmental Impact Assessment (EIA) pursuant to Government of India legislation. Environmental Impact Assessment Notification dated 27th January 1994, Item No. 21 of Schedule-1 specifies that any highway project needs environmental clearance from the Central Government in the form of an approved EIA. The Notification was followed by the amendment dated 10th April, 1997. The Ministry of Environment and Forests has revised the EIA notification, 1994, and issues the revised EIA notification on 14th September 2006.

As per new notification the Categorization of Highway Projects Required Environmental Clearance are given in Box 1 under below.

Box 1: EIA Notification dated 14th September 2006

The Notification States:

Category-A: i) New National Highway, ii) Expansion of National Highways greater than 30.0 km, involving additional right of way greater than 20 m passing through more than one State.

Category-B: i) New State Highway, ii) Expansion of National\ State Highways greater than 30.0 km involving additional right of way greater than 20.0 m.

General Condition: any project or activity specified in Category B will be treated as Category A if located in whole or in part within 10.0 km from the boundary of: i) protected areas notified under the Wild Life (protection) Act, 1972, ii) Critically polluted areas as notified by the Central Pollution Control Board from time to time, iii) Notified Eco-sensitive areas, and iv) Inter State Boundaries and International Boundaries.

Note: This means that clearance shall not be required in i) widening projects of more than 30 km length with up to 20m land acquisition put together on either side, and ii) widening project of up to 30 km length

Sources: Gazette Notification, GoI dated 14th September 2006

2.5.2 Interface with the State Department of Environment and Forests

Every state in India has now their respective Departments of Environment & Forests. This Department performs the functions similar to the MoE&F at the State Level.

As the project falls under either Category A the Project shall require prior environmental clearance from the Central Govt. in the Ministry of Environment and Forest (MoEF) on the recommendations of an Expert Appraisal Committee (EAC) to be constituted by the Central Govt.

2.5.3 Interface with the Central Pollution Control Board (CPCB)

The Central Pollution Control Board (CPCB) is another technical wing of the MOEF entrusted with the responsibilities for detection and abatement of pollution. The main responsibilities of CPCB include inter-alia the following:

- Plan and implement water, air and noise pollution programs;
- Advise the Central Government on water, air and noise pollution programs;
- Set air, water and nose standards; and
- Co-ordinate with the State Pollution Control Boards.

The project has no direct interface with CPCB but indirectly through the activities falling under the purview of SPCB.

2.5.4 Interface with the State Pollution Control Boards

Every state of India has their respective pollution control boards, which act in unison with the policies of the CPCB. The State Pollution Control Boards (SPCB), in turn, is the empowered institution to issue licenses to the industries. These licenses are issued on the condition of total compliance with the standards of permissible pollution as prescribed from time to time by the CPCB or as modified (usually in more stringent terms) norms depending on local conditions. Every licensed industry is required to carry out environmental auditing and submit such reports to the license issuing authority. The State Pollution Control Boards can repeal such licenses on the observed violation of the norms.

The SPCB plays a major role in environmental management at the State level, particularly with regard to air, water and noise issues. Agency is also acting as a facilitator for Central and State environmental clearance process. The main functions are to:

- Plan and execute state-level air and water initiatives;
- Advise State Government on air, water and industry issues;
- Establish emission standards based on National Minimal Standards;
- Issue consent orders (permits) for industrial air and water discharges;
- Issue "No Objection Certificates" for "industrial development" (defined in such a way as to include road projects).
- Publish statistics and disseminate information; and
- Take legal action against defaulters.

Facilitate the National Environmental clearance requirements at the state Level as a nodal agency coordinating all other stakeholder institutions. These requirements also include public hearing.

The project has direct interface with Mizoram State Pollution Control Boards as following permission / consents are mandatory for the project under Air and Water Acts:

- No-Objection-Certificate / Consent-for-Establishment to be obtained by MORT&H before commencement of any physical activity;
- Consent-for-Establishment and Consent-for Operation of stone crushing units and hot mix plants (including Diesel Generator) under Air and Water Acts to be obtained by Contractor.

Besides, SPCB will be consulted for quarry operation complying with its guidelines.

2.5.5 Interface with Public Utility Companies

The respective public utility companies in each state are to be interacted for the following activities, as will be applicable:

- Shifting water supply lines;
- Shifting / raising of electric poles / overhead lines; and
- Shifting telephone lines / OFC cable.

2.5.6 Interface with Local Bodies

The local bodies including Panchayat are to be interacted for following activities:

- Working on government land including collecting materials and disposal debris on government land;
- Withdrawing water from canals/streams/rivers for the purpose of construction; and
- Locating construction camp.

2.6 Statutory Environmental Clearance Requirements of the Project

As per MoE&F's EIA Notification dated 14.09.2006, any highway project falls under Category A if the project entails i) New National Highways; and ii) Expansion of National Highways greater than 30 KM, involving additional right of way greater than 20m involving land acquisition. The proposed 4-laning project does not involve additional land acquisition of 20m for a length of 30km and thus does not fall under Category A project, as defined in EIA Notification. Therefore, the project does not require any environmental clearance from MoE&F. However, the project requires NOC (Consent-for-Establishment and Consent-for-Operation) from the respective State Pollution Control Boards.

The applicability of environmental and other relevant rules and acts has been assessed. The Table 2.6 shows the clearances required during different stages of road works.

Table 2.6: Clearance Requirements

Sl. No.	Activity	Statute	Requirement	Competent Authority	Responsible Agency for Obtaining Clearance	Time Required
Pre-Construction Stage (Responsibility: MORT&H)						
1	Conversion of single lane to 2 lane	Water Act of 1974, Air Act of 1981	NOC (Consent-for-establishment and consent-for-operation)	States Pollution Control Boards for respective section	MORT&H	3-4 months
2	Road side tree cutting	Forest Conservation Act 1980 & MOEF Letter Dt. 18.02.1998	Permission for roadside tree cutting	Local Authority (DC)	MORT&H	2-3 months
3	Filling of roadside water bodies (ponds and borrow pits)	State Fisheries Policy Draft Wetlands (Conservation & Management) Rules, 2008	Permission for filling of water bodies	State Irrigation Department State Fisheries Department State Wetlands Conservation Committee	MORT&H	2-3 months
Construction Stage (Responsibility: Contractor)						
1	Establishing stone crusher, hot mix plant, wet mix plant and Diesel Generator Sets	Water Act of 1974, Air Act of 1981, Noise Rules of 2000 and Environmental Protection Action of 1986 and as amended	Consent-for-establishment	States Pollution Control Boards for respective section	The Contractor	2-3 months
2	Operating stone crusher, hot mix plant, wet mix plant and Diesel Generator Sets	Water Act of 1974, Air Act of 1981, Noise Rules of 2000 and Environmental Protection Action of 1986 and as amended	Consent-for-operation	States Pollution Control Boards for respective section	The Contractor	2-3 months
3	Use and storage of explosive for quarry blasting work	India Explosive Act 1984	Explosive licence for use and storage	Chief Controller of Explosives	The Contractor	2-3 months
4.	Storage of fuel oil, lubricants, diesel etc. at construction camp	Manufacture storage and Import of Hazardous Chemical Rules 1989	Permission for storage of hazardous chemical	States Pollution Control Boards for respective section and or Local Authority (DC)	The Contractor	2-3 months
5	Quarry operation	State Minor Mineral Concession Rules, The Mines Act of 1952, Indian	Quarry Lease Deed and Quarry License	State Department of Mines and Geology	The Contractor	2-3 months

Sl. No.	Activity	Statute	Requirement	Competent Authority	Responsible Agency for Obtaining Clearance	Time Required
		Explosive Act of 1984, Air Act of 1981 and Water Act of 1974				
6	Extraction of ground water	Ground Water Rules of 2002	Permission for extraction of ground water for use in road construction activities	State Ground Water Board	The Contractor	2-3 months
7	Engagement of labour	Labour Act	Labour license	Labour Commissioner	The Contractor	2-3 months

Chapter - 3

Baseline Environmental Set up

CHAPTER - 3

BASELINE ENVIRONMENTAL SET UP

3.1 Approach and Methodology

Execution of the Project for widening to 2-lane of Road Aizawl (Km 0/0) to Keitum (Km 125/0) of NH-54 in the State of Mizoram under Phase-2 of SARDPE-NE is having some direct impact on the Environment. It is, therefore, necessary to undertake Environmental Impact Assessment Study for the proposed project to assess the potentially critical impacts of the Project on the environment and to suggest mitigative measures which are required to be incorporated during the initial planning stages.

The existing road alignment section of NH-54 passes through hilly terrain covered with mixed jungle and teak plantations. As hill cutting will be mostly involved in widening of the road including improvements of curves and hair-pin bends, acquisition of forest/jungle land would be essential.

The existing environmental setting for the stretch to be extended has been assessed from two perspectives, Regional and Local. The regional environment has been defined as a corridor of 15 Km on either side of the proposed project road, while the local setting pertains to the environmental features within and adjacent to the ROW.

Sequential flow of activities for Environmental Impact Assessment is shown in Fig-3.1

The regional setting is determined by topography, geology, Climate and Meteorology and the land use pattern. The relevant information related to regional environmental setting has been collated and compiled from published literature, mainly from government sources. On the other hand, local environmental setting pertains to soil, air and water quality, noise level, structure, utility services and road side plantation and relevant information related to these features has been obtained through primary data generation.

The emphasis of analysis and tabulation of data – primary and secondary is to assess how the project road construction and operation would impact these environmental features.

Accordingly, a reconnaissance survey was carried out to study the present environmental set up of the study corridor (15 km on the either side of the highway) which is the corridor for environmental concern in general and proposed ROW in particular on the basis of which screening exercises have been undertaken to identify the environmentally sensitive issues and areas. Detailed studies on each of the issues / parameters shall help establishment of exact conditions in respect of assessment of potential negative impact of the project on environment.

The following activities have been carried out for preparation of **EIA/EMP** Report. The sequential flow of activities for EIA is shown in Fig 3.1.

Secondary Data Collection:

Relevant Secondary Data were collected from concerned authorities like Survey of India, Zoological and Botanical Survey of India, state Irrigation and PWD, District Collectors Office.

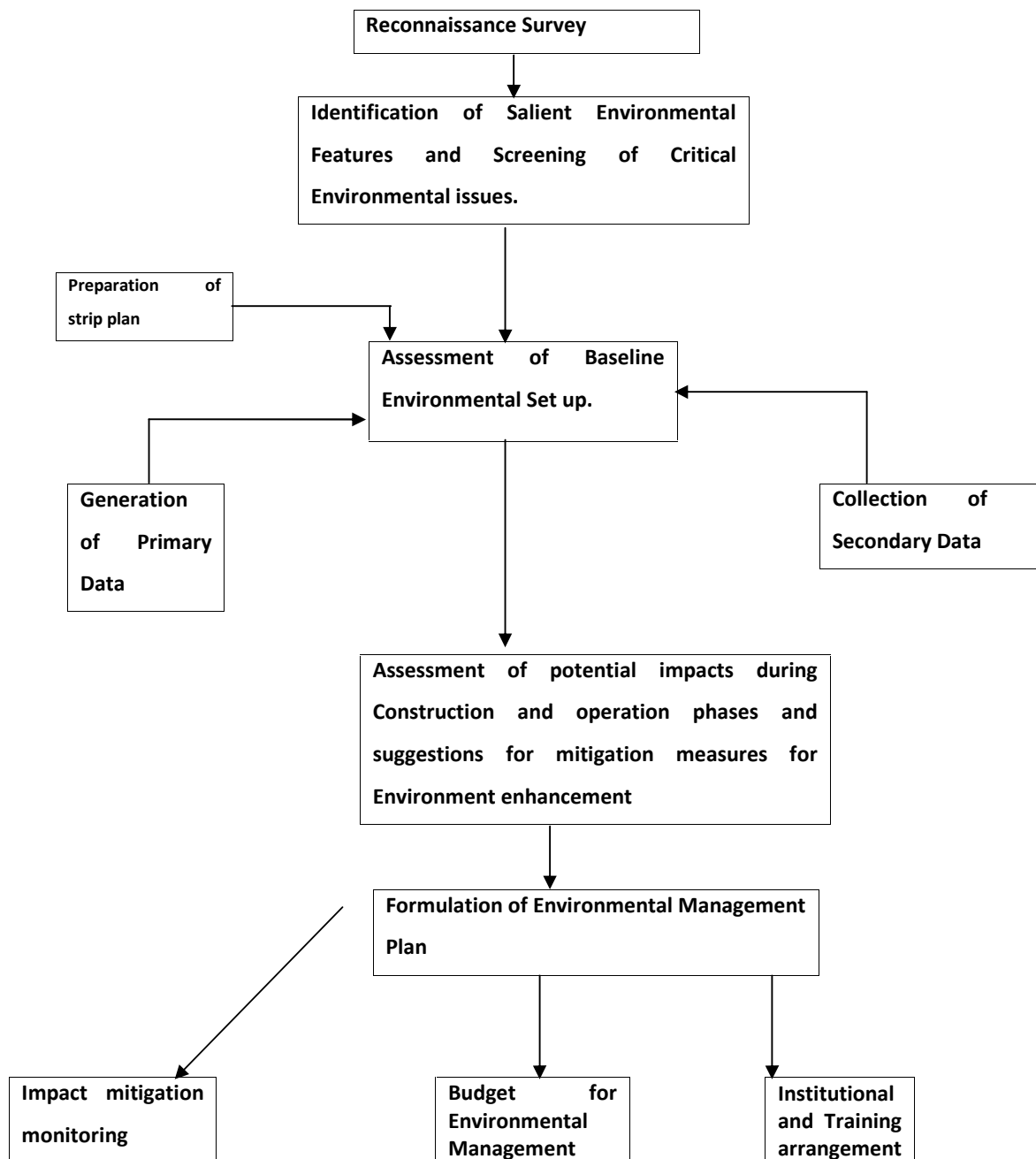
Primary Data Generation:

- **Air Quality:** Measurement of Air quality (6 stations) in Urban residential cum commercial , semi urban, and rural areas for parameters like Respirable dust (RD) , Suspended particulate matter (SPM), SO₂, NO_x, CO and Pb as shown in 3.3.1
- **Noise Level:** Noise level monitoring in 11 monitoring stations in 3.3.3.
- **Water Quality:** Water samples of surface water source were collected from River Turial (Chainage 24.600km. Ground water was collected and parameters analyzed as per Bureau of Indian Standards (BIS) from 4 locations shown in 3.3.2
- **Soil Quality:** Soil Samples locations along the study corridor and tested for standard parameters including Lead (Pb) content. Locations of soil sampling sites as shown in 3.3.4.

Figure- 3.1

Approach and Methodology

Environmental Impact Assessment



requirements

3.2 Regional Environmental Set up

3.2.1 Topography

Mizoram is mostly covered with hills. The hills are steep and are separated by rivers, which flow either to the north or south, creating deep gorges between the hill ranges. Eastern sector is higher than western sector. Average height of the hills is about 900 meters. The Blue Mountains (Phawngpui) is tallest with a height of 2210 meters. Flatlands adjacent to Cachar Valley and flatlands of Champhai, Mat, Tlabung and Chamdun have immense potentials for agriculture and horticulture development.

3.2.2 Geology

The folded structure of Mizoram ranges at the junction of two moving tectonic plates. The folded hilly or mountainous North South belts with perpendicular faults comprise sediments of Surma, Barail, Tipam groups and Alluvium in river beds consisting of deposits of argillaceous and arenaceous sand stones, shale, siltstones and mudstones. The rock system is weak unstable, weathered and prone to seismic and weather influence resulting in landslides. The soft, black to grey rock is used locally for building materials and for low trafficked road construction works. There are no useful minerals of economic significance. Typical soils are sandy loams that have been heavily leached due to the high slopes leaving it porous and lacking in minerals.

The Geology of Mizoram consists of a repetitive succession of Neogene (Tertiary) arenaceous and argillaceous sediments occurring in a series of approximately North- south trending longitudinal plunging anticlines and synclines. The topography of the area is often a good indication of lithology and argillaceous groups of rocks occur in relatively lower altitudes as compared to arenaceous rocks.

The parent materials are predominantly shales and siltstone, with a reasonable percentage of clay minerals. Therefore, a certain degree of cohesiveness is evident. Further, as the rocks are relatively impermeable, the dry months provide opportunity of desiccation of the upper topsoil creating some weak

bond by geo-chemical processes (laterisation, limonisation, or sometimes kaolinisation).

The geological formation is of recent origin resulted by nine repetitive successions of Neocene arenaceous and argillaceous sediments gradually thrown into series of North- South trending longitudinal, plunging anti-clines and synclines. In the higher elevations arenaceous formations occur while the low-lying areas and depressions are represented by argillaceous rocks. The common rocks found are sandstone, shale, silt, stone, clay stones and slates. The rock system is weak and unstable prone to frequent seismic influence. The local geology is highly important for the success of road projects.

3.2.2.1 Landslides

The rock system of the Lushai Hills is weak, unstable, weathered and prone to seismic and weather influence producing landslides. There are two major land slide/sinking areas at Km 13.400 to km 13.900 and km 60.500 to km 61.200. As these are unstable hilly areas, precaution should be taken to widen the slide zones. It is seen that the reasons of such failure are due to quarrying in the area inflicting environmental degradation. The practice of quarrying should cease from environmental point of view.

3.2.2.2 Seismicity

The National Highway NH-54 from Aizawl (Km 0/0) to Keitum (Km 125/0) falls under Zone V of the Seismic Zonation Map of India.

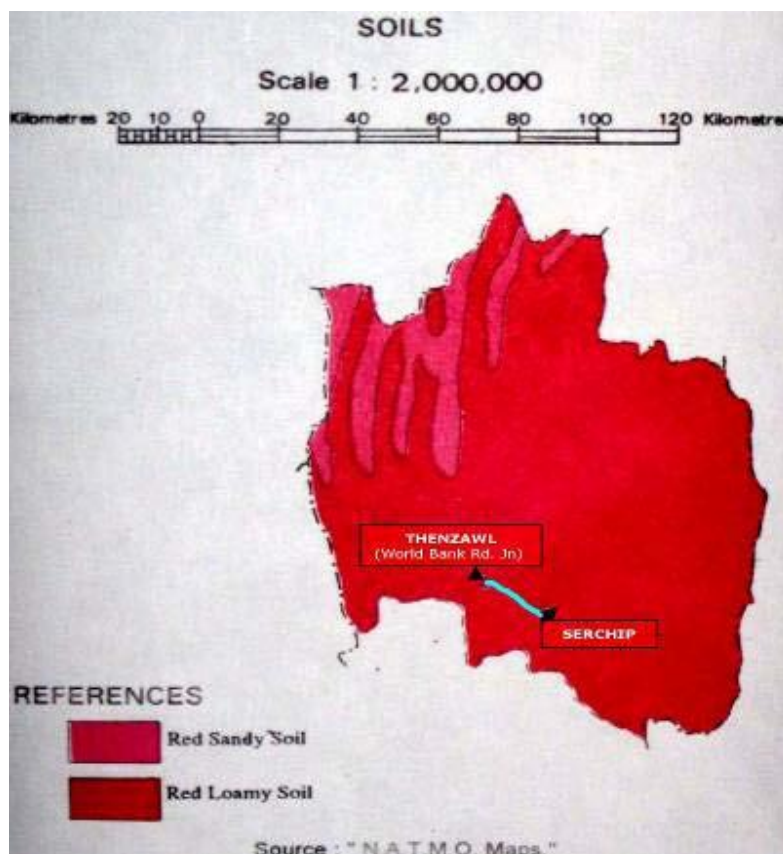
3.2.3 Drainage:

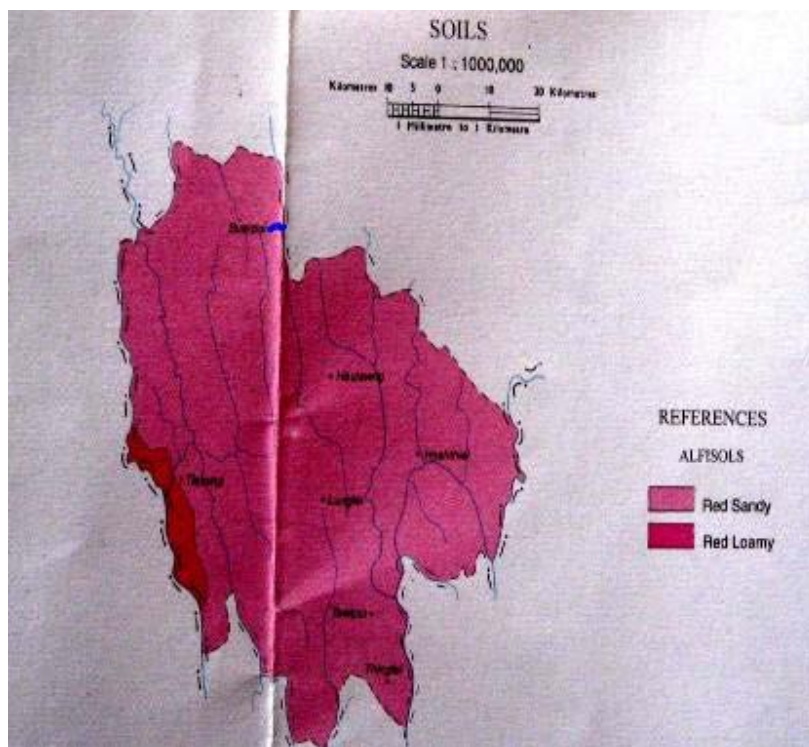
The site has natural drainage, channels (nalas), and creeks.

Tut or Gudur river, the Sonai (also known as Tuirial) and the Tuivawl which drain the northern territory and eventually join the river Barak in the plains of Cachar in Assam. The Section of road from Km 0/0 to Km 125/0 is drained mainly by Tuirial River and numerous tributaries that join the river. Although many rivers and streamlets drain the hill ranges the most and useful rivers are the Tlwan (also known as the Dhaneswari or Katakhal)

3.2.4 Soil and its Characteristics

Soil texture, in general, varies from sandy loams, clayey loams to clay. Although the soils are mature, profuse rainy spells in the region coupled with the high gradients have accelerated the problem of leaching of the loose soils. These soils are highly porous with low water holding capacity and this is the main cause of the low water table in Mizoram. The soils of Mizoram are deficient in potassium, phosphorous, nitrogen and humus. The traditional jhum cultivation has adversely affected the productivity. Although superficial greenery is observed owing to the profuse rainfall, the tract is actually in the process of fast degradation. The pH of these soils is acidic to neutral due to excessive leaching. The soil characteristic along the Project road is given in **Figure placed below**.





3.2.5 Climate & Meteorology

The maximum average temperature in the summer is 30°C, while in the winter the minimum average is around 11°C. The four months between November and February are winter time in Mizoram, which is followed by the spring. The three months from June to August are known as the rainy season. The climate is at its moderate best in the two autumnal months.

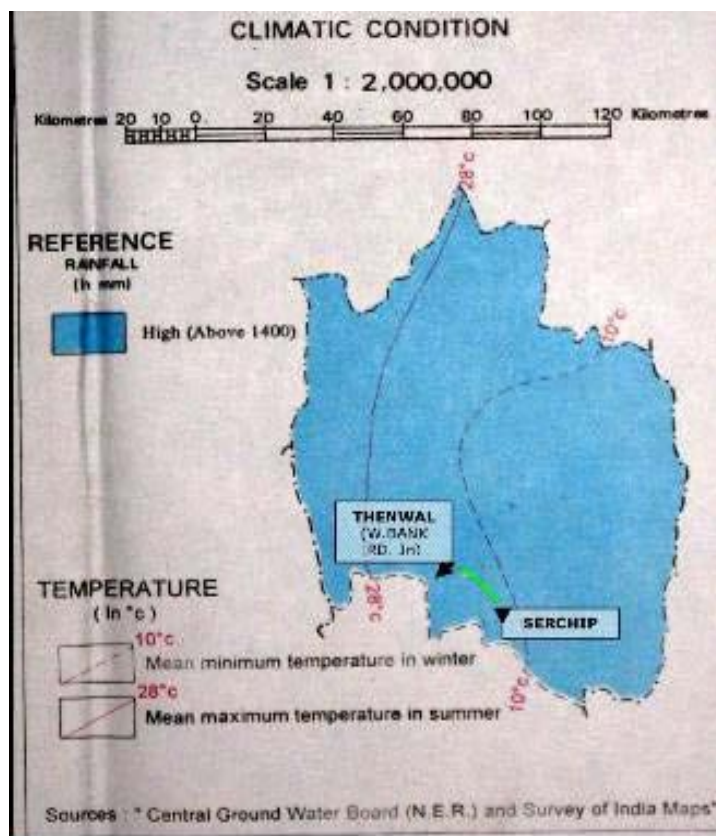
Storms come in the middle of April to herald the beginning of summer.

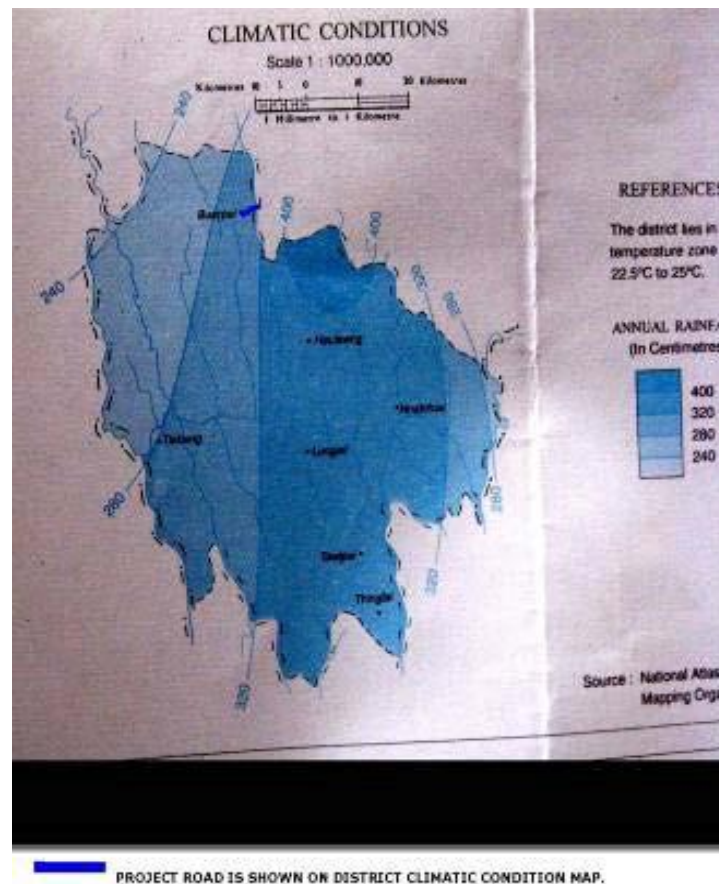
Rainy season is from May to September. The average rainfall is 250 cm per year. September and October, when the temperature moves between 19°C to 25°C.

Average Annual Rainfall	-	2200 mm to 3300 mm
Concentration of precipitation	-	May to September
Humidity	-	75 to 95%
Cloudiness	-	Mild clouded
Wind	-	Generally light except rainy season
Temperature	-	11 ⁰ - 21 ⁰ C in winter

- 20⁰ -30⁰ C in summer

The Climatic map along the Project road on state Highway) is given below:





3.2.6 Land Use

Mizoram is made up of wooded hills. It is noted that the main land use is jungles and forest comprising bamboo groves/tropical tree plantation and wild banana trees. Agriculture is the main occupation with more than 80% of the population depending upon the agriculture and allied sector. Contour farming system has been introduced in place of old system of "Jhum" cultivation thereby eliminating the wasteful and soil detrimental practice.

3.2.7 Study of Areas of environmental concern.

- Around 15 Km of the project areas no Protected areas, National Parks, Wild life Sanctuaries Biosphere Reserve Marine Parks are found. Some wet lands or catchment areas are noticed. But there is a Planted Forest at 25th km of NH- 54 on either side of River Tuirial. There are also some plantations (both private and Govt.) on either side of

the road. Tawi Wild Life Sanctuary (60 Sq.km) is located 62 Km away from the Highway. Presence of wild animals like Tigers, Elephants, Black Bears, Bison, Langurs, Porcupines, Mongoose etc. have been reported in the jungles/sanctuary

- There are no critically polluted areas listed by Central Pollution Control Board.
- No State or International boundaries exist within 15 km of either side of the Highway.
- There are no eco sensitive zones around 15 Km of the project area.
- There is no mangrove vegetation around the site and no endangered species are found.
- The site does not have any history of Industrial pollution and so no question of any penalties levied by the Pollution Control Board.
- There are no fishing Villages around 15 Km of the site.
- There is no salt water intrusion, flooding due to sea level rise and climate change.

3.2.8 Biological Environment:

3.2.8.1 Flora

Mizoram being a thickly wooded state has a wide range of floral species many of which still remain to be identified. According to botanists, Himalayan Maple is one of the most important trees in Mizoram; other common floral species are Duabanga, Chalmoogra, Champa, Sal, Teak, Bel, Jackfruit, Banyan, Gamri, Jungle Neem, Rohini, Mulberry, Oak and Pine. All said, Bamboo is perhaps the most important floral group in Mizoram. Several species of canes too grow in the state.

3.2.8.2 Fauna

Important species of mammals found in Mizoram are Tigers, Elephants, Malayan Sun Bear, Black Bear, Small toothed civet, clawless otter, serow, slow loris, Hoolock Gibbons, Assamese Macaque, Capped Langur, Chinese Pangolin, Himalayan crested porcupine, crab-eating Mongoose and Barking Deer.

Mizoram is also home to large family of birds and insects. Birds of some species-such as Hume's Bartailed Pheasant, Peacock Pheasant, Great Pied Horn bill, Indian Pied Horn bill, Kalig Pheasant, Whistling Teal, Indian Parakeet, Large hawk Cuckoo and Forest Eagle. However, it may be said that Owl, Pheasant, Patridge, Hawk are the important birds of Mizoram. Butterflies are also found in the hills of Mizoram.

3.3 Local Environmental Setting:

3.3.1 Ambient Air Quality:

In order to access ambient air quality of the study corridor monitoring has been carried out in 6 locations—3 Residential and 3 Commercial areas as shown in **Table 3.3.1.1** Monitoring is carried out for determination of concentration of SPM, RSPM, SO₂, NO_x, CO, HC and CH₄.

Table 3.3.1.1: Location of Ambient Air Quality Monitoring Stations

Sl No	Location	Chainage	Distance from Road Center	Height of the Sampling station from Ground Level	Description of location site
1	Zemabawk	8.200	7 m	5 m	1 st floor of a residential complex on left side of NH-54, Residential area
2	Seling	40.730	9 m	6 m	Presbyterian Church, Commercial Area
3	Tlungvel	59.400	6 m	4 m	Roof top of a commercial shop, commercial, Residential Area
4	Chhingchhip	82.420	7 m	7.5 m	Roof top of Mizoram Rural Bank, Commercial area
5	Serchhip	110.700	5 m	9 m	Roof Top of a Residential Complex, Residential area.
6	Keitum	124.480	6 m	3.5 m	Keitum Market Complex, Commercial/ Residential area

The results of monitoring are given in Table 3.3.1.2

Table 3.3.1.2 : Ambient Air Monitoring Data

Sl No.	Type of Area (Residential/ Commercial area)	Location	SPM	RSPM	SO ₂	NO _x	CO	HC as CH ₄
		(Ch. km and name of the village)	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³
1	Residential	8.200	55	22	4	32	ND	ND
2	Commercial	40.730	50	24	4	34	ND	ND
3	Residential/ Commercial	59.400	51	21	4	28	ND	ND
4	Residential	82.420	50	23	4	30	ND	ND
5	Residential	110.700	53	22	4	28	ND	ND
6	Commercial/ Residential area	124.480	59	27	4	30	ND	ND

Ambient Air Quality Standards as given in Table 3.3.1.3

Table 3.3.1.3: Ambient Air Quality Standards

Pollutant	Time Weighed Average	Industrial	Residential, Rural and other areas	Sensitive areas
Sulphur Dioxide (SO ₂)	Annual Average* 24 Hours**	80 µg/m ³ 120 g/m ³	60µg/m ³ 80µg/m ³	15µg/m ³ 30µg/m ³
Oxide of Nitrogen (NO _x)	Annual Average* 24 Hours**	80 µg/m ³ 120 g/m ³	60µg/m ³ 80µg/m ³	15µg/m ³ 30µg/m ³
Suspended Particulate Matter (SPM)	Annual Average* 24 Hours**	360 µg/m ³ 500 g/m ³	140µg/m ³ 200µg/m ³	70µg/m ³ 100µg/m ³
Respirable Particulate Matter (RPM) (Size < 10)	Annual Average* 24 Hours**	120 µg/m ³ 150 g/m ³	60µg/m ³ 100µg/m ³	50µg/m ³ 75µg/m ³

µm)				
Lead (Pb)	Annual Average* 24 Hours**	1.0- µg/m ³ 2.5g/m ³	0.75µg/m ³ 1.0µg/m ³	0.75µg/m ³ 0.75µg/m ³
Carbon Monoxide(CO)	8 Hours** 1 Hour	5.0 ppm 10.0 ppm	2.0 ppm 4.0 ppm	1.0 ppm 2.0 ppm

Source: Central Pollution Control Board, New Delhi

*Indicate Annual Arithmetic Mean of Minimum 104 measurement in a year measured twice a week, 24 hours, at uniform intervals.

3.3.2 Surface water and Ground water Quality

There is no past data on surface water quality in this stretch. River Tuirial and tributaries are located within the study area. Since during construction of bridge/other structures water quality may affect; assessment of water quality is therefore essential.

Besides, there are many nallahs and stream crossing the Project road and many ponds are available near the Project road.

Surface water quality of the project corridor has been analyzed by collecting surface water sample along the Project road. The surface water sampling from River Tuirial has been done along Project road at 24.6 Km. Ground Water Samples have been collected at 4 locations as shown in **Table 3.3.2**. The surface water quality is given in **Table 3.3.3**. The observed value of pH and dissolved oxygen is within permissible limits of class D

Table 3.3.2: Location of water sampling site

Sl no	Location (Chainage)
Surface Water	
1	River Tuirial (24.600Km)
Ground Water	
1	Tube well water at Zemabawk (10.370Km)

2	Tube well water at Seling (41.220 Km)
3	Tube Well water at Chhingchhip (82.150 Km)
4	Tube well water at Chhiahtlang (100.600 Km)

3.3.2.1 Surface Water Quality

Physical, Chemical, and Bacteriological analysis results are given in **Table- 3.3.3**

Table 3.3.3: Surface water quality of River Tuirial

Sl. No.	Parameters	Results
1	pH (at 27°C)	7.51
2	Temperature	21
3	Turbidity in N.T.U	8.0
4	Free Ammonia (as N) in mg/l	0.11
5	Biochemical Oxygen Demand 5 days at 20°C in mg/l	<2.0
6	Dissolved oxygen in mg/lit	5.3
7	Electrical Conductivity in ms/cm at 23°C	0.064
8	Boron as B in mg/l	<0.5
9	Sodium Absorption Ratio	2.28
10	Total Coliform Organisms MPN/100 ml	1600

3.3.2.2 Ground Water Quality

The ground water quality along the project corridor has been assessed by collecting and testing sample from hand pump. The ground water sampling has been done from hand pump at the Project road at 4 locations as shown in **table -3.3.2**

The ground water quality monitoring results are given in **Table 3.3.2.2**. The observed values of ground water parameter such as Turbidity, Iron, Total Coliform Organisms and Faecal Coliform Organisms

MPN/100 ml are beyond permissible limits of Drinking water Standards (IS: 10,500) and it is not fit for drinking purpose.

Table 3.3.2.2: Ground water Quality

Sl. No.	Parameters	Results	Norms as per IS: 10500-1991	
			Desirable limit	Permissible limit
1	Temperature (at time of sampling)	22	---	---
2	Odour	Unobjectionable	Unobjectionable	---
3	Taste	Unobjectionable	---	---
4	Turbidity in N.T.U.	22.0	5	10
5	pH (at 27°C)	7.06	6.5-8.5	No Relaxation
6	Alkalinity in mg/l	220.5	200	600
7	Total Hardness as CaCO ₃ in mg/l	208.0	300	600
8	Sodium as Na in mg/l	21.26	---	---
9	Iron as Fe in mg/l	5.0	0.3	1
10	Total Dissolved Solid (TDS) in mg/l	280.0	500	2000
11	Total Solid (TS) in mg/l	302.0	---	---
12	Total Suspended Solid (TSS) in mg/l	22.0	---	---
13	Calcium as Ca in mg/l	49.0	75	200
14	Potassium as K in mg/l	2.0	---	---
15	Magnesium as Mg in mg/l	20.56	30	100
16	Sulphate as SO ₄ -2 in mg/l	< 4.0	200	400
17	Sulphite as SO ₃ -2 in mg/l	Nil	---	---

Sl. No.	Parameters	Results	Norms as per IS: 10500-1991	
			Desirable limit	Permissible limit
18	Phosphate as PO ₄ -3 in mg/l	0.11	---	---
19	Nitrate as NO ₃ in mg/l	<0.4	45	100
20	Nitrite as NO ₂ in mg/l	<0.4	---	---
21	Ammoniacal Nitrogen as N in mg/l	<0.02	---	---
22	Fluoride as F in mg/l	0.12	1	1.5
23	Chloride as Cl in mg/l	14.0	250	1000
24	Biochemical Oxygen Demand 5 days at 20°C in mg/l	<2.0	---	---
25	Dissolved Oxygen in mg/l	6.2	---	---
26	Chemical Oxygen Demand in mg/l	<4.0	---	---
27	Oil and Grease in mg/l	<1.4	---	---
28	Lead as Pb in mg/l	<0.05	0.05	No Relaxation
29	Electrical Conductivity in ms/cm at 23°C	0.45	---	---
30	Total Coliform Organisms MPN/100 ml	300	Not more than 10 organisms/100ml	---
31	Faecal Coliform Organisms MPN/100 ml	170	ABSENT	---

3.3.3 Noise Quality

Most of the stretch is under rural and jungle/forest areas. Noise generated from use of horn by vehicles at rural stretch is less. However, at commercial and urban/semi-urban areas, expected noise level will be higher.

Noise attributed to roads depends on factors such as traffic intensity, the type and condition of the vehicles plying on the road, acceleration/deceleration/gear changes by the vehicles depending on the level of congestion and smoothness of road surface (IRC:104-1988). excessively high noise levels are a concern for sensitive receptors, i.e. hospitals and educational institutions. Ambient noise quality adjacent to project corridor has been assessed by undertaking noise level monitoring at each location as shown in **Table 3.3.3.1** for three alternate days.

The results of ambient noise level monitoring along the Project road The Leq (day) and Leq (night) are within permissible limits of Noise level standards of CPCB for the residential and sensitive area along the Project road.

Table 3.3.3.1: Location of noise level Monitoring Sites

Sl No	Location (Chainage	Distance from the road center (m)	Description of Monitoring Site
1	Bawngkawn Junction Point (3.00Km)	4	Commercial area
2	Zemabawk (7.100km)	4	Mixed – Residential /Commercial Area
3	Tuirial River (25.600Km)	3	Sensitive Area
4	Seling, Near School(38.000)	7	Sensitive Area
5	Seling Market (40.800 Km)	4	Commercial area
6	Darlawng (56.200Km)	2.5	Residential Area
7	Tlungvel Market (59.550)	3	Mixed – Residential /Commercial Area
8	Chhiahtlang (84.200Km)	2.5	Open Area
9	Chhiahtlang (98.400Km)	3.5	Residential Area
10	Serchhip Market (110.100 Km)	4	Commercial area
11	Keitum (124.500 Km)	3	Mixed – Residential /Commercial Area

Day time and Night time level are depicted in **Table: 3.3.3.2**

Table 3.3.3.2: Ambient Noise Level data

Sl. No.	Monitoring Location	Leq (Day) dB (A)	Leq (Night) dB (A)	Permissible limits as per SPCB/ CPCB	
				Day dB (A)	Night dB (A)
1	Bawngkawn Junction Point (3.00Km)	45	38	65	55
2	Zemabawk (7.100km)	42	33	55	45
3	Tuirial River (25.600Km)	52	42	50	40
4	Seling, Near School(38.000)	50	45	50	40
5	Seling Market (40.800 Km)	52	47	65	55
6	Darlawng (56.200Km)	42	40	55	45
7	Tlungvel Market (59.550)	53	49	55	45
8	Chhiahtlang (84.200Km)	42	38	55	45
9	Chhiahtlang (98.400Km)	43	40	55	45
10	Serchhip Market (110.100 Km)	51	46	65	45
11	Keitum (124.500 Km)	42	40	55	45

Ambient Air Quality Standards are shown in **Table 3.3.3.3**

Table 3.3.3.3: Ambient Noise Quality Standards

Area / Class	Day Time (6:00am – 9:00 pm)	Night Time (9:00pm – 6:00 am)
	Standard (dBA)	Standard (dBA)
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence	50	40

L_{eq} = Equivalent Sound energy

3.3.4 Soil Monitoring Data

The soil condition along Project road is red sandy soil. The primary data collection of soil quality along the Project road has been done by Environmental sub-consultant (Mitra S. K. Pvt. Ltd., Kolkata).

The soil sampling along the Project road has been done at Zemabawk, Turial and Serchhip to represent the soil characteristic along the project site.

Soil characteristics are shown in Table 3.3.4

Table 3.3.4: Soil Characteristics along the project site

Sl No	Parameters	Test Method	Results
1	pH(AT 28 ⁰ C) (1:5)	IS : 2720	7.07
2	Conductivity at 27 ⁰ C in ms	IS : 2720	0.089
3	Texture	-	Very heavy clay
4	Cation Exchange capacity (g of Sodium ion per g of soil)	-	0.0064
5	Sodium Adsorption Ratio	-	1.48
6	Water Holding capacity in %	-	1.92
7	Porosity in %	-	67.62
8	Nitrogen as N in %	IS 14684 – 1989	0.024
9	Phosphorus as P in %	IS: 2720	0.0001
10	Iron as Fe in %	IS: 2720	1.41
11	Potassium in cm / hr	IS:2720	0.011
12	Permeability in cm/hr	-	7.8

3.3.5 Land Use within ROW:

The Project Road NH-54 (Road Aizawl – Keitum 125 km long) passes through hilly terrain. About 30% of the road stretch (hill side) falls under forest/jungle area/plantation; the details of these are as below in **Table 3.3.5**

Table 3.3.5

<u>Stretch of Road (km)</u>	<u>Type of cover</u>
♦ Km 12.000 to 12.700	Jungle
♦ Km 16.525 to 16.800	Teak Plantation

◆ Km 19.600 to 19.950	Teak Plantation
◆ Km 27.100 to 27.350	Jungle
◆ Km 29.100 to 29.500	Jungle
◆ Km 31.000 to 31.450	Teak Plantations
◆ Km 33.000 to 33.750	Jungle
◆ Km 33.750 to 34.000	Teak Plantation
◆ Km 47.000 to 48.000	Jungle
◆ Km 49.000 to 49.900	Jungle
◆ Km 50.200 to 50.600	Jungle
◆ Km 51.250 to 51.800	Jungle
◆ Km 53.000 to 53.700	jungle
◆ Km 55.000 to 55.800	Jungle
◆ Km 61.150 to 61.850	Jungle
◆ Km 62.000 to 62.600	Jungle
◆ Km 63.000 to 63.850	Jungle
◆ Km 65.600 to 66.000	Jungle
◆ Km 69.400 to 70.000	Jungle
◆ Km 70.200 to 70.600	Jungle
◆ Km 75.000 to 80.000	Jungle
◆ Km 83.150 to 85.000	Jungle
◆ Km 86.500 to 87.000	Jungle
◆ Km 87.400 to 88.000	Jungle
◆ Km 89.000 to 92.000	Jungle
◆ Km 93.000 to 96.000	Jungle
◆ Km 101.500 to 103.000	Jungle
◆ Km 103.850 to 104.000	Jungle
◆ Km 105.000 to 106.000	Jungle
◆ Km 115.000 to 121.000	Jungle

♦ Km 122.500to 123.800 Jungle

(Total length of the road stretch under forest/jungle/plantation cover is 35 km approx.)

3.3.6 Road Side Trees:

Detailed field survey has been undertaken to note the type of trees, their girth Size and their position in ROW. A summary showing distribution of trees by girth size and names of trees within ROW has been given in Table 3.3.6.1; 3.3.6.2; 3.3.6.3; 3.3.6.4

Table 3.3.6.1: Road side trees girth wise

Sl.	Name of Tree	Girth Size				Total
		0.00-0.50	0.50-1.00	1.00-2.00	2.00<	
1	Arjun	19	4	0	0	23
2	Aamlakhi	120	14	1	0	135
3	Ahant	6	6	3	1	16
4	Akashmoni	100	23	9	0	132
5	Arecanut	471	0	0	0	471
6	Ajar	11	0	0	0	11
7	Bokul	5	3	0	0	8
8	Bhelu	30	17	0	0	47
9	Bogori	36	0	0	0	36
10	Bottolbrush	173	22	4	0	199
11	Coconut	15	5	0	0	20
12	Debadaru	3	0	0	0	3
13	Eucalyptus	130	78	16	3	227
14	Gamari	101	59	3	0	163
15	Jia	22	17	0	0	39
16	Jalphai	9	5	1	0	15
17	Jam	296	108	6	2	412
18	Krishnasura	568	145	40	14	767
19	Kadam	30	3	0	0	33
20	Koroi	136	68	12	2	218
21	Kanthai	583	259	23	3	868
22	Madar	206	65	16	1	288
23	Mangoo	754	285	38	9	1086
24	Neem	81	49	8	1	139
25	Poma	173	113	16	2	304
26	Radhasura	233	48	7	3	291
27	Rubber	14	2	1	0	17
28	Sonaru	45	16	4	0	65
29	Segun	2683	1170	179	52	4084

Sl.	Name of Tree	Girth Size				Total
		0.00-0.50	0.50-1.00	1.00-2.00	2.00<	
30	Simalu	74	27	2	1	104
31	Sisu	20	5	0	1	26
32	Satiyana	33	18	3	1	55
33	Sal	0	0	0	0	0
34	Sirish	255	122	39	19	435
35	Teteli	147	51	10	2	210
36	Uriam	32	6	0	1	39
37	Others	2810	1191	164	42	4207
Total		10424	4004	605	160	15193

Table 3.3.6.2 : Category Utility Tree

Sl.	Name of Tree	Girth Size				Total
		0.00-0.50	0.50-1.00	1.00-2.00	2.00<	
1	Arjun	19	4	0	0	23
2	Bokul	5	3	0	0	8
3	Eucalyptus	130	78	16	3	227
4	Gamari	101	59	3	0	163
5	Neem	81	49	8	1	139
6	Rubber	14	2	1	0	17
7	Segun	2683	1170	179	52	4084
8	Simalu	74	27	2	1	104
9	Sisu	20	5	0	1	26
10	Sal	0	0	0	0	0
11	Sirish	255	122	39	19	435
Total		3382	1519	248	77	5226

Table: 3.3.6.3 Category Fruit Trees

Sl.	Name of Tree	Girth Size				Total
		0.00-0.50	0.50-1.00	1.00-2.00	2.00<	
1	Aamlakhi	120	14	1	0	135
2	Arecanut	471	0	0	0	471
3	Bogori	36	0	0	0	36
4	Coconut	15	5	0	0	20
5	Jalpai	9	5	1	0	15
6	Kanthai	583	259	23	3	868
7	Mango	0	0	0	0	0
8	Teteli	147	51	10	2	210
Total		1381	334	35	5	1755

Sl.	Name of Tree	Girth Size				Total
		0.00-0.50	0.50-1.00	1.00-2.00	2.00<	

Category Flower Trees Table : 3.3.6.4

Sl.	Name of Tree	Girth Size				Total
		0.00-0.50	0.50-1.00	1.00-2.00	2.00<	
1	Akashmoni	100	23	9	0	132
2	Bottolbrush	173	22	4	0	199
3	Krishnasura	568	145	40	14	767
4	Kadam	30	3	0	0	33
5	Radhasura	233	48	7	3	291
Total		1104	241	60	17	1422

3.3.7 Distribution of Religious Places & Cultural sites

Practically there is no **cultural heritage** site in the road stretch under study. However, there are some **cultural and religious structures** along the road section. These are :

1) Religious properties located along the project corridor

- At Ch. 3.00 on LHS – Church
- At Ch. 5.650 on RHS – Gurudwara
- At Ch. 5.700 on LHS – Hari Mandir
- At Ch. 40.700 on RHS – Presbyterian Church
- At Ch. 43.500 on RHS -Presbyterian Church
- At Ch. 44.900 on RHS -Presbyterian Church
- At Ch. 56.550 on RHS – Church
- At Ch. 98.250 on RHS – Presbyterian Church
- At Ch. 41.000 on LHS – Baptist Church

2) Graveyard

- At Ch. 18.600 on RHS –
- At Ch. 28.580 on LHS –
- At Ch 46.730 on RHS –
- At Ch. 64.900 on LHS – School
- At Ch. 66.560 on RHS – School
- At Ch. 80.830 on LHS – School

- At Ch. 106.080 on LHS – School

3) **Cultural Properties**

I. Properties along the corridor:-

- At Ch. 5.100 on RHS – Community Hall
- At Ch. 27.630 on LHS – Community Centre
- At Ch. 39.500 on RHS – Anganbadi Centre
- At Ch. 43.800 on LHS – Community Hall
- At Ch. 56.500 on RHS – Darlawng Community Hall
- At Ch. 58.200 on LHS – Public Library
- At Ch. 40.900 on LHS – Selling Community Hall
- At Ch. 45.650 on RHS – YMA Library
- At Ch. 98.300 on LHS – YMA Library
- At Ch. 124.840 on LHS – Library
- At Ch. 66.700 on LHS – Khumtung Community Hall

Chapter - 4

Anticipated Environmental Impacts & Mitigation Measures

CHAPTER 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0 GENERAL

This chapter assesses the nature, type and magnitude of the potential impacts likely on the various relevant physical, biological and cultural environmental components along the Project road. The description of the impacts on the individual components has been structured as per the discussion in Chapter 3 of this report.

The impacts of the activities proposed as part of the project can occur during the following stages:

- Pre Construction Stage
- Construction Stage
- Operation Stage

The identification and assessment of these impacts will help in formulating the mitigation measures in order to reduce and eliminate these impacts.

4.1 PHYSICAL ENVIRONMENT

4.1.1 Topography

(a) Impacts

Construction Stage

During construction stage, change in topography will take place due development of road to 2-lane standard. The change in topography is linear and spread over length. The change in topography may also take place due to opening; operation and refilling of borrow areas.

Operation Stage

The proposed project is not likely to have any significant impact on the topography of the project area. However temporary changes may occur along the road corridor due to widening of road surface.

(b) Mitigation Measures

During construction phase following restrictions should be imposed to mitigate the impact on topography through

- Existing vegetation including shrubs and grasses along the route (except within the strip directly under embankment or cutting) will be properly maintained during construction phase; and
- The borrow areas are to be opened, operated and closed as per clause no 305.2.2 of Specifications for Road and Bridge Works of, Ministry of Road Transport and Highways (MoRTH). The borrow areas shall be filled with the rejected waste/material and then finally a layer of Top Soil is to be spread over it before carrying out plantation, turfing, etc.

4.1.2 Geology & Soil

(a) Impacts

Construction Stage

The proposed project is not likely to have any significant impact on the existing geology and soil pattern.

Erosion of topsoil could be moderate and not much significant in long-term adverse impacts, resulting from construction of roads is anticipated. The potential for soil erosion can be pervasive during the construction stage, more pronounced along:

- Bridge and fills;
- Over-steep banks; and
- Embankment slopes and spoils.

(b) Mitigation Measures

The proposed project is not likely to have significant impact on the existing geology, hence no mitigation measures have been proposed.

4.1.3 Seismicity

(a) Impacts

Construction Stage

The area covered by the present study falls in zone V of IS code 1893-2002.

The blasting activity during construction will not have any major impact on the overall earthquake potential as it will be limited to construction period only and will be done according to prescribed norms.

Operation Stage

No Impact on seismicity is anticipated during operation phase as no major changes is envisaged in the area due to construction of project.

(b) Mitigation Measures

No mitigation measure is required.

4.1.4 Physiography

(a) Impacts

Construction Stage

The impact on physiography will be felt in the entire stretch of highway. With the construction of highway the physiography of the area will get altered. The change in physiography will be limited within the ROW of the project.

Operation Stage

No impact on physiography is anticipated during operation phase. However, the turfing and plantation on road side will be pleasing to eyes.

(b) Mitigation Measures

The design and construction of highway has been fixed as per IRC Guideline. Since change in physiography will be pleasing to the eyes and construction of highway is a requirement, no mitigation measures are warranted except provision for adequate cross drainage structures.

4.1.5 Soil

(a) Impacts

Construction Stage

The soil erosion may take place in the pre construction stage due to the following:

1. Site preparation may involve demolition of building, clearing of brushwood, tree removal, temporary re-routing of utilities, diversion or rechanneling of waterways. This brings risks of erosion to the exposed ground or stored topsoil.
2. Setting up of labors' camps may lead to loss of productive soils and impact the soil productivity especially at micro level.

The soil erosion in construction stage may take place at the slope of the embankments, construction sites of cross drainage structures, at borrow areas and at construction sites which will be cleared.

The erosion may takes place at the site of land parcel due to clearing of site and removal of trees.

Operation Stage

The soil erosion in operation stage may take place during operation at side slopes of road and near the approaches to bridges and interchanges.

(b) Mitigation Measures

Design Stage

To check soil erosion on critical road side, turfing with grasses and shrubs will be carried out in accordance with the recommended practice IRC guidelines. At the locations of steep slopes near crossings of highway with major rivers suitable protection measures such as stone pitching will be adopted.

Construction Stage

Prior to the start of work, the contractor shall submit to the Executive Engineer for approval of his schedules for carrying out temporary and permanent erosion / sedimentation control works as are applicable for the items of clearing and grubbing, drainage excavation, embankment / sub grade construction bridges and other structures across water courses, pavement courses and shoulders. Contractor shall also submit for approval his proposed method of erosion / sedimentation control on service road / inspection road and borrow areas and his plans for disposal of waste materials. Work shall start only when the Engineer has approved the erosion / sedimentation control schedules and methods of operations for the applicable construction.

In the construction stage the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill material operations shall be limited to the extent practicable. The contractor will provide immediate permanent or temporary erosion control measures to prevent soil erosion and sedimentation that will adversely affect construction operations, damage adjacent properties or cause contamination of nearby streams or other watercourses, village ponds or water bodies etc.

The green belt will be developed simultaneously along with construction activities to check the start of erosion process.

Operation Stage

In the operation stage the turfing and other slope protection measures like sodding, turfing shall be monitored regularly. The green belt will be monitored and loss of plants/species will be done immediately.

4.1.6 Compaction of Soil

(a) Impacts

Pre Construction Stage

Compaction of soil will occur in the pre-construction phase due to movement of the construction equipment and machinery and during the setting up of construction camps.

Construction Stage

Compaction will be beyond the main carriageway and service roads and within the vegetated area of the RoW by the movement of vehicles and heavy machinery. Movement of vehicles during road construction is the major cause of soil compaction and this may also occur along haul road and near borrow areas during cartage of borrow materials. This impact is direct and will be the most in the RoW. It is necessary to ensure that there is no adverse impact of soil compaction in areas other than the RoW, where vegetation can grow and rain infiltration will take place.

Operation Stage

During the operation period compaction will be restricted to the carriageway of highway and service roads. Compaction cannot be said to be an impact of the operation stage as the pavement itself is a function of compacted base and sub base.

(b) Mitigation Measures

Pre Construction Stage

During pre- construction stage, establishment of construction camp and installation of plants and machinery at campsite, machinery and equipment will be unloaded and kept at campsite only. All construction vehicles will move and parked at the designated location only. The movement of construction machinery and plants preferably be limited to Right of Way. Haul roads shall be constructed and maintained in good condition.

Construction Stage

During Construction phase all construction vehicles will ply within the Row and designated routes. In no case these shall ply through open land or agriculture fields.

Operation Stage

No mitigation measures are warranted.

4.1.7 Soil Quality

(a) Impacts

Pre Construction Stage

Contamination of soil in the pre-construction stage may be considered as a short-term residual negative impact. Soil contamination may take place due to solid waste from the labor camp set up during pre-construction stage. This impact is significant at locations of construction camps; stockyards, hot mix plants, etc. as these will come up in this stage.

Construction Stage

Contamination of soil during construction stage is primarily due to construction and allied activities. The sites where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Pollution of soil can also occur at the site of hot-mix plants from leakage or spillage of asphalt or bitumen at the site of batching plants because of spillage of cement, leakage of curing agents. This contamination is likely to be carried over to water bodies in case of dumping is done near water body locations.

Operation Stage

During the operation stage, soil pollution due to accidental vehicle spills or leaks is a low probability but potentially disastrous to the receiving environment, should they occur. These impacts can be long term and irreversible depending upon the extent of spill.

(b) Mitigation Measures

(i) Contamination of Soil from Fuel and Lubricants

Construction Stage

At various construction sites, the vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. It will be ensured that the fuel storage and refueling sites are kept away from drainage channels and important water bodies. At the wash down and refueling areas, "Oil Water Separators" shall be provided. The contamination of soil may take place due to dumping of solid waste in unscientific manner, leaching of fuel/oil & grease from workshops, petrol stations and DG sets. All spills and discarded petroleum products shall be disposed off in accordance to the Hazardous Waste (Management and Handling Rules, 1989). Fuel storage and refueling areas will be located at least 500 m from all water bodies and reserved/protected forests near the road alignment. In all fuel storage and refueling areas located on agricultural lands or productive lands, the topsoil preservation shall be carried out.

Operation Stage

The petrol pumps & vehicle washing area and sites of DG sets will be monitored regularly for any POL leakages and corrective remedial measures like spread of sand, provision of oil & grease separators for passing wash water of petrol pumps & vehicle washing area before diverting it to water bodies.

(ii) Contamination of Soil from Solid Wastes.

Construction Stage

The earth work will be carried out strictly in accordance with the design so that no excess earth is borrowed. The construction waste generated will be reused in the construction of highway. Bituminous waste will be used after milling and in case bituminous waste is required to be disposed off it shall be disposed in secured way by providing 50 mm thick clay layer.

The solid waste generated during construction phase which includes municipal waste both organic & inorganic, hazardous waste may include POL waste, biomedical waste, E-waste etc. which shall be stored/treated/disposed off in accordance with Municipal Solid Waste (Management & Handling) Rule 2000, Hazardous Waste (Management, Handling & Transboundary Movement) Rules 2008, Biomedical Waste (Management and Handling) Rules 1998 and E-Waste (Management and Handling) Rules, 2010 respectively.

Mitigation Measures

Operation Stage

The Solid waste generated from the way side amenities will include Municipal Waste both Organic and inorganic, Hazardous Waste like used batteries will be treated in accordance with Municipal Solid Waste (Management & Handling) Rule 2000, Hazardous Waste (Management, Handling & Transboundary Movement) Rules 2008.

4.1.8 Quarry

(a) Impacts

The excavation of quarries for obtaining rock, soil and aggregate materials for road construction may cause direct and indirect long-term adverse impacts on the environment.

Substantial quantities of crushed rocks, earth / sand / fly ash of suitable engineering quality and strength will be required for pavement construction. Keeping in view of large quantities required for the 4-lane highway for the flexible pavements approved quarries have been considered for quarry material.

The project induced impact is mainly during transportation of the bulk material over a long distance. However, all the approach roads being permanent in nature, no impact on the approach-road pavement, other than spillage and dust pollution due to transportation, is envisaged.

A huge quantity of sand would be required for the cement concrete rigid pavement and/or cross-drainage structures proposed. River sand is available from the quarries on river bed and thus borrowing of sand from riverbed will also have resource depletion impact.

(b) Mitigation Measures

Design Stage

Quarry

- Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials, quality and other logistic arrangements.
- In case the contractor decides to use quarries other than recommended by Feasibility consultants, then it will be selected based on the suitability of the materials and as per established law.
- The contractor will procure necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the "PIU through Engineer.
- Contractor will also work out haul road network and report to Environmental Expert of IC and IC will inspect and in turn report to PIU before approval.
- Clause No. 111.3 & MORT&H Specifications for Road and Bridge works

Construction Stage

Quarry

- The contractor shall obtain materials from quarries only after the consent of the Department of Mining / SPCB / District Administration or will use existing approved sources of such materials. Copies of consent/ approval/ rehabilitation plan for opening a new quarry or use of an existing quarry source will be submitted to Environment Expert IC and the Resident Engineer. Clause No. 111.3 MORT&H Specifications for Road and Bridge works
- The contractor will develop a Comprehensive Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy to PIU and IC prior to opening of the quarry site. Guidelines VI Guideline for Quarry Management
- The quarry operations will be undertaken within the rules and regulations in force in the state.

Operation Stage

No Impact is envisaged however quarry areas will be monitored for the Rehabilitation.

4.1.9 Land Use Pattern

(a) Impacts

Pre Construction Stage

There will be change in the land use of the area which will be acquired for the development of highway.

Construction Stage

In the construction stage the land use pattern of the project corridor is categorized as urban/commercial, rural, agricultural and linear plantation. It is noted that due to proposed development of the road to 2 lane standard. There will not have any major impact on existing land use pattern except on linear plantation along the road and on ponds present along the road. There will however be observed temporary changes in the land use pattern at the vicinity of the project site because of cutting of trees, cutting, filling and construction related structures.

There may be temporary change in the land use because of temporary land acquisition for establishment of labor camps, construction camps, storage areas, haulage roads and construction work. This change will be temporary and the site will be restored after development of road.

Operation Stage

In the Operation stage the proposed widening and strengthening of existing single lane into 2-lane development of the road to lane standard will not have any major impact on existing land use pattern.

4.2 METEOROLOGY

(a) Impacts

Though no change in the macro-climatic setting (precipitation, temperature and wind) is envisaged due to the project, the microclimate is likely to be temporarily modified by vegetation removal and the creation of paved surface for road and its structures construction. There will be an increase in daytime temperature around Row of alignment and Land Parcels due to loss of shade of trees. This rise in temperature will be localized as entire area is open. The temperature rise phenomenon will be more prominent at locations of cutting of trees in clusters.

(b) Mitigation Measures

Avoidance measures, as the minimizing of the number of trees to be cut, have been worked out as part of the design finalization. The project will involve significant cutting of trees in the RoW. Though no change in the macro-climatic setting (precipitation, temperature and wind) is envisaged due to the construction of highway, the microclimate is likely to be temporarily modified by vegetation removal, and due to construction of paved pavement surface.

4.3 AIR

(a) Impacts

Construction Stage

(i) Generation of Dust

Dust generation due to procurement and transport of raw materials from quarries and borrow pits, site clearance, use of heavy vehicles, machinery/ equipment, stone crushing handling and storage of aggregates and generation of fine particulate matter (smoke) in asphalt processing will be responsible for short-term and localized degradation of air quality.

(ii) Generation of Exhaust Gases

Hot mix plants contribute substantially to the deterioration of air quality due to emissions of oxides of Sulphur, Hydrocarbons and particulate matter. From the results of the ambient air quality monitoring conducted along the road, it is noticed that the values for NO_x and SO₂ are mostly within the standards as prescribed by the Central Pollution Control Board (Refer **Table 4.1 of Chapter 4** for air quality results). Concentration of SPM and RPM are high at all the locations. All these locations are generally residential cum commercial area. The concentration of the air pollutants will further increase during construction period but for limited period only.

During the construction period, temporary impacts include generation of Odour from construction activities as well as from construction camps. Dust would be generated from haulage of materials and detouring of traffic on non-permanent, temporary pavement etc.

(iii) Increase in Fuel Consumption

During construction of road, the movement of different types of construction machinery and vehicle will be increased. This in other way increases the fuel consumption, which has direct impact on national economy.

Operation Stage

(i) Generation of Dust

The project road is mostly passing through the rural areas with alluvial soil. Dust generation due to movement of vehicles is envisaging along the project road, but not in significant amount.

(ii) Generation of Exhaust Gases

Due to increase in speed and volumes of vehicular traffic on the project corridor, marginal increase in the air pollutant levels is expected but not significant.

(iii) Increase in Fuel Consumption

Widening of road will definitely attract larger community to use this corridor which in-turn increase the fuel consumption and has direct impact on national economy.

(b) Mitigation Measures

The negative impacts on air quality during construction will be mostly localized and concentrated in the (ROW)/COI. However, it is likely that impacts due to dust generation are felt downwind of the site rather than the site itself. Some of the mitigation measures suggested for control of air pollution are as described below.

- The asphalt plants, crushers and the batching plants will be sited at least 500 m in the downwind direction from the nearest settlement;
- All precautions to reduce the level of dust emissions from the hot mix plants, crushers and batching plants will be taken up. The hot mix plant will be fitted with dust extraction units;
- Asphalt and concrete plants will be operated in conformity with government pollution control legislation, and located away from the settlements as far as possible.
- All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the SPCB norms. Regular monitoring of Suspended particulate Matter at crusher sites, during the construction, will be conducted;
- Water will be sprayed on the lime/cement and earth mixing sites, asphalt mixing site and temporary service and access. After compacting the earthwork, water will be sprayed on regularly to prevent dust;
- To avoid dust emissions likely to result from the spills of construction materials and borrow materials, the vehicles delivering material will be covered;
- Planting of trees/vegetation on the periphery of the construction site must be taken up; and
- During the operation stage of the project, vehicular emissions of critical pollutants (SPM, RSPM, CO, SO₂, and NO_x) will be monitored and roadside tree plantation will be maintained.

Table 4.3 presents a comparative account of the sources of air pollution, their impact and mitigation measures planned as given below.

Table 4.3: Sources of Air Pollution, Impacts and Suggested Mitigation Measures

Sl. No.	Source of Air Pollution	Impacts	Suggested Mitigation Measures
1	<ul style="list-style-type: none"> • Cutting of slopes for widening of the road; • Transportation and tipping of cut material; • Soil erosion • Transportation of raw materials from quarries and borrow sites; • Stone crushing, handling and storage of aggregates in the 	Generation of Dust (SPM)	<ul style="list-style-type: none"> • To ensure that crushers, batching plants and asphalt plants all are located at a distance of 500 m away in the downwind direction from the nearest human settlement; • To ensure that all precautions shall be taken to reduce the level of dust emissions from crushers, batching and asphalt plants and from transportation of other

Sl. No.	Source of Air Pollution	Impacts	Suggested Mitigation Measures
	<ul style="list-style-type: none"> asphalt plants; Site leveling, clearing of trees, laying of asphalt, construction of bridges; Asphalt mix plants due to mixing of aggregates with bitumen 		<ul style="list-style-type: none"> materials; Provision of wind breaking wall around the sources of dust such as vibrating screens, conveyors, etc. should be made and regularly checked for all stone crushers used to supply material for the project; Vehicles delivering loose and fine materials like crusher dust and soil/spoils shall be covered to reduce spills on existing roads; The hot mix plant will be fitted with dust extraction units; Water will be sprayed on earthworks, temporary haulage and detour roads on a regular basis. During and after compaction of the sub-grade, water will be sprayed at regular intervals to prevent dust generation; It shall be ensured that the dust emissions from the vibrating screen and crusher at the stone quarries do not exceed the emission standards set by CPCB; and Monthly monitoring shall be conducted at locations where earthworks or slope cutting operations shall be conducted. An adequate cyclone/scrubber to control emissions from the stock of hot mix plants will need to be provided in the event of emissions exceeding the CPCB norms
2	<ul style="list-style-type: none"> Hot mix plants; Large construction equipment trucks and asphalt producing and paving equipment; Movement of heavy machinery, oil tankers etc. on steep slopes shall relatively contribute towards higher emissions of gases; Toxic gases released through the heating process during bitumen 	Generation of polluting gases including SO ₂ , NO _x and HC	<ul style="list-style-type: none"> All vehicles, equipment and machinery used for construction work shall be regularly maintained to ensure that the pollution emission levels conform to the CPCB norms; and To ensure the efficiency of the mitigation measures suggested, air quality monitoring shall be carried out at least once a month at all these locations to check as to whether the emission levels are within the norms as prescribed by CPCB.

4.4 Water Environment

(a) Impact

Road constructions have a wide range of effects on water resources, stemming from construction activities. The following major adverse impacts on the water resources are likely to occur.

Construction Stage

(i) Use of Local Water Supply for Construction

Use of water for construction activities such as compaction, suppression, concrete work may play a demand upon local water supplies of the total water requirement per day; the demand would be met from surface water bodies like ponds, canal and rivers. However, permission from the Water Resource Department and Local Administration is mandatory if contractor propose to use water from under surface water source.

Municipal water supply will be used only for drinking purposes (for construction camps), if available and if permitted by the local municipal authority. No local/municipal water supply would be used for construction purpose.

(ii) Increased Run-off

Road projects may marginally lead to increased run-off during construction stages, which will increase sediment accumulation in near by water bodies. Though most of the natural watercourses are perennial in nature, the impacts due to the increased run-off would be negligible due to the project road.

(iii) Degradation of Water Quality

During construction, the disposal of solid and liquid waste from labour camps, fuel and lubricant spills or leaks from construction vehicles, pollution from fuel storage and distribution sites and that from hot-mix plants is likely to affect water quality unless adequate mitigation measures are designed.

(iv) Change in Natural Drainage Pattern

The existing highway will be upgraded to 2-lane configuration on the existing alignment. The drainage will be slightly obstructed during the construction period, but for a limited period. Hence, change in natural drainage pattern is very in-significant from the present state of the project.

(v) Disappearance of Surface Water Bodies

The existing highway will be upgraded to 2-lane configuration with widening on both sides and one side of the existing alignment. These will leads partial filling of roadside surface water bodies (mainly ponds) during widening. But from the widening plan it is clear that water bodies will not be disappear during widening of project.

Operation Stage

(i) Increased Run-off

Road projects may marginally lead to increased run-off during operational stages due to increase in impervious surface and sediment will be accumulation in near by water bodies. Though most of the natural watercourses are non-perennial in nature, the impacts due to the increased run-off would be negligible due to the project road and will be restricted only during monsoon and early part of post-monsoon seasons.

(ii) Degradation of Water Quality

In the operation stage, pollutants from vehicles, and accidental fuel spills may make their way into the receiving environment. The major pollutants of concern are suspended solids, oil and grease, lead etc.

All the rivers present at this road section are non-perennial surface water bodies. No adverse direct impact on the water quality (both underground and surface water bodies) is expected during the operation period.

(iii) Change in Natural Drainage Pattern

The existing highway will be upgraded to 2-lane configuration on the existing alignment. The change in natural drainage pattern is very in-significant from the present state of the project.

(b) Mitigation Measures

(i) Contamination of Water from Construction Waste

To avoid contamination of the various water bodies and drainage channels, construction work close to the canals or other water bodies will be avoided, especially during monsoon period. All necessary precautions will be taken to construct temporary or permanent devices to prevent water pollution due to increased siltation and turbidity. All wastes arising from the project will be disposed off, as per the State Pollution Control Board norms, so as not to block the flow of water in the channels. The wastes will be collected, stored and taken to approve disposal sites.

(ii) Contamination of Water from Fuel and Lubricants

To avoid contamination of the water body and drainage channels from fuel and lubricants, the vehicles and equipments will be properly maintained and re-fuelled only at designated places. The slopes of embankment leading to water bodies will be modified and re-canalized so that contaminants do not enter the water body. Oil and grease traps will be provided at fuelling locations, to prevent contamination of water.

Discharge of oil and grease is most likely from construction vehicle parking area, vehicle repair area and workshops. An oil interceptor shall be provided to ensure that all wastewater flows into the interceptor prior to its discharge. The device has a chamber for separation of oil and water and can handle 200 L/hr of wastewater. The oil float appearing on the surface is removed by periodic cleaning once a week by skimming off the oil film from the surface.

(iii) Sanitation and Waste Disposal in Construction Camps

The sewage system (including septic tanks and soak pits) for construction camps will be properly designed and built so that no water pollution takes place to any water body or watercourse. The workplace will have proper medical approval by local medical, health or municipal authorities.

(iv) Use of Water for Construction

The contractor will make arrangements for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected. Due to the non-availability of water required for construction, if a new tube-well is to be bored, prior sanction and approval by the Central Ground Water Board (CGWB) will be obtained. Wastage of water during the construction will be minimized.

4.5 Drainage

Drainage pattern in the adjoining area for implementation of the project will not be changed. All cross drainage structures shall be retained by repairing.

4.6 Rainwater Harvesting

Strategy for executing RWH structures on the national Highway is as under:-

Collecting and Storing: This method can be adopted by connecting road sides to the channel. Approximately 600,000 litres of water can be collected from one Km runway (two lane) in a hour when

there is a normal rainfall. This method further involves 3 steps

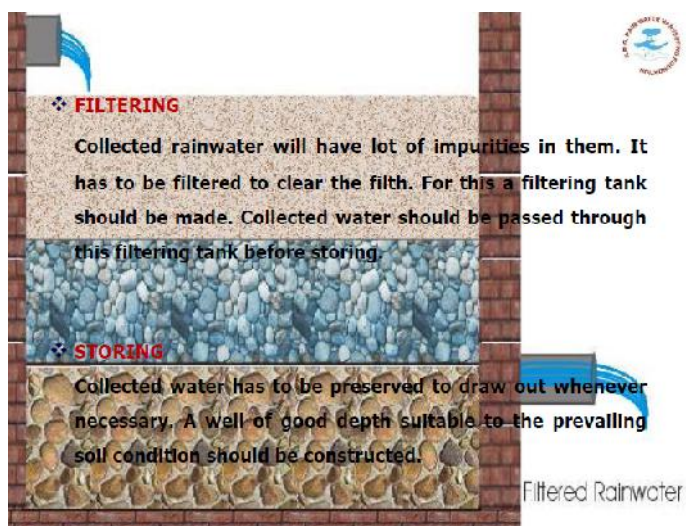
- 1) Diverting
- 2) Filtering
- 3) Storing

Diverting

During the monsoon the raindrops that fall on the road and on the higher part of road can be gathered to provide a good quality of freshwater supply to road side farmers. In order to save it properly, the water collection have to be diverted towards a particular storage point on every 10 kms.

Filtering

Collected rainwater will have lot of impurities in them. It has to be filtered to clear the filth. For this a filtering tank should be made. Collected water should be passed through this filtering tank before storing.



Storing

Collected water has to be preserved to draw out whenever necessary. A well of good depth suitable to the prevailing soil condition should be constructed.



Rainwater Filtering and percolation canal can be made at the places with heavy rain records





Benefits of the project

- Initiating this project would make entire highway connectivity of the country a green belt zone with local flora development.
- his process would increase ground water table and would certainly help in crop production of the road side agricultural land.
- For the travellers, the temperature of the highways will keep cool due to heavy plantation and people would also become aware of the local floras of the region they are passing by.
- Heavy plantation would also benefit in later years for the commercial use and this will automatically provide road cross safety for passengers

4.7 NOISE

(a) Impacts

Construction Stage

The noise levels in the project area during the construction stage will increase though shall be intermittent and temporary in nature.

Typical noise levels associated with the various construction activities and construction equipments are presented in **Table 4.7.1** below.

Table 4.7.1: Typical Noise Levels of Principal Construction Equipments [Noise Level in dB(A) at 50 Feet/approx. 17m]

Cleaning		Structure Construction	
Bulldozer	80	Crane	75-77
Front end loader	72-84	Welding generator	71-82
Jack hammer	81-98	Concrete mixer	74-88
Crane with ball	75-87	Concrete pump	81-84
Excavation and Earth Moving		Concrete vibrator	76
Bulldozer	80	Air compressor	74-87
Backhoe	72-93	Pneumatic tools	81-98
Front end loader	72-84	Bulldozer	80
Dump truck	83-94	Cement and dump trucks	83-94
Jack hammer	81-98	Front end loader	72-84
Scraper	80-93	Dump truck	83-94
Grading and Compaction		Paver	86-88
Grader	80-93	Landscaping and Clean-up	
Roller	73-75	Bulldozer	80
Paving		Backhoe	72-93
Paver	86-88	Truck	83-94
Truck	83-94	Front and end loader	72-84
Tamper	74-77	Dump truck	83-94
		Paver	86-88
		Dump truck	83-94

Source: U.S. Environmental Protection Agency, noise from Construction Equipment and Operations. Building Equipment and Home Appliance. NJID. 300.1. December 31, 1971

Noise quality monitoring was conducted at 10 locations along the road; it was found that the Noise levels are much above the standards as prescribed by the Central Pollution Control Board (CPCB). For details of Ambient noise quality results refer **Chapter 3**. The noise level will be increase during construction period, which have significant impact for a limited period.

Operation Stage

In general, it is evident that the impact of road-related noise is high when the road passes through densely populated areas, town ships and markets, and when there is a traffic bottleneck (or a high mix of slow and fast moving vehicles) or when the speed of traffic stream is low and idling of vehicles.

During the operation stage of the project, reduction of vehicular engine noise (as a result of reduced congestion from earlier, smoother flow of traffic due to 2 separate lanes), vehicular body noise (as a result of reduced development roughness) and reduction of blowing of horns will bring the noise levels down, but as volume of traffic, mainly heavy duty traffic will be increase in future due to rapid development and industrialization along the road corridor this may increase noise slightly.

(b) Mitigation Measures

The noise levels in the project area during construction will increase though shall be intermittent and temporary in nature. The noise levels shall be more pronounced around settlements and in inhabited areas. The increase in noise levels will cause discomfort to local residents and workers. Following mitigation measures shall be adopted to keep the noise levels under control.

- The plants and equipment used for construction will strictly conform to Central Pollution Control Board (CPCB) noise standards;
- Vehicles, equipment and construction machinery shall be monitored regularly with particular attention to silencers and mufflers to maintain noise levels to minimum;
- Workers in the vicinity of high noise levels must wear ear plugs, helmets and should be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A);
- In construction sites within 150 m of human settlements, noisy construction will be stopped between 10 PM and 6 AM except in case of laying of cement concrete pavement for which lower working temperature is a requirement;
- Hot mix plant, batching or aggregate plants shall not be located within 500 m of sensitive land use as schools and hospitals;
- At critical locations, especially along sensitive receptors such as hospitals and schools, noise barriers such as earth, concrete, wood, metal or double-glazing of windows for façade insulation shall be used;
- The noise control measures include limitations on allowable grades eg. Open- graded asphalt and avoidance of surface dressings to reduce tire noise in sensitive areas. Maintenance of proper road surface repairs also helps in reducing noise levels;
- Construction machinery will be located away from the settlements;
- Careful planning of machinery operation and scheduling of operations can reduce the noise levels. Use of equipment, emitting noise not greater than 90 dB(A) for the eight-hour operations shift and locating of construction yards at a distance of at least 500 m from any residential areas can be adhered to;
- Use of noise shields to construction machinery and provision of earplugs to the heavy machine operators are some of the mitigation measures, which should be followed by the contractors during the civil works.

Under the proposed development the noise levels will be much more pronounced during construction stage particularly around settlements and in inhabited areas. Mitigation measures as listed in **Table 4.7.2** shall therefore be adopted for mitigating noise levels.

Table 4.7.2: Sources of Noise Pollution, Impacts and Suggested Mitigation Measures

Sl. No.	Source of Noise Pollution	Impacts	Suggested Mitigation Measures
1	<ul style="list-style-type: none"> Mobilization of heavy construction machinery; Acceleration/deceleration/gear changes by the vehicles depending on the level of congestion and smoothness of road surface; Excavation for foundations and grading of the site; Construction of structures and facilities; Crushing plants, asphalt production plants; Loading, transportation and unloading of construction materials. 	Increased Noise Levels causing discomfort to local residents and workers	<ul style="list-style-type: none"> All construction equipment, plants, machinery and vehicles will follow prescribed noise standards. All construction equipment used for an 8 hour shift shall conform to a standard of less than 90 dB(A); At construction sites within 150 m of human settlements, noisy construction shall be stopped between 10.00 PM and 6.00 AM; Vehicles and construction machinery shall be monitored regularly with particular attention to silencers and mufflers to maintain noise levels to minimum; Workers in the vicinity of high noise levels must wear ear plugs, helmets and should be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90 dB(A) per 8 hour shift; Hot mix plant, batching or aggregate plants shall not be located within 500 m of sensitive land use as schools, hospitals etc; At critical locations, especially along sensitive receptors such as hospitals and schools, noise barrier walls and mounds of various materials such as earth, concrete, wood, metal or double glazing of windows for façade insulation shall be used.

4.8 BIOLOGICAL ENVIRONMENT

4.8.1 Flora/Road Side Trees

(a) Impacts

Construction Phase

The main impact on flora involves the removal of trees and grubbing of vegetative cover for construction and a clear zone within the Right of Way (ROW). Widening of the 1-lane to 2-lanes would have negative impact on plant species by way of cutting the trees and shrubs for construction activities. The types of impacts on flora can be as follows:

- Loss of trees;
- Loss of canopies;
- Loss of green tunnels;
- Compaction of vegetation, and
- Pollution and dust accumulation on vegetation.

A total number of 23,596 trees exist within the right of way within which 16,992 nos., i.e. 72.0% of the total will be impacted and have to be removed. Details of impacted trees on LHS/RHS are given in **Table 4.8.1** below. The number of trees affected has been calculated as per the best alternative decided for widening the highway taking into account the following:

- Minimum land acquisition;
- Minimum disturbance to utility services and other features; and
- Least impact on the environment.

The most significant impact of the proposed project will be the removal of small to medium girth trees which are planted within 2-5 years. No endangered or threatened species of flora has been recorded on the roadside and therefore none of these would be impacted. Marginal impact may arise with respect to air quality and ambient noise, as trees attenuate air pollutants and noise at varying degrees.

Table 4.8.1: Affected Trees

SI No	Name	GIRTH SIZE(m)								TOTAL
		0.00 - 0.50		0.50-1.00		1.00-2.00		>2.00		
		LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS	
1	Arjun	16	6	4	0	0	0	0	0	26
2	Amalakhi	56	77	14	1	1	0	0	0	149
3	Ahant	6	3	4	5	3	0	1	0	22
4	Akashmoni	75	36	17	8	6	3	0	0	145
5	Arecanut	351	153	0	0	0	0	0	0	504
6	Ajar	4	7	0	0	0	0	0	0	11
7	Bokul	5	2	1	2	0	0	0	0	10
8	Bhelu	10	22	11	8	0	0	0	0	51
9	Bogori	3	38	0	0	0	0	0	0	41
10	Bottolbrush	117	98	23	18	4	2	0	0	262
11	Coconut	5	14	3	2	0	0	0	0	24
12	Debadaru	1	3	0	0	0	0	0	0	4
13	Eucalyptus	99	45	70	20	16	1	3	0	254
14	Gamari	43	62	37	22	2	1	0	0	167
15	Jia	8	15	13	4	0	0	0	0	40
16	Jalphai	3	7	3	2	1	0	0	0	16
17	Jam	133	170	48	64	3	3	2	0	423
18	Krishnasura	325	302	114	47	35	10	15	0	848
19	Kadam	10	21	0	3	0	0	0	0	34
20	Koroi	58	86	34	36	4	7	2	1	228
21	Kanthai	337	360	152	166	17	8	3	0	1043
22	Madar	128	80	55	12	14	2	1	0	292
23	Mangoo	448	497	225	153	31	7	6	4	1371
24	Neem	55	34	35	20	7	1	0	1	153

SI No	Name	GIRTH SIZE(m)								
		0.00 - 0.50		0.50-1.00		1.00-2.00		>2.00		TOTAL
		LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS	
25	Poma	56	142	57	61	9	6	2	0	333
26	Radhasura	88	174	25	28	5	2	3	0	325
27	Rubber	11	5	2	1	1	0	0	0	20
28	Sonaru	12	38	12	5	4	2	0	0	73
29	Segum	1484	1244	702	512	163	17	52	0	4174
30	Imalu	31	47	10	18	2	0	1	0	109
31	Sisu	0	20	3	2	0	0	1	0	26
32	Satiyana	20	15	13	7	1	2	1	0	59
33	Sal	0	2	0	0	0	0	0	0	2
34	Sirish	146	138	76	56	29	10	19	0	474
35	Teteli	63	98	31	28	9	2	1	1	233
36	Uriam	23	9	6	0	0	0	1	0	39
37	Others	1677	1696	728	674	122	66	30	14	5007
38		5907	5766	2528	1985	489	152	144	21	16992

Operation Phase

Total 16,992, Numbers i.e. 72.0% of total trees ie 23,596 will be affected. After removal of trees a handsome numbers of Trees will be planted ($16,992 \times 3 = 50,976$) along the road which will absorbed pollution load in-terms of air and noise and also improve the aesthetic value in future.

(b) Mitigation Measures

The tree plantation felled will be replaced and compensated according to the Compensatory Afforestation Policy under the Forest Conservation Act, 1980. Apart from trees earmarked for feeling, no additional tree clearing within the ROW will be carried out.

Plantation of shrubs and under trees in the median shall be undertaken to prevent the glare of the vehicles coming in the opposite direction. Construction vehicles, machinery and equipment will move or be stationed in the (ROW) to prevent compaction of vegetation. While operating on temporarily acquired land for traffic detours, storage, material handling or any other construction related or incidental activities, it will be ensured that the trampling of soil will be avoided.

Construction of road will involve removal of topsoil and cutting resulting in clearing of vegetation cover and felling of trees. However such impacts will primarily occur at the project site during initial period of the construction phase and will be minimized through adoption of mitigation measures. As per the result of tree inventory 16,992 trees will going to be affected due to widening and strengthening of road. It is recommended that these trees will be compensated @ 1:3 that is $16,992 \times 3 = 50,976$ trees will be planted against 16,992 trees.

However, following measure will be taken care during construction phase -

- It is suggested that regular monitoring by the forest department should be done;

- Anti-poaching measures during construction phase should be strengthened to check violation of existing regulations;
- Water sprinkling trucks used as construction vehicles should be properly and regularly done, so that dust pollution problem on vegetation will be minimized;
- A suitable landscaping plan for the project road has been prepared to enhance the ecological status of the area;
- It was noticed, that the project road did not have tree cover at few locations tree plantation at these location will enhance the aesthetics as well as reduce the pollution level of the area; and
- A initiative should be taken to removed the impacted small girth size trees with the help of Forest Department and replanted them at designed place. Though cost involvement against this type of work is very high, it will save the life of growing plants.

4.8.2 Fauna

No endangered or threatened fauna species were reported in the area close to the project highway. Hence no specific mitigation measure has been proposed to avoid / minimize impacts on fauna. However, following measure will be taken care during construction phase” to avoid collision of some wild as well domestic animals:

- It is suggested that regular monitoring by the forest department should be done;
- Anti-poaching measures during construction phase should be strengthened to check violation of existing regulations;
- Side barriers will be provided to avoid collision of animals in forest area; and
- Animal under passes will be provided at various suitable locations to avoid accident.

4.9 Socio-Economic Environment

4.9.1 Religious and Cultural Properties

The following properties are likely to be affected:

AIZAWL DISTRICT

Properties likely to be affected:-

Religious properties

At Ch. 41.000 on LHS – Baptist Church

Cultural Properties

Properties likely to be affected:-

- At Ch. 40.900 on LHS – Selling Community Hall
- At Ch. 45.650 on RHS – YMA Library

SERCHHIP DISTRICT

Cultural Properties

I. Properties likely to be affected:-

- At Ch. 66.700 on LHS – Khumtung Community Hall

The nature and magnitude of impacts may vary depending upon its location such as displacement or loss of part thereof, vibration, noise pollution, damage from air pollution, dust accumulation, vehicular collision etc.

(b) Mitigation Measures

The project road does not run through specially preserved natural territories, proposed alignment will be worked out to minimize the impact on cultural / religious properties along the highway. If any valuable or invaluable articles such as fabrics, coins, artifacts, structures, or other archaeological relics are discovered, the excavation will be stopped and Archaeology Department central government will be intimated. At these chance found locations, Archaeologists will supervise the excavation to avoid any damage to the relics. About 44 cultural properties exist (within 20 m from the edge of the carriage way) out of that 2 is likely to impacted by the proposed work. It is recommended that proper compensation will be paid prior to the dislocation of these structures.

- All necessary and adequate care shall be taken to minimize impact on cultural properties (which includes cultural sites and remains, places of worship, graveyards, monuments and any other important structures as identified during design and construction);
- All conservation and protection measures will be taken up as per design. Access to such properties from the road shall be maintained clear and clean.
- All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation.
- The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing and shall, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same, awaiting which all work shall be stopped 100 m all directions from the site of discovery.

4.9.3 Amenities

(a) Impact

Construction Phase

There are number of amenities like hand tube-wells, water tap, wells, etc. exists along ROW and going to be affected by the project, are listed in **Table 4.9.3** below. All the affected public amenities will be properly compensated to minimize the problem of local communities.

Table 4.9.3: Affected Amenities

S. No.	Name of Amenity	LHS	RHS	Total
1	Hand Tube Well	7	14	21
2	Water Tap	38	46	84
3	Water Tank	5	10	15
4	HTP	1	2	3
5	Electric Post	344	319	663
6	Transformer	1	0	1
7	Telephone Post	163	160	323
8	OFC	93	100	193
9	KMP	37	25	62
10	Tower	0	1	1

Operation Phase

Shifting and construction of new amenities will reduce the adverse impacts that are faced by the local people during construction.

(b) Mitigation Measures

Project road side amenities like hand pumps, water tap, tube wells existing along ROW and going to be affected by the project, will be compensated and relocated with community consultation to avoid any kind of conflict between local communities.

4.9.4 Human Health

(a) Impact

Construction Phase

The pollutants generated during construction period are likely to have adverse impact on the health of workers and nearby habitation area. However, this is temporary in nature. Project allied activities such as unhygienic activities if any in construction camps may induce some new vector borne diseases among the local communities, which is not in the area at the moment. However, these adverse impacts can be effectively mitigated through enforcement of adequate mitigation measures as outlined in the Environment Management Plan.

Thus while construction phase might have some temporary adverse impacts on human health, on the whole it can be said that human health will not significantly deteriorate due to the implementation of the project.

Operation Phase

It is envisaged that the air pollution levels with the project scenario will be slightly in higher site than in the existing and without project scenario due to further increased vehicle speed, increased vehicle numbers, but it will not increase significantly due to better geometric design, improved pavement quality and increased of lane.

Thus while construction phase might have some temporary adverse impacts on human health, on the whole it can be said that human health will not significantly deteriorate due to the implementation of the project.

(b) Mitigation Measures

Construction of the road will inevitably result in generation of wastes. However, the amount of waste in normal situations is relatively small. The amount of waste created in constructing the road may be greater than usual due to substandard subsoil materials which will need to be replaced. The Contractor will be required to control the construction site, keep it clean and provide appropriate facilities for the temporary storage of all waste until it is disposed. Construction waste will be stored in special waste storage areas. The same concerns waste resulting from earth-moving/excavation. The waste will be stored adequately to avoid pollution of water supplies and sources as well as to avoid dust formation during dry seasons. The Contractor will be responsible for the safe transportation and storage of all waste in order to prevent any kind of environmental pollution or harmful effect to people or animals.

All necessary safeguards shall be taken to ensure safety, welfare and good health of all persons entitled to be on site and that works are carried out in a safe and efficient manner. The personnel working at vulnerable locations at site will wear safety helmets and strong footwear. This is to be ensured that all workmen and staff employed at the site use safety equipment such as eye protectors, hearing protectors, safety helmet, safety equipment for working over water, rescue equipment etc. as and when required. Fire extinguishers and first-aid equipment shall also be kept at the site.

Injuries might occur during the construction period. It is therefore pertinent to provide first aid facilities for all the construction workers requirements. At construction camps and at all workplaces first aid equipment and nursing staff must be provided along with the -

- ☞ Good and sufficient water supply will be maintained to avoid waterborne / water-related diseases and to secure the health of the workers; and
- ☞ Adequate drainage, sanitation and waste disposal will be provided at workplaces.

Protection of existing habitations from dust, Noise, Odour etc during construction Stage:-

- (a) Protection of existing habitations from dust during construction Stage :-**The contractor will take every precaution to reduce the level of dust from crushers/hot mix plants, construction sites involving earthwork by sprinkling of water, encapsulation of dust source and by erection of screen/barriers. All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement. The contractor will provide necessary certificates to confirm that all crushers used in construction conform to relevant dust emission control legislation. The suspended particulate matter value at a distance of 40m from a unit located in a cluster should be less than 500 g/m³. The pollution monitoring is to be conducted as per the monitoring plan. Alternatively, only crushers licensed by the SPCB shall be used. Required certificates and consents shall be submitted by the Contractor in such a case to the 'EO-PIU' through the 'Engineer'. Dust screening vegetation will be planted on the edge of the RoW for all existing roadside crushers. Hot mix plant will be fitted with dust extraction unit.

(b) Protection of existing habitations from Noise during construction Stage :-

The Contractor will confirm the following:

- All plants and equipment used in construction shall strictly conform to the MoEF/CPCB noise standards.
- All vehicles and equipment used in construction will be fitted with exhaust silencers.
- Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.
- Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986.

- Maintenance of vehicles, equipment and machinery shall be regular to keep noise levels at the minimum.
- At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching will be stopped during the night time between 9.00 pm to 6.00 am.
- No construction activities will be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 9.00 am to 6.0 pm.
- Monitoring shall be carried out at the construction sites as per the monitoring schedule and results will be submitted to 'EO PIU' through the 'Engineer'.

(c) Protection of existing habitations from Odour during construction Stage :-

Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of SPCB. The Contractor will submit PUC certificates for all vehicles/equipment/machinery used for the project. Monitoring results will also be submitted to 'PIU' through the 'Engineer'.

4.9.5 Road Safety

(a) Impact

Construction Phase

The project will improve the road safety through design measures identified during the various road surveys. Road safety will be enhanced in the project through engineering (design), enforcement (safety measures, signage, etc.) and education. The issue of road safety is one of the key issues that may surface in construction stage. During the construction stage, dismantling of structure, cutting of trees, haulage material obstructing vision, spillage of lubricants on road making it slippery are generally the cause of road accidents. Similarly, in operation stage, increase in traffic and increase in speed would tend to increase in accidents. In spite of these, the social benefits from the project are quite significant.

It is likely that there will be some concern of safety for highway users during construction period, as haulage of material and other equipment would restrict movement of vehicles. Highway patrolling system with ambulance facility and crane will render assistance to users in distress and disabled vehicles which in-turn will improve the safety level.

(b) Operation Phase

Road safety will be enhanced in the project through engineering (design), enforcement (safety measures, signage, etc.) and education. The proposed project implementation would improve the road safety for the highway users as well as locals living by the side of the road. The measures for the road safety include – provision of safety barrier of rigid, flexible or semi rigid type, strengthening of pavement with markings, median, improved traffic signs, pickup bus stops, intersection improvement, service road and footpath, pedestrian crossing facility with blinker light, striping and antiglare screen.

In operation stage, increase in traffic and increase in speed would tend to increase in accidents. In spite of these, the social benefits from the project are quite significant. In operation phase, increase in vehicle speed may cause thereof to the safety of pedestrians and for cattle for crossing road. Accident-prone areas were generally found near intersection and are being improved. Highway patrolling system with ambulance facility and crane will render assistance to users in distress and disabled vehicles which in-turn will improve the safety level.

(b) Mitigation Measures

To maintain adequate road safety, metal beam crash barriers, concrete crash barrier, fencing in urban areas, thermoplastic road marking and proper road signage lighting arrangements will be made. Segregating slow moving traffic in the market places by service lanes, provision of wider median in rural stretches and plantation of shrubs and under trees to avoid the glare of vehicles moving in opposite directions during night are some of the design solutions provided. Traffic management plans will be developed, especially in congested locations. Traffic control measures including no access will be enforced strictly on the main highway. Further growth of encroachment and squatting within the ROW will be discouraged.

The stretches of the road with points of traffic conflicts i.e. at major cross road crossings, town areas have been provided with underpasses, flyover or bypasses. There will not be any adverse

effect on traffic in the surrounding areas. The project Road will ease the traffic congestion and possibility of accidents will be reduced due to Grade Separated junctions and ROBs.

Road Safety Checklist

The use of checklists is highly recommended as they provide a useful "aide memoire" for the audit team to check that no important road safety aspects are being overlooked. They also give to the project manager and the design engineer a sense of understanding of the place of safety audit in the design process. The following lists have been drawn up based on the experience of undertaking systematic safety audit procedures overseas. This experience indicates that extensive lists of technical details has encouraged their use as "tick" sheets without sufficient thought being given to the processes behind the actions. Accordingly, the checklists provide guidelines on the principal issues that need to be examined during the course of the safety audits.

Stage 1 – During Feasibility Study

The audit team should review the proposed design from a road safety perspective and check the following aspects keeping an eye to IRC:SP:84:2009, IRC:SP:73:2007 and specifications for road and bridge works of MoRTH as shown in **Table 4.9.5.1**

Table: 4.9.5.1

CONTENTS	ITEMS
Aspects to be checked.	A. Safety and operational implications of proposed alignment and junction strategy with particular references to expected road users and vehicle types likely to use the road.
	B. Width options considered for various sections.
	C. Departures from standards and action taken.
	D. Provision of pedestrians, cyclists and intermediate transport.
	E. Safety implications of the scheme beyond its physical limits i.e. how the scheme fits into its environs and road hierarchy.
A1 : General	<ul style="list-style-type: none"> ➤ Departures from standards ➤ Cross-sectional variation ➤ Drainage ➤ Climatic conditions ➤ Landscaping ➤ Services apparatus ➤ Lay-byes ➤ Footpaths ➤ Pedestrian crossings ➤ Access (minimize number of private accesses) ➤ Emergency vehicles ➤ Public Transport ➤ Future widening ➤ Staging of contracts ➤ Adjacent development.
A2 : Local Alignment	<ul style="list-style-type: none"> ➤ Visibility ➤ New/Existing road interface ➤ Safety Aids on steep hills
A3: Junctions	<ul style="list-style-type: none"> ➤ Minimise potential conflicts ➤ Layout ➤ Visibility
A4: Non-Motorised road users Provision	<ul style="list-style-type: none"> ➤ Adjacent land ➤ Pedestrians ➤ Cyclists ➤ Non-motirised vehicles
A5: Signs and Lighting	<ul style="list-style-type: none"> ➤ Lighting ➤ Signs/Markings
A6: Construction and Operation	<ul style="list-style-type: none"> ➤ Buildability ➤ Operational ➤ Network Management

Stage 2 – Completion of Preliminary Design

The audit team should review the proposed design from a road safety perspective and check the following aspects keeping an eye to IRC:SP:84:2009, IRC:SP:73:2007 and specifications for road and bridge works of MoRTH as shown in **Table 4.9.5.2**

Table: 4.9.5.2

CONTENTS	ITEMS
Aspects to be checked.	<p>A. Safety and operational implications of proposed alignment and junction strategy with particular references to expected road users and vehicle types likely to use the road.</p> <p>B. Width options considered for various sections.</p> <p>C. Departures from standards and action taken.</p> <p>D. Provision of pedestrians, cyclists and intermediate transport.</p> <p>E. Safety implications of the scheme beyond its physical limits i.e. how the scheme fits into its environs and road hierarchy.</p>
B1 : General	<ul style="list-style-type: none"> ➤ Departures from standards ➤ Cross-sectional variation ➤ Drainage ➤ Climatic conditions ➤ Landscaping ➤ Services apparatus ➤ Lay-byes ➤ Footpaths ➤ Pedestrian crossings ➤ Access (minimize number of private accesses) ➤ Emergency vehicles ➤ Public Transport ➤ Future widening ➤ Staging of contracts ➤ Adjacent development.
B2 : Local Alignment	<ul style="list-style-type: none"> ➤ Visibility ➤ New/Existing road interface ➤ Safety Aids on steep hills
B3: Junctions	<ul style="list-style-type: none"> ➤ Minimise potential conflicts ➤ Layout ➤ Visibility
B4: Non-Motorised road users Provision	<ul style="list-style-type: none"> ➤ Adjacent land ➤ Pedestrians ➤ Cyclists ➤ Non-motorised vehicles
B5: Signs and Lighting	<ul style="list-style-type: none"> ➤ Lighting ➤ Signs/Markings
B6: Construction and Operation	<ul style="list-style-type: none"> ➤ Buildability ➤ Operational ➤ Network Management

Stage 3 – Completion of Detailed Design

The audit team should satisfy itself that all issues raised at Stage 1 have been resolved items may require further consideration where significant design changes have occurred.

If a scheme has not been subject to a stage 1 audit, the items listed in Checklists B1 to B6 should be considered together with the items listed below in **Table 4.9.5.3**

Table: 4.9.5.3

CONTENTS	ITEMS
Aspects to be checked.	<p>A. Any design changes since Stage 1.</p>
	<p>B. The detailed design from a road safety viewpoint, including the road safety implications of future maintenance (speed limits; road signs and markings ; visibility ; maintenance of street lighting and central reserves).</p>

CONTENTS	ITEMS
C1 : General	<ul style="list-style-type: none"> ➤ Departures from standards ➤ Drainage ➤ Climatic conditions ➤ Landscaping ➤ Services apparatus ➤ Lay-byes ➤ Access ➤ Skid-resistance ➤ Agriculture ➤ Safety Fences ➤ Adjacent development.
C2 : Local Alignment	<ul style="list-style-type: none"> ➤ Visibility ➤ New/Existing road interface
C3: Junctions	<ul style="list-style-type: none"> ➤ Layout ➤ Visibility ➤ Signing ➤ Lighting ➤ Road Markings ➤ T,X,Y-junctions ➤ All roundabouts ➤ Traffic signals
C4: Non-Motorised road users Provision	<ul style="list-style-type: none"> ➤ Adjacent land ➤ Pedestrians ➤ Cyclists ➤ Non-motorised vehicles
C5: Signs and Lighting	<ul style="list-style-type: none"> ➤ Advanced direction signs ➤ Local traffic signs ➤ Variable message signs ➤ Other traffic signs ➤ Lighting
C6: Construction and Operation	<ul style="list-style-type: none"> ➤ Buildability ➤ Operational ➤ Network Management

4.9.6 Social Interaction

(a) Impact

Construction Phase

Construction of road will limit the social interaction amongst the towns and villages along this improved route for few initial years.

Operation Phase

With the addition of another one lane in the existing highway, the social interaction amongst the towns and villages along this improved route will be strengthened. The quality of the life will also be enhanced.

(b) Mitigation Measure

No mitigation measure is required.

Chapter - 5

**Environmental Management Plan and
Institutional Arrangement**

CHAPTER - 5

ENVIRONMENTAL MANAGEMENT PLAN AND INSTITUTIONAL ARRANGEMENT

The environmental management measures shall be implemented during the various stages of the project viz: Pre-construction stage, Construction Stage and Operational Stage. The environmental management plan is as described below.

5.1 Objectives of EMP

The Environmental Management Plan (EMP) consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operational phases of the project to eliminate adverse environmental impacts, to offset them, or to reduce them to acceptable levels. The main aim of the Environmental Management Plan is to ensure that the various adverse impacts are mitigated and the positive impacts are enhanced. The objectives of the EMP at various stages of the project planning and implementation are described below.

A description of the various management measures suggested during different stages of construction / rehabilitation of road and bridges is provided in **Table 5.1** and **Table 5.2** respectively.

5.2 Pre-Construction Stage

5.2.1 Pre-construction Activities by PIU/Independent Consultant

Prior to the contractor mobilization, the PIU will ensure that an encumbrance free Corridor of Impact is handed over to enable the start of construction. Clearance involves the following activities:

- Removal and felling of trees is very minimal;
- Relocation of common property resources and community assets like telephone poles, electric poles and hand pumps will be impacted;
- Formal arrangements for maintenance of enhancement sites. This includes plantation of trees and barricades along the road; and
- Modification (if any), of the contract documents by the Engineer of the Independent Consultant.

5.2.2 Pre-construction Activities by Contractor

- Pre-construction stage involves mobilisation of the contractor and the activities undertaken by the contractor pertaining to the planning of logistics and site preparation necessary for commencing construction activities. The activities include:
- Joint field verification of EMP by the Environment Specialist of the Independent Consultant and Contractor.
- Identification and selection of material sources (quarry and borrow material, water, sand etc).

- Procurement of construction equipment / machinery such as crushers, hot mix plants, batching plants and other construction equipment and machinery.
- Selection, design and layout of construction areas, hot mix and batching plants, labour camps etc.
- Apply for and obtain all the necessary clearances/ NOC,s/ consents from the agencies concerned.
- Planning traffic diversions and detours including arrangements for temporary land acquisition.

5.3 Construction Stage

5.3.1 Construction activities by the Contractor

Construction stage is the most crucial stage in terms of activities that require careful management to avoid environmental impacts.

There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the Engineering Costs. They include providing roadside drainage, provision of cross drainage structures etc.

5.3.2 Construction Activities by the PIU/Independent Consultants

The PIU/Independent Consultant shall be involved in the smooth execution of the project and assisting the contractor during this phase. Their work shall include but not limited to :

- Monitoring and guiding the contractor on adopting good environmental and engineering practices;
- Arrangement of plantation through the Forest Department;
- Arranging training to the contractor and other stakeholders according to the needs arising; and
- Making changes in the design if need so arises.

5.4 Operation Stage

The operational stage involves the following activities by PIU -

- Monitoring of environmental conditions through approved monitoring agency; and
- Monitoring of operational performance of the various mitigation/enhancement measures carried out.

Table 5.1: Generic Environmental Management Plan

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
PRE-CONSTRUCTION STAGE						
Pre-construction Activities by PIU						
P1	Preservation of Trees	<p>All efforts will be made to preserve trees including evaluation of minor design adjustments/ alternatives to save trees. Specific attention will be given for protecting giant trees, and locally important trees (religiously important etc.).</p> <p>Tree cutting is to proceed only after all the legal requirements including attaining of In-principle and Formal Clearances from the Forest Dept./ DoEF/ MoEF are completed and subsequently a written order is issued to the Contractor.</p> <p>Particular species declared as 'protected' by the State's Forest Dept. in the private land will be felled only after due clearance from the Forest Dept./ concerned agencies is obtained.</p> <p>In the event of design changes, additional assessments including the possibility to save trees shall be made.</p> <p>Stacking, transport and storage of the wood will be done as per the relevant norms.</p> <p>Systematic corridor level documentation for the trees cut and those saved will be maintained with "EO-IC".</p>	<p>Clause No. 201.2 MORT&H Specifications for Road and Bridge works</p> <p>Guideline-I</p>	Throughout Corridor	PIU Forest Department Contractor	EO-IC
P2	Relocation of Community Utilities and Common Property Resources	All community utilities and properties i.e., water supply lines, sewer lines, hand pumps will be relocated before construction starts, on any section of the project corridor. The PIU will relocate these properties in consultation and written agreement with the agency/ owner/community. Environmental considerations with suitable/required actions including health and hygiene aspects will be kept in mind while relocating all community utilities and resources.	As in RAP	Throughout Corridor	PIU Concerned Agencies Contractor	EO-IC
P3	Orientation of Implementing Agency and Contractors	<p>The PIU shall organize orientation sessions and regular training sessions during all stages of the project. This shall include on-site training (general as well as in the specific context of a sub-project).</p> <p>These sessions shall involve all staff of Independent Consultants, field level</p>	Project Requirements	Throughout Corridor	Contractor	EO-IC

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		implementation staff of PIU and Contractor, Environmental Experts. The contractor will ensure that his staff including engineers, supervisors and operators attend the training sessions.				
P4	Joint Field Verification	<p>The Environmental Expert of IC and the Contractor will carry out joint field verification to ascertain any additional possibility to saving trees, environmental and community resources.</p> <p>The verification exercise should assess the need for additional protection measures or changes in design/ scale/ nature of protection measures including the efficacy of enhancement measures suggested in the EMP. Proper documentation and justifications/reasons shall be maintained in all such cases where deviation from the original EMP is proposed.</p>	Project Requirements	Throughout Corridor	Contractor Environmental Expert of IC	PIU NHAI
P5	Assessment of Impacts due to Changes/Revision s/Additions in the Project Work	The Environmental Expert of IC will assess impacts and revise/ modify the EMP and other required sections of the project documents in the event of changes/ revisions (including addition or deletion) in the project's scope of work.	Project Requirements	Throughout Corridor	Contractor Environmental Expert of IC	PIU NHAI
P6	Crushers, hot-mix plants and Batching Plants Location	<p>Hot mix plants and batching plants will be sited sufficiently away from settlements and agricultural operations or any commercial establishments. Such plants will be located at least 1000 m away from the nearest village/ settlement preferably in the downwind direction.</p> <p>The Contractor shall submit a detailed layout plan for all such sites and approval of Environmental Expert of IC shall be necessary prior to their establishment. Arrangements to control dust pollution through provision of windscreens, sprinklers, and dust encapsulation will have to be provided at all such sites.</p> <p>Specifications of crushers, hot mix plants and batching plants will comply with the requirements of the relevant current emission control legislations and Consent/NOC for all such plants shall be submitted to the "PIU through Independent Consultant.</p> <p>The Contractor shall not initiate plant/s operation till the required legal clearances are obtained and submitted. The engineer will ensure that the regulatory and legal requirements are being complied with.</p>	<p>Clause No 111.1 MoRT&H</p> <p>Air (P&CP) Act 1981,</p> <p>Guideline-I</p>	Throughout Corridor	Contractor	Engineer EO-IC
P7	Other Construction Vehicles,	All vehicles, equipment and machinery to be procured for construction will confirm to the relevant Indian Standard (IS) norms. The discharge	Project Requirement,	Throughout Corridor	Contractor	Engineer EO-IC I

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
	Equipment and Machinery	<p>standards promulgated under the Environment Protection Act, 1986 will be strictly adhered to.</p> <p>Noise limits for construction equipments to be procured such as compactors, rollers, front loaders concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB (A), measured at one meter from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986.</p> <p>The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced for EO - IC and NHA verification whenever required.</p> <p>Mobile equipment shall be placed at least 100metres away from the nearest dwelling.</p>	Guideline-I			
P8	Quarry	<p>Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials, quality and other logistic arrangements.</p> <p>In case the contractor decides to use quarries other than recommended by Feasibility consultants, then it will be selected based on the suitability of the materials and as per established law.</p> <p>The contractor will procure necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the "PIU through Engineer.</p> <p>Contractor will also work out haul road network and report to Environmental Expert of IC and IC will inspect and in turn report to PIU before approval.</p>	Clause No. 111.3 & MORT&H Specifications for Road and Bridge works	Along the Project Influence Area	Contractor	EO-IC PIU
P9	Arrangement for Construction Water	<p>The contractor will use ground water as a source of water for the construction and can set up the own bore well facility for construction work.</p> <p>Contractor can use the ponds with written agreement of owner, but in this case since ponds are not present along the road hence not applicable</p> <p>To avoid disruption/disturbance to other water users, the contractor will extract water from fixed locations and consult the Environmental Expert of</p>	<p>Clause No. 1010 MORT&H Specifications for Road and Bridge works</p> <p>EP Act 1986</p>	Along the Project Road	Contractor	EO-IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		<p>IC before finalizing the locations.</p> <p>The Contractor will provide a list of locations and type of sources from where water for construction will be used. The contractor will seek approval from the EO-IC prior to the finalization of these locations.</p> <p>The contractor will not be allowed to pump from any irrigation canal and surface water bodies used by community.</p> <p>The contractor will need to comply with the requirements of the State Ground Water Department and seek their approval for doing so and submit copies of the permission to IC and PIU prior to initiation of any construction work.</p>				
P10	Construction Camp Locations – Selection, Design and Lay-out	<p>Siting of the construction camps will be selected by the contractor as per the guidelines.</p> <p>Construction camps will not be proposed within 500 m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community applies only in case where a construction camp doesn't house plant sites.</p> <p>Location for stockyards for construction materials will be identified at least 1000 m from watercourses.</p> <p>The waste disposal and sewage system for the camp will be designed, built and operated such that no odour is generated.</p>	Guidelines II Guidelines for Siting and Layout of Construction Camp	Along the Project Road	Contractor	EO- IC PIU
P11	Implementation - Information Meetings	<p>The contractor will organize at least 2 implementation information meetings in the vicinity of Project Site (minimum one in each section) for general public to consult and inform people about his plans covering overall construction schedule, safety, use of local resources (such as earth, sand, water), traffic safety and management plans of debris disposal, drainage protection, canal training work during construction, pollution abatement and other plans, measures to minimize disruption, damage and in convenience to roadside users and people along the road. The first Implementation information meeting be conducted within four weeks of mobilization. The people should be informed about the date, time and venue atleast 7 days prior to meetings. Public shall be informed about the meeting through display of posters at prominent public places (panchayat offices, offices of</p>	Project Requirements	Along the Project Road	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		Market committees, Notice board of religious places etc.) and distribution of pamphlets along roadside communities or in any manner deemed fit. The contractor will maintain a channel of communication with the communities through his designated Environment and Safety Officer to address any concern or grievances. Periodic meetings will also be conducted during the construction period to take feedback from communities or their representatives to ensure minimum disturbance. The mechanism and contents for disclosure shall be approved by PIU prior to the meetings.				
CONSTRUCTION STAGE						
C1	Clearing and Grubbing	<p>Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimum.</p> <p>Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert of IC.</p> <p>The Contractor under any circumstances will not cut trees other than those identified for cutting and for which he has written instructions from the PIU. The PIU will issue these instructions only after receiving all stages of clearances from the Forest Department/ MoEF.</p> <p>Vegetation only with girth of over 30 cm will be considered as trees and shall be compensated, in the event of PIU's instruction to undertake tree cutting.</p> <p>The sub grade of the existing pavement shall be used as embankment fill material.</p> <p>The existing base and sub-base material shall be recycled as sub-base of the haul road or access roads.</p> <ul style="list-style-type: none"> The existing bitumen surface may be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes etc. 	<p>Clause No. 201 MORT&H Specifications for Road and Bridge works</p> <p>Guideline-III Guidelines for Site Clearance</p>	Along the work in progress	Contractor	EO-IC PIU
C2	Disposal of debris from dismantling structures and road surface	The contractor shall identify disposal sites. The identified locations will be reported to the Environmental Expert of IC. These locations will be checked on site and accordingly approved by Environmental Expert of IC prior to any disposal of waste materials.	Clause No. 201.4 MORT&H Specifications for Road and Bridge	Along the work in progress	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		<p>All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, will be considered incidental to the work and will be planned and implemented by the contractor as approved and directed by the Environmental Expert of IC.</p> <p>The pre-designed disposal locations will be a part of Comprehensive Solid Waste Management Plan to be prepared by Contractor in consultation and with approval of Environmental Expert of IC.</p> <p>Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area.</p>	<p>works</p> <p>Guideline-IV Guidelines for Disposal Site Management</p>			
C3	Other Construction Wastes Disposal	<p>The pre-identified disposal locations will be a part of Comprehensive Waste Disposal Management Plan to be prepared by the Contractor in consultation and with approval of Environmental Expert of IC. Location of disposal sites will be finalized prior to initiation of works on any particular section of the road.</p> <p>The Environmental Expert of IC will approve these disposal sites after conducting a joint inspection on the site with the Contractor.</p> <p>Contractor will ensure that any spoils of material unsuitable for embankment fill will not be disposed off near any water course, agricultural land, and natural habitat like grass lands or pastures. Such spoils from excavation can be used to reclaim borrow pits and low-lying areas located in barren lands along the project corridors (if so desired by the owner/community and approved by the Environment Expert IC).</p> <p>Non-bituminous wastes other than fly ash may be dumped in borrow pits (preferably located in barren lands) covered with a layer of the soil. No new disposal site shall be created as part of the project, except with prior approval of the Environmental Expert of IC.</p> <p>All waste materials will be completely disposed and the site will be fully cleaned and certified by Environmental Expert of IC before handing over.</p> <p>The contractor at its cost shall resolve any claim, arising out of waste disposal or any non-compliance that may arise on account of lack of action</p>	<p>Clause No. 301.3.2 MORT&H Specifications for Road and Bridge works</p>	Along the Road	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		on his part.				
C4	Stripping, stocking and preservation of top soil	<p>The topsoil from all areas of cutting and all areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way will be earmarked for storing topsoil. The locations for stock piling will be pre-identified in consultation and with approval of Environmental Expert of IC. The following precautionary measures will be taken to preserve them till they are used:</p> <p>(a) Stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, silt fencing will protect the edges of the pile.</p> <p>(b) Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles shall be covered with gunny bags or vegetation.</p> <p>(c) It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles.</p> <p>Such stockpiled topsoil will be utilized for -</p> <ul style="list-style-type: none"> covering all disturbed areas including borrow areas only in case where these are to be rehabilitated as farm lands (not those in barren areas) top dressing of the road embankment and fill slopes filling up of tree pits, in the median and in the agricultural fields of farmers, acquired temporarily. <p>Residual topsoil, if there is any will be utilized for the plantation at median and side of the main carriageway.</p>	Clause No. 301.2.2 MORT&H Specifications for Road and Bridge works	Along the Road	Contractor	EO- IC PIU
C5	Planning for Traffic Diversions and Detours	<p>Temporary diversions will be constructed with the approval of the Resident Engineer and Environmental Expert of IC for which contractor will seek prior approval for such plans.</p> <p>Detailed Traffic Control Plans will be prepared and submitted to the Resident Engineer for approval, seven days prior to commencement of works on any section of road. The traffic control plans shall contain details diversions; traffic safety arrangement during construction; safety measures</p>	<p>Clause No. 112 MORT&H Specifications for Road and Bridge works</p> <p>IRC; SP 55 Guideline-VII</p>	Along the Road	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		<p>for night – time traffic and precautions for transportation of hazardous materials. Traffic control plans shall be prepared in line with requirements of IRC's SP- 55 document and The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.</p> <p>The contractor will also inform local community of changes to traffic routes, conditions and pedestrian access arrangements with assistance from IC and PIU. The temporary traffic detours will be kept free of dust by sprinkling of water three times a day and as required under specific conditions (depending on weather conditions, construction in the settlement areas and volume of traffic).</p>	Guidelines for Traffic management during construction			
C6	Quarry Operations	<p>The contractor shall obtain materials from quarries only after the consent of the Department of Mining / SPCB (both the states) / District Administration or will use existing approved sources of such materials. Copies of consent/ approval/ rehabilitation plan for opening a new quarry or use of an existing quarry source will be submitted to Environment Expert IC and the Resident Engineer.</p> <p>The contractor will develop a Comprehensive Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy to PIU and IC prior to opening of the quarry site.</p> <p>The quarry operations will be undertaken within the rules and regulations in force in the state.</p>	<p>Clause No. 111.3 MORT&H Specifications for Road and Bridge works</p> <p>Guidelines VI Guideline for Quarry Management</p>	Quarry Areas	Contractor	EO- IC PIU
C7	Transporting Construction Materials and Haul Road Management	<p>Contractor will maintain all roads (existing or built for the project), which are used for transporting construction materials, equipment and machineries as précised. All vehicles delivering fine materials to the site will be covered to avoid spillage of materials.</p> <p>All existing highways and roads used by vehicles of the contractor or any of his sub-contractor or suppliers of materials and similarly roads, which are part of the works, will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles.</p> <p>Contractor will arrange for regular water sprinkling as necessary for dust suppression of all such roads and surfaces with specific attention to the settlement areas.</p>	Project Requirement	All Roads Used	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		The unloading of materials at construction sites/close to settlements will be restricted to daytime only.				
C8	Construction Water	<p>Contractor will arrange adequate supply and storage of water for the whole construction period at his own costs. The Contractor will submit a list of source/s from where water will be used for the project to 'PIU' through the Engineer.</p> <p>The contractor will source the requirement of water preferentially from ground water but with prior permission from the Ground Water Board. A copy of the permission will be submitted to 'PIU' through the Engineer prior to initiation of construction.</p> <p>The contractor will take all precaution to minimize the wastage of water in the construction process/ operation.</p>	Clause No. 1010 EP Act 1986 MORT&H Specifications for Road and Bridge works	Along the Project	Contractor	EO- IC PIU
C9	Disruption to Other Users of Water	<p>While working across or close to any perennial water bodies, contractor will not obstruct/ prevent the flow of water.</p> <p>Construction over and close to the non-perennial streams shall be undertaken in the dry season. If construction work is expected to disrupt users of community water bodies, notice shall be served well in advance to the affected community by the contractor.</p> <p>The contractor will take prior approval of the River Authority or Irrigation Department for any such activity. The PIU and the Engineer will ensure that contractor has served the notice to the downstream users of water well in advance.</p>		All Water Bodies Used	Contractor	EO- IC PIU
C11	Drainage	Contractor will ensure that no construction materials like earth, stone, ash or appendage is disposed off in a manner that blocks the flow of water of any water course and cross drainage channels. Contractor will take all-necessary measures to prevent any blockage to water flow. In addition to the design requirements, the contractor will take all required measures as directed by the 'EO-IC' and the 'Resident Engineer' to prevent temporary or permanent flooding of the site or any adjacent area.	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works	Drainage line along the road	Contractor	EO- IC PIU
C12	Siltation of Water Bodies and Degradation of Water Quality	<p>The Contractor will not excavate beds of any stream/canals/ any other water body for borrowing earth for embankment construction.</p> <p>Contractor will construct silt fencing at the base of the embankment</p>	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge	All Surface Water Bodies Along the Road	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		<p>construction for the entire perimeter of any water body (including wells) adjacent to the ROW and around the stockpiles at the construction sites close to water bodies. The fencing will be provided prior to commencement of earthwork and continue till the stabilization of the embankment slopes, on the particular sub-section of the road. The contractor will also put up sedimentation cum grease traps at the outer mouth of the drains located in truck lay byes and bus bays which are ultimately entering into any surface water bodies / water channels with a fall exceeding 1.5 m. in present case three Sedimentation Cum Grease Trap are proposed, However the item has been kept in case need arises during construction.</p> <p>Contractor will ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby watercourse.</p>	<p>works</p> <p>Water (P & CP) Act 1981</p>			
C13	Slope Protection and Control of Soil Erosion	<p>The contractor will take slope protection measures as per design, or as directed by the Environmental Expert of IC to control soil erosion and sedimentation.</p> <p>All temporary sedimentation, pollution control works and maintenance thereof will be deemed as incidental to the earth work or other items of work and as such as no separate payment will be made for them.</p> <p>Contractor will ensure the following aspects:</p> <ul style="list-style-type: none"> During construction activities on road embankment, the side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Turfing works will be taken up as soon as possible provided the season is favorable for the establishment of grass sods. Other measures of slope stabilization will include mulching netting and seeding of batters and drains immediately on completion of earthworks. In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank. Along sections abutting water bodies, stone pitching as per design specification will protect slopes. 	<p>Clause No. 306 & 305.2.2 MORT&H Specifications for Road and Bridge works</p> <p>Guideline-IX Soil Erosion & Sedimentation Control)</p>	Along the Roads	Contractor	EO- IC PIU
C14	Water Pollution from Construction Wastes	The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into streams,	Clause No. 501.8.6 MORT&H	Along the road	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		<p>water bodies or the irrigation system. Contractor will avoid construction works close to the streams or water bodies during monsoon.</p> <p>All waste arising from the project is to be disposed off in the manner that is acceptable and as per norms of the State Pollution Control Board.</p>	<p>Specifications for Road and Bridge works</p> <p>Water (P & CP) Act 1974</p>			
C15	Water Pollution from Fuel and Lubricants	<p>The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500 m from rivers and irrigation canal/ponds.</p> <p>All location and layout plans of such sites will be submitted by the Contractor prior to their establishment and will be approved by the 'EO-IC, PIU/ NHAI'.</p> <p>Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided for vehicle parking, wash down and refueling areas as per the design provided.</p> <p>In all, fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage.</p> <p>Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to IC and PIU) and approved by the Environmental Expert of IC. All spills and collected petroleum products will be disposed off in accordance with MoEF and state PCB guidelines.</p> <p>'EO-IC and Resident Engineer' will certify that all arrangements comply with the guidelines of PCB/ MoEF or any other relevant laws.</p>	<p>Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works</p> <p>Water (P & CP) Act 1974</p> <p>Guideline XI Guidelines For The Storage, Handling, Use And Emergency Response For Hazardous Chemicals</p>	Along the Roads	Contractor	EO- IC PIU
C16	Dust Pollution	<p>The contractor will take every precaution to reduce the level of dust from crushers/hot mix plants, construction sites involving earthwork by sprinkling of water, encapsulation of dust source and by erection of screen/barriers. All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement.</p>	<p>Clause No. 111 & 501.8.6 MORT&H Specifications for Road and Bridge works</p>	Along the Roads, Construction Site/ Camps	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		<p>The contractor will provide necessary certificates to confirm that all crushers used in construction conform to relevant dust emission control legislation.</p> <p>The suspended particulate matter value at a distance of 40m from a unit located in a cluster should be less than 500 g/m³. The pollution monitoring is to be conducted as per the monitoring plan.</p> <p>Alternatively, only crushers licensed by the SPCB shall be used. Required certificates and consents shall be submitted by the Contractor in such a case to the 'EO-PIU' through the 'Engineer'.</p> <p>Dust screening vegetation will be planted on the edge of the RoW for all existing roadside crushers. Hot mix plant will be fitted with dust extraction units.</p>	Air (P & CP) Act 1981			
C17	Emission from Construction Vehicles, Equipment and Machineries	<p>Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of SPCB.</p> <p>The Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project. Monitoring results will also be submitted to 'PIU' through the 'Engineer'.</p>	<p>Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works</p> <p>Air (P & CP) Act 1981</p> <p>Central Motor & Vehicle Act 1988</p>	Along the Roads , all vehicles used/ Camps	Contractor	EO- IC PIU,
C18	Noise Pollution: Noise from Vehicles, Plants and Equipments	<p>The Contractor will confirm the following:</p> <ul style="list-style-type: none"> All plants and equipment used in construction shall strictly conform to the MoEF/CPCB noise standards. All vehicles and equipment used in construction will be fitted with exhaust silencers. Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986. Maintenance of vehicles, equipment and machinery shall be regular to keep noise levels at the minimum. 	<p>Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works</p> <p>EP Act 1986</p> <p>Noise Rules 2002</p>	Along the Roads, all vehicles used/Camps	Contractor	EO- IC, PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching will be stopped during the night time between 9.00 pm to 6.00 am. <p>No construction activities will be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 9.00 am to 6.0 pm.</p> <p>Monitoring shall be carried out at the construction sites as per the monitoring schedule and results will be submitted to 'EO PIU' through the 'Engineer'.</p>				
C19	Personal Safety Measures for Labour	<p>Contractor will provide:</p> <ul style="list-style-type: none"> Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete etc. Welder's protective eye-shields to workers who are engaged in welding works Protective goggles and clothing to workers engaged in stone breaking activities and workers will be seated at sufficiently safe intervals Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. Adequate safety measures for workers during handling of materials. The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. <p>The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract.</p> <p>The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to.</p> <p>The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with</p>	<p>The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996</p> <p>Factories Act 1948 Guideline VIII</p> <p>Guideline for workers safety During construction</p>	Along the Roads, all vehicles used/Camps	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		<p>products containing lead in any form.</p> <p>The contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint.</p> <p>Contractor will provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint dry is rubbed and scrapped.</p> <p>The Contractor will mark 'hard hat' and 'no smoking' and other 'high risk' areas and enforce non-compliance of use of PPE with zero tolerance. These will be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and will be approved by 'IC' and 'PIU'.</p>				
C20	Traffic and Safety	<p>The contractor will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the 'EO-IC' and 'Resident Engineer' for the information and protection of traffic approaching or passing through the section of any existing cross roads.</p> <p>The contractor will ensure that all signs, barricades, pavement markings are provided as per the MOSRT&H specifications. Before taking up of construction on any section of the existing lanes of the highway, a Traffic Control Plan will be devised and implemented to the satisfaction of 'EO-IC' and 'Resident Engineer'</p>	<p>IRC: SP: 55</p> <p>Guidelines VII</p> <p>Guidelines for Traffic Management during Construction</p>	Along the Roads , all vehicles used/Camps	Contractor	EO- IC PIU
C21	Risk from Electrical Equipment(s)	<p>The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that -</p> <ul style="list-style-type: none"> No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. <p>All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the 'Resident Engineer'.</p>	<p>The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996</p> <p>Factories Act 1948</p>	Along the Roads	Contractor	EO- IC PIU
C22	Risk Force Measure	The contractor will take all reasonable precautions to prevent danger to the workers and public from fire, flood etc. resulting due to construction activities.	The Building and other construction workers (Regulation of	Along the Roads, construction	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		The contractor will make required arrangements so that in case of any mishap all necessary steps can be taken for prompt first aid treatment. Construction Safety Plan prepared by the Contractor will identify necessary actions in the event of an emergency.	Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Camps		
C23	First Aid	The contractor will arrange for - <ul style="list-style-type: none"> a readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital Equipment and trained nursing staff at construction camp. 	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Along the Roads, construction Camps	Contractor	EO- IC PIU
C24	Flora and Chance found Fauna	The contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Environmental Expert of IC and carry out the IC's instructions for dealing with the same. The Environmental Expert of IC will report to the near by forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.	Forest Conservation Act 1980 Wild Life Act 1972	Along the Roads	Contractor	EO- IC PIU
C25	Accommodation	Contractor will follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labor camp. The location, layout and basic facility provision of each labor camp will be submitted to IC and 'EO-PIU' prior to their construction. The construction will commence only upon the written approval of the Environmental Expert of IC.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Along the Roads, construction Camps/site	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		The contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the IC.	Guidelines II Guidelines for Siting and Layout of construction camp			
C26	Potable Water	<p>The Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing.</p> <p>The Contractor will also provide potable water facilities within the precincts of every workplace in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996.</p> <p>The contractor will also guarantee the following:</p> <ol style="list-style-type: none"> Supply of sufficient quantity of potable water (as per IS) in every workplace/labor campsite at suitable and easily accessible places and regular maintenance of such facilities. If any water storage tank is provided that will be kept such that the bottom of the tank at least 1mt. from the surrounding ground level. If water is drawn from any existing well, which is within 30mt. proximity of any toilet, drain or other source of pollution, the well will be disinfected before water is used for drinking. All such wells will be entirely covered and provided with a trap door, which will be dust proof and waterproof. A reliable pump will be fitted to each covered well. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. <p>Testing of water will be done as per parameters prescribed in IS 10500:1991.</p>	<p>The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996</p> <p>Factories Act 1948</p>	Along the Roads, construction Camps/construction site	Contractor	EO- IC PIU
C27	Sanitation and Sewage System	<p>The contractor will ensure that -</p> <ul style="list-style-type: none"> the sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women adequate water supply is to be provided in all toilets and urinals 	Project Specific Requirement	Along the Roads, construction Camps/Construction Sites	Contractor	EO- IC PIU

Client:

Final Detailed Project Report

S. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		All toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition.				
C28	Waste Disposal	<p>The contractor will provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of IC.</p> <p>Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Environmental Expert of IC will have to be provided by the contractor.</p>	Guidelines II Guidelines for Siting and Layout of Labor Camp	Along the Roads, construction Camps	Contractor	EO- IC PIU

Table 5.2: Environmental Management Plan

Sl. No.	Environmental Issue	Management Measures	Reference	Time Frame	Location	Responsibility	
						Execution/ Civil Work	Supervision / Monitoring
OPERATION STAGE							
Activities to be carried Out by PIU							
O1	Monitoring Operation Performance	<p>The PIU will monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project.</p> <p>The indicators selected for monitoring include the survival rate of trees; utility of enhancement provision, status of rehabilitation of borrow areas and disposal sites,</p>	-	Operation Phage	Along the Road	PIU	PIU
O2	Maintenance of Drainage	<p>PIU will ensure that all drains (side drains, median drain and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding.</p> <p>PIU will ensure that all the sediment and oil and grease traps set up at the water bodies are cleared once in every three months.</p>		Operation Phase	Along the Road	PIU	PIU

Client:

Final Detailed Project Report

Sl. No.	Environmental Issue	Management Measures	Reference	Time Frame	Location	Responsibility	
						Execution/ Civil Work	Supervision / Monitoring
O3	Pollution Monitoring	The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination in the selected locations as suggested in pollution monitoring plan (Refer Chapter 4 for Monitoring Locations of air, water and noise) will be responsibility of PIU. PIU will either appoint PCB or its approved pollution-monitoring agency for the purpose.		Operation Phase	Along the Road	PIU through Pollution Monitoring Agency	PIU
O4	Atmospheric Pollution	Ambient air concentrations of various pollutants shall be monitored as envisaged in the pollution-monitoring plan	Air (P & CP) Act 1981	Operation Phase	Along the Road	PIU through Pollution Monitoring Agency	PIU
O5	Noise Pollution	Noise pollution will be monitored as per monitoring plan at sensitive locations. Noise control programs are to be enforced strictly. Monitoring the effectiveness of the pollution attenuation barriers Hospital Boundary wall will be taken up thrice in the operation period.	Noise Rules 2002	Operation Phase	Along the Road	PIU through Pollution Monitoring Agency	PIU
O6	Water Pollution	Water Quality will be monitored as per monitoring plan	Water (P & CP) Act 1974	Operation Phase	Along the Road	PIU through Pollution Monitoring Agency	PIU
O7	Soil Erosion and Monitoring Areas	Visual monitoring and inspection of soil erosion at quarries (if closed and rehabilitated), embankment > 2m. and other places expected to be affected, will be carried out once in every three months as suggested in monitoring plan.		Operation Phase	Along the Road	PIU	PIU
O8	Road Safety	Road Safety will be monitored during operation especially at location where traffic-calming measures have been proposed.		Operation Phase	Along the Road	PIU	PIU

Chapter - 6

Environmental Monitoring Plan

CHAPTER - 6

ENVIRONMENTAL MONITORING PLAN

The purpose of the training and monitoring programme is to ensure that the envisaged purpose of the project is achieved and results in desired benefits to the target population. To ensure the effective implementation of the Environmental Management Plan (EMP), it is essential that an effective monitoring program should be designed and carried out. The environmental monitoring programme provides such information based on which management decision may be taken during construction and operational phases. It provides basis for evaluating the efficiency of mitigation and enhancement measures and suggest further actions that need to be taken to achieve the desired effect.

The Environmental Monitoring will depend on institutional strengthening arrangements including environmental training, implementation schedule and procedure for monitoring and reporting on the work proposed in the EMP. In order to proper implementation of the EMP one experienced Environmental Officer (EO) from another concerned Department should be engaged in the Project Implementation Unit (PIU). Long term establishment of special Environmental Unit within PIU, environmental training to Project Coordinators responsible for overseeing the work, environmental training of relevant consultant and contractor's staff and development of environmental monitoring and reporting form and procedures. Thus the following components are essential for proper implementation of EMP

- ✓ Organisational and staffing arrangements;
- ✓ Environmental training;
- ✓ Monitoring procedures; and
- ✓ Record keeping.

6.1 Organizational and Staffing Arrangements

- Government will establish a PIU and all the staff members of this unit should have some responsibility to meet Govt's environment policy requirements and adequate attention paid to ecological concerns;
- An Environmental Officer (EO) would be seconded to the PIU from the Department of Forest or related department;
- The EO will be assisted by the Project Coordinators (PC's) identified by the PIU to observe construction contracts;
- Before the commencement of construction, the PC's will undergo training in the environmental issues associated with road construction and maintenance projects;
- Environmental Management Unit will be established in accordance with PIU requirements with adequate support staff;
- EMU within PIU will see the day-to-day Environment Management of the on-going project;

- The EO attached to the PIU should be a very qualified, experienced and competent officer and he should be able to developed and impart training to contractors and supervision consultants staff. The EO will coordinate the road safety components of the proposed institutional development plan and issues related to the effect of roadside environment on road safety and non-motorized traffic.

PIU =====>	EMAP UNIT =====>	RAP UNIT
Functions	Staff	Staff
1. Implement and monitor as well as other related environmental activities. 2. Implement and monitor RAP and related R&R activities	1. Environmental Engineer 2. Forest Officer (for Environment) 3. Support Staff	1. Senior Revenue Officer 2. Social Scientist 3. Executive Engineer 4. Support Staff

6.2 Training

A comprehensive training programme must be planned for the project intended to address all components of the project. Training of staff will be undertaken at a number of levels. The programme should be intended for all contractors, consultants and the engineers. Immediate short-term training will be essential for PC's and other staff of PIU and the Contractor's staff to raise their level of environmental awareness.

A list of appropriate training module and tentative time frame is given in **Table 6.1** below.

Table 6.1: Training Module

Training Type	Target Group	Time	Items
Orientation Training	Engineers/Contractors	Pre Construction Stage	Environmental Issues in EMP
EM implementation Training	Consultants/Contractors/PIU Engineers	Pre Construction Stage	All measures included in EMP and site selection for Plants, Camps & Stores
Safety Training	Construction Staff/Supervisor	Construction Stage	Road safety, signage, traffic management, accident management
Maintenance Training	PIU staff, EMU, Local Bodies, Police	After Construction	Road safety, Accident Management, Maintenance of Road

6.3 Monitoring

The monitoring programme should includes-

- Visual observations;
- Selection of environmental parameters at specific locations; and
- Sampling and regular testing of these parameters.

The Objectives of environmental monitoring programme are-

- Evaluation of the efficiency of mitigation and enhancement measures;
- Updating of the actions and impacts of baseline data;
- Adoption of additional mitigation measures if the present measures are insufficient; and
- Generating the data, which may be incorporated in environmental management plan in future projects.

Monitoring methodology covers the following key aspects:

- Components to be monitored;
- Parameters for monitoring of the above components;
- Monitoring frequency;
- Monitoring standards;
- Responsibilities for monitoring; and
- Monitoring costs.

Environmental monitoring of the parameters involved and the threshold limits specified are discussed below.

6.3.1 Ambient Air Quality Monitoring Programme (AAQMP)

The air quality parameters viz: Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x), Carbon Monoxide (CO), Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM) and Lead (Pb) shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in **Table 6.3.1**. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan **Table 6.3.4**.

Table 6.3.1: National Ambient Air Quality Standards

Pollutants	Time weighted	Sensitive	Industrial Area	Residential Rural & Other	Method of Measurement
Sulphur Dioxide (SO ₂)	Annual*	15 µg/m ³	80 µg/m ³	60 µg/m ³	Improved West and Gaeke method
	24 hours**	30 µg/m ³	120 µg/m ³	90 µg/m ³	Ultraviolet fluorescence
Oxides of Nitrogen (NO _x)	Annual	15 µg/m ³	80 µg/m ³	65 µg/m ³	Jacob and Hochheiser modified (Na-Arsenite)
	24 hours**	30 µg/m ³	120 µg/m ³	91µg/m ³	Gas phase chemiluminescence
Carbon	8 hours**	1000 µg/m ³	5000 µg/m ³	2000 µg/m ³	Non dispersive

Pollutants	Time weighted	Sensitive	Industrial Area	Residential Rural & Other	Method of Measurement
Monoxide (CO)	1 hour	2000 µg/m ³	1000 µg/m ³	4000 µg/m ³	infrared spectroscopy
Lead (Pb)	Annual*	0.50 µg/m ³	1.0 µg/m ³	0.75 µg/m ³	AAS Method 24 hours after sampling using EPM 20000 or equivalent filter paper
	24 hours**	0.75 µg/m ³	1.5 µg/m ³	1.00 µg/m ³	
Respirable Particulate(R PM) – Size less than 10 µm	Annual*	50 µg/m ³	120 µg/m ³	60 µg/m ³	----
	24 hours**	75 µg/m ³	150 µg/m ³	100 µg/m ³	----
Suspend Particulate Matter (SPM)	Annual*	70 µg/m ³	360 µg/m ³	140 µg/m ³	Average flow rate not less than 1.1M ³ / minute
	24 hours**	100 µg/m ³	500 µg/m ³	200 µg/m ³	

Source : National Ambient Air Quality Monitoring Series NAQMS/a/1996-97, Central Pollution Control Board, Delhi.

* Average Arithmetic mean of minimum 104 measurements in a year taken for a week 24 hourly at uniform interval.

** 24 hourly/8hourly values should meet 98 percent of the time in a year.

6.3.2 Water Quality Monitoring Programme

Water quality parameters such as pH, BOD, COD, DO, total suspended solids, total dissolved solids, lead, Coliform count, Cadmium, Zinc etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications IS 10,500, 1991, presented in **Table 6.3.2A** and **Table 6.3.2B** respectively. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan **Table 6.3.4**.

Table 6.3.2A: Primary Water Quality Standards

Sl. No.	Designated Best Use	Class of Water	Criteria
1	Drinking Water source (with conventional treatment)	A	1. Total Coliforms MPN/100 ml shall be ≤50 2. PH between 6.5 to 8.5 3. Dissolved Oxygen 6 mg/L or more 4. Biochemical Oxygen demand (BOD) ₃ days 27°C 2 mg/L or less
2	Outdoor bathing (organized)	B	1. Total Coliforms MPN/100 ml shall be 500 or less 2. pH between 6.5 to 8.5 3. Dissolved Oxygen 5 mg/L or more 4. Biochemical Oxygen demand (BOD) ₃ days 27°C 3 mg/L or less
3.	Drinking Water source (without conventional treatment)	C	1. Total Coliforms MPN/100 ml shall be 5000 or less 2. pH between 6 to 9 3. Dissolved Oxygen 4 mg/L or more 4. Biochemical Oxygen demand (BOD) ₃ days 27°C 3 mg/L or less
4.	Propagation of Wildlife	D	1. pH between 6.5 to 8.5 for fisheries 2. Dissolved Oxygen 4 mg/L or more 3. Free Ammonia (as N) 1.2 mg/L or less

Sl. No.	Designated Best Use	Class of Water	Criteria
5.	Irrigation, Industrial Cooling, Controlled Waste	E	1. pH between 6.0 to 8.5 2. Electrical Conductivity at 25° C µmhos/cm Max. 2250 3. Sodium absorption rations Max. 26 4. Boron, Max.2 mg/L

Ref: CPCB (1999). Bio mapping of rivers. Parivesh New Letter, 5 (iv), Central Pollution Control Board, Delhi, PP.20

Table 6.3.2B: Indian Drinking Water Standard (IS: 10,500)

Sl. No.	Parameters	Desirable Limit	Permissible Limit	Method of Test
Essential Characteristics				
1	Colour, Hazen Units, Max.	5	25	3025 (part4) 1983
2	Odour	Unobjectionable	-	3025 (parts 5): 1984
3	Taste	Agreeable	-	3025 (part 8): 1984
4	Turbidity NTU, Max.	5	10	3025 (part 7): 1984
5	pH value	6.5 to 8.5	No relaxation	3025 (part 11): 1984
6	Total hardness (as CaCO ₃) mg/l, Max.	300	600	3025 (part 21): 1983
7	Iron (as Fe) mg/L Max.	0.3	1.0	3025 (part 21): 1983
8	Chlorides (as Cl) mg/L Max.	250	1000	3025 (part 32): 1988
9	Residual, free chloride, mg/L Min.	0.2		3025 (part 26): 1986
Desirable Characteristics				
1	Dissolved solids mg/L Max.	500	2000	3025 (part 16): 1986
2	Calcium (as Ca) mg/L Max.	75	200	3025 (Part 16) 1986
3	Magnesium (as Mg) mg/L, Max.	30	1.5	16,33,34 of IS 3025: 1964
4	Copper (as Cu) mg/L Max.	0.05	0.3	35 of 3025: 1964
5	Manganese (as Mn) mg/L, Max.	0.1	0.3	35 of 3025: 1964
6	Sulphate (as SO ₄), mg/L, Max.	200	400	3025(part 24): 1986
7	Nitrate (as NO ₂) mg/L, Max.	45	100	3025 (part24): 1988
8	Fluoride (as F) mg/L, Max.	1.0	1.5	23of 3025:1964
9	Phenolic compounds (as C ₆ H ₅ OH) mg/L, Max.	0.001	0.002	54of 3025:1964
10	Mercury (as Hg) mg/L, Max.	0.001	No relaxation	(See not mercury ion analyzes)
11	Cadmium (as Cd), mg/L, Max.	0.01	No relaxation	(See note)
12	Selenium, (as Se). mg/L, Max.	0.01	No relaxation	28of 3025:1964
13	Arsenic (As) mg/L, Max.	0.05	No relaxation	3025 (part 37); 1988

Sl. No.	Parameters	Desirable Limit	Permissible Limit	Method of Test
14	Cyanide (as CN) mg/L, Max.	0.05	No relaxation	3025 (part 27) 1988
15	Lead (as Pb), mg/L, Max.	0.05	No relaxation	(See note)
16	Zinc (as Zn) mg/L, Max.	5	15	39 of 3025:1964
17	Anionic detergents (as MBAS) mg/L, Max.	0.2	1.0	Methylene-blue extraction method
18	Chromium (as Cr ⁶⁺) mg/L, Max.	0.05	No relaxation	38 of 3025:1964
19	Poly nuclear aromatic hydro carbons (as PAH) mg/L, Max.	-	-	-
20	Mineral oil mg/L, Max.	0.01	0.03	Gas Chromatography method
21	Pesticides mg/L, Max.	Absent	0.001	-
22	Radioactive Material	-	-	58 of 3025:1964
23	Alpha emitters bq/L, Max.	-	0.1	-
24	Beta emitters pci/L, Max.	-	1	-
25	Aluminum (as Al) mg/L, Max.	200	600	13 of 3025: 1964
26	Aluminum (as Al) mg/L, Max.	0.03	0.2	31 of 025: 1964
27	Boron mg/L, Max.	1.0	5	29 of 3029: 1964

Source: Indian Standard Drinking Water Specification – IS 10500, 1991

6.3.3 Noise Level Monitoring Programme

As with air and water quality, the noise levels shall be monitored at already designated locations in accordance with the Ambient Noise Quality standards given in **Table 6.3.3** below. The location, duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan **Table 6.3.4**.

Table 6.3.3: National Ambient Noise Quality Standards

Sl. No.	Area Code	Category of Zone	Limit Leq in dB (A)	
			*Day	**Night
1	A	Industrial	75	70
2	B	Commercial	65	55
3	C	Residential	55	45
4	D	Silence Zone	50	40

* Day Time – 6.00 am – 9.00 pm (15 hours)

** Night Time – 9.00 pm – 6.00 am (9 hours)

6.3.4 Environmental Monitoring Plan

Monitoring plan for various performance indicators for construction and monitoring stages is summarized in **Table 6.3.4**.

6.4 Reporting

Record of progress and site-specific EMP implementation records should be kept by the EO and EE. The frequent meeting of EO with the Contractors will minimize the information and communication gap on different environmental and others related matters. The various reporting guidelines and arrangements are as follows.

6.4.1 Preparation of EMP Monthly Progress Report

The Contractor has the responsibility to prepare the monthly report. The monthly report will contain an introductory section containing the basic information on the contract package, brief description of the implementation status till date and the past month progress.

The monthly report will contain a separate section for each of the following items-

Construction Camp	Quarries	Borrow Areas
Sand Mining	Spoils & Debris Disposal	Solid Waste
Traffic Management	Road Safety	Mitigation Measures
Enhancement Measures	Environmental Monitoring Activities	Others, if any

The monthly report should also contain the following:

- Implementation arrangement should be present within the monthly report. It should include the Environmental Engineer's work with time schedule.
- One monthly report per contract package.
- Signed copies of these reports should be submitted by the Contractor (3 copies) to the Project Supervision Consultants with in seventh of each month.
- Project Supervision Consultants should verify the reports and should be submitted to PIU by 10th of each month.

6.4.2 Preparation of EMP Quarterly Progress Report

This report will be prepared by the Project Supervision Consultants and should contain –

- The quarterly report should summarized and draw the key issues from the 3 monthly progress report.
- It will also contain an introductory section containing the basic information on the contract package, brief description of the implementation status till date and the past quarter progress.

The quarterly report should contain the following:

- Implementation arrangement should be present. It should include the Contractor's Environmental Engineer's work with time schedule.
- One quarterly report per contract package.

- Signed copies of the report should be submitted by the Project Supervision Consultants (3 copies) to the PIU.

Table 6.3.4: Environmental Monitoring Plan

Environmental Component	Project Stage	Monitoring						Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	Supervision
Air	Construction Stage	SPM, RSPM, SO ₂ , NO _x , CO	High volume sampler to be located 50 m from the plant in the downwind direction. Use method specified by CPCB for analysis	Air (P&CP) Act, 1981 and its amendment	Hot mix Plant / Batching Plant	Three times in a Year for three years	Continuous 24 hours or for 1 full working day	Contractor through approved monitoring agency	P I U, NHAI
		SPM, RSPM	High volume Sampler to be located 40 m from the earthworks site downwind direction. Use method specified by CPCB for analysis	Air (P&CP) Act, 1981 and its Amendment.	At locations as listed in Chapter 4 (Table 4.4) Air quality locations or as specified by the Engineer NHAI / IC	Three times in a Year for three years	Continuous 24 hours or for 1 full working day	Contractor through approved monitoring agency	P I U, NHAI
	Operational Stage	SPM, RSPM, SO ₂ , NO _x	High volume sampler to be located 50m from the plant in the downwind direction. Use method specified by CPCB for analysis	Air(P&CP) Act,1981 and its Amendment	At locations as listed in Chapter 4 (Table 4.4) Air quality locations or as specified by the Engineer NHAI / IC	Three times in a year for one year	Continuous 24 hours or for 1 full working day	P I U, NHAI	P I U, NHAI
Surface Water Quality	Construction Stage	pH, BOD, COD, TDS, TSS, DO, Oil & Grease and Pb	Grab sample collected from source and analyze as per Standard Methods for Examination of Water and Wastewater	Water quality standards by CPCB	Four surface water body	Twice in a Year for 3 years	-	Contractor through approved monitoring agency	P I U, NHAI
	Operation Stage	pH, BOD, COD, TDS, TSS, DO, Oil & Grease and Pb	Grab sample collected from source and analyze as per Standard Methods for Examination of Water and Wastewater	Water quality standards by CPCB	Three surface water body	Twice in year for 1 year	-	P I U, NHAI	P I U, NHAI

Environmental Component	Project Stage	Monitoring						Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	Supervision
Noise Levels	Construction Stage	Noise levels on dB (A) scale	Free field at 1 m from the equipment whose noise levels are being determined	Noise standards by CPCB	At equipment yards	Once every 3 month (max) for three years, as required by the engineer	Reading to be taken at 15 seconds interval for 15 minutes every hour and then averaged	Contractor through approved monitoring agency	P I U, NHAI
	Operation Stage	Noise levels on dB (A) scale	Equivalent Noise levels using an integrated noise level meter kept at a distance of 15 m from edge of Pavement	Noise standards by CPCB	As directed by the Engineer (At maximum 4 locations)	Thrice a year for 1 years	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	P I U, NHAI	P I U, NHAI
Soil Erosion	Construction Stage	Turbidity in Storm Water Silt load in ponds, water courses	----	As specified by the engineer NHAI / Water quality standards	As specified by the engineer NHAI / Independent Consultant, all along the project corridor	Pre-monsoon and post-monsoon seasons for 3 years	----	Contractor	P I U, NHAI
	Operational Stage	Turbidity in Storm Water Silt load in ponds, water courses	----	As specified by the engineer NHAI / Water quality standards	As specified by the engineer NHAI / Independent consultant, all along the project corridor	Three times a year for one year	----	P I U, NHAI	P I U, NHAI
Plantation of trees	Construction as well as Operational Stage	75% Plant Survival	The success of tree planting. Rate of survival after six months, one year and 18 months in relation	-	All along the project corridor	Maintenance for three to five years after	-	NGO, and PIU, NHAI	P I U, NHAI

Environmental Component	Project Stage	Monitoring						Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	Supervision
			to total planted			plantation			
Construction Sites and Construction Camps	Construction Stage	Monitoring of: Storage Area Drainage Arrangements Sanitation in Construction Camps	The parameters as mentioned in chapter-4 but to be checked for adequacy.	To the satisfaction of the NHAI and the Water quality standards given by CPCB	At storage area and construction camps	Quarterly in the construction stage	----	Contractor	P I U, NHAI

Chapter - 7

Environmental Budget

CHAPTER - 7

ENVIRONMENTAL BUDGET

The environmental budget for the various environmental management measures proposed in the EMP and environmental monitoring plan are presented in **Table 7**. There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the Engineering Cost. Various environmental aspects covered under engineering costs are listed below.

- Turfing and Pitching of slopes
- Construction of slope protection works as retaining walls, crash barriers etc.
- Cleaning of culverts
- Safety signage
- Junction development etc.

7.1 Construction Related Environmental Mitigation Costs

This includes the mitigation costs for the following items as indicated in **Table 7**.

Dust Suppression / Management - The contractor shall take an all out effort to reduce the level of dust during construction. As a good practice, the contractor shall use the "vehicle mounted vacuum cleaner brooms" instead through manual labour and brooms, which creates lot of dust during road cleaning operation. The cost for this is a part of good engineering practices, while cost incurred for additional water sprinkling along the construction surface to suppress excessive dust will be completely met from the environmental mitigation costs.

Prevention of Water and Soil Pollution - In order that water and soil does not get polluted from discharge of oil and grease from construction vehicle area, vehicle parking area, and workshops, etc., an oil interceptor shall be provided at such locations.

Compensatory Afforestation and its Maintenance – Due to proposed widening activity about 16,992 trees will be affected and have to be removed. Afforestation work @ 1:3 that is 51,000 saplings shall be planted to enhance the environmental quality as well as aesthetics.

Environmental Enhancement Measures – In general environmental enhancement measures such as landscaping, selective tree planting, improvement of the natural resources for the local population (provision of fodder, fuel wood, etc. by careful selection of species to be planted within the RoW) etc. shall be carried out to improve the aesthetics in the project area. Environmental enhancement measures pertaining to Bus Shelter / Bus Bay, Truck terminals, and Junction improvement should be provided as per engineering designs.

Waste Disposal – Disposal of waste shall be carried out as per the Contractor's Environmental Management Plan and waste disposal guideline.

Site Restoration – Restoration of construction sites such as diversions, workers camps (with respect to drainage arrangements, sanitation and storage area), and at construction

yards shall be taken up once the works at such locations have been completed as per the Contractor's Site Restoration Plan and Environmental Management Plan.

7.2 Construction / Operation Related Monitoring Costs

This includes the mitigation costs for the following items as indicated in **Table 7**.

Air Quality – Air quality parameters such as SPM, RSPM, SO₂, NO_x, CO shall be monitored at hot-mix plant / batching plant locations at stretches of the project road where construction is in progress. During operational stage the same parameters shall be measured at locations as given in **Chapter 3**.

Water Quality – Water quality parameters such as pH, BOD, COD, TDS, TSS, DO, Oil and Grease and Pb etc. shall be monitored as indicated in chapter-3 and at other locations as advised by the Independent Consultant (IC).

Noise Levels – Noise quality parameters during construction stage will be monitored at equipment yards and at other locations as indicated in **Chapter 3** or as directed by of the IC.

Soil Erosion – During construction, parameters such as turbidity in storm water, silt load in pond and Canals as listed in **Chapter 3** and at culverts shall be monitored as directed in the monitoring plan. Similarly during operational stage the same parameters shall be monitored.

Table 7 : Environmental Budget for Various Environmental Management Measures

Sl. No.	Items	Unit	Rate (Rs.)	Quantity	Total Cost (Rs.)
Mitigation Cost					
1	Dust Management with sprinkling of water, covers for vehicles transporting construction material	Nos. (1 water tanker for 25 km stretch for two years)	2,000 per Water Tanker per Day	125/25 = 5 in Numbers 5 Nos. x 365 x 2 = 3650	73,00,000.00
2	Relocation of Hand Pumps	No.	-	-	Covered in Engineering and R&R Cost
3	Sewage Disposal During Construction	No. (Provision of soak Pit, @ No./20 km)	2,000	6	12,000.00
4	Oil Interceptors at Vehicle parking areas	No. (Provision of soak Pit, @ No./20 km)	6,000	6	36,000.00
5	Plantation of saplings including tree Guard and its maintenance (Compensatory afforestation rate is 1:3)	No.	832.00 (Source-CPWD)	51,000	4,24,32,000.00
6	Median Shrub Plantation	No.	4,11,132.00 (Source-	120	4,93,35,840.00

Sl. No.	Items	Unit	Rate (Rs.)	Quantity	Total Cost (Rs.)
			:CPWD)		
8	Cutting of trees (Privately owned trees)	-	-	-	2,87,00,000.00
9	Miscellaneous informatory signs and others	-	-	-	Covered in Engineering cost.
Sub Total – Mitigation Cost : A					12,78,15,840.00
Monitoring Cost					
1	Ambient Air Quality Monitoring along the road by contractor during construction	No. of Samples	6,000	At 6 locations, thrice in a year for a period of 3 years (Total 6x3x3 = 54 Samples)	3,24,000.00
2	Ambient Air Quality Monitoring at Hot mix plant and batch plant	No. of Samples	6,000	At 3 locations thrice in a year for 3 years (Total 3x3x3 =27 Samples)	1,62,000.00
3	Ambient Air Quality Monitoring during operation phase along the road at locations listed in Table 4.4	No. of Samples	6,000	At 3 locations, thrice in a year for a period of one years (Total 3x3x1= 9 samples)	54,000.00
4	Surface Water Quality Monitoring along the road during construction	No. of Samples	6,000	At 1 locations twice in a year for 3 year (Total 1x2x3 = 6 samples)	30,000.00
5	Surface Water Quality Monitoring along the road during operation	No. of Samples	5,000	At 1 locations twice in a year for 1 year (Total 1x2x1 = 2 samples)	10,000.00
6	Monitoring of Noise Level along the Hot mix plant and Batch plant	No. of Samples	2,000	At 3 location, once in every 3 months for 3 years (Total 3x4x3 =36 Samples)	72,000.00
7	Monitoring of Noise Level along the road at locations where monitoring was done during constructions	No. of Samples	2,000	At 11 locations, Thrice in a year for 1 years (Total 11x3x1 =33 Samples)	66,000.00
8	Monitoring of Soil along hot mix plant and batch plant	No of Samples	3,500	At 3 locations, twice in a year for 3 years (Total 3x2x3 = 18 samples)	63,000.00
9	Monitoring of Soil during operation phase	No. of Samples	3,500	At 3 locations thrice in a year for 1years (Total 3x3x1 = 9 samples)	31,500.00

Sl. No.	Items	Unit	Rate (Rs.)	Quantity	Total Cost (Rs.)
Sub Total – Monitoring Cost : B					8,12,500.00
Training & Other Costs					
1	Training & Mobilization costs for 3 years	Construction and operation	5,00,000.00 per year	For 3 years	15,00,000.00
2	Enhancement	Construction and operation			Covered in Engineering Cost
3	Facilities and Equipments		Lump sum	Vehicle, Pollution monitoring kit, computer, etc.	15,00,000.00
Sub Total – Training and Other Cost : C					30,00,000.00
Sub Total (A+B+C)					13,16,28,340.00
Contingency @ 5%					65,81,417.00
GRAND TOTAL					13,82,09,757.00
Rupees Thirteen Crores Eighty Two Lakh Nine Thousand Seven Hundred and Fifty Seven Only					

Chapter - 8

Resettlement and Rehabilitation Budget

Chapter - 8

RESETTLEMENT AND REHABILITATION BUDGET

8.1 Introduction

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

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

8.2 Compensation for Private Agricultural Land:

The unit rate for agricultural land has been estimated as per The Mizoram (Land Revenue) Rules, 2013 and LARR Act 2013. To meet the replacement cost of land compensation will be calculated over updated land rate with upto 100% additional as registration cost plus upto 100% solatium or as decided by District Magistrate. It may be noted that the District Magistrate have the discretionary power in valuation of land in his jurisdiction. The State Government may also announce packages for Land Acquisition.

8.3 Compensation for Residential/ Commercial and other structures:

The compensation cost of structures are arrived at by assessment of market value, consultation with DPs and data collected from building contractors and property agents this meets the replacement cost of the structures. Actual cost of the structure might be ascertained from the survey of the R&B department of the State Government. The average estimated rate for permanent structures without land has been calculated at Rs.

10,500/m², semi-permanent structures have been calculated at Rs. 7,500/m², and temporary structures have been calculated at the rate of Rs. 3,500/m².

8.4 Assistance

Shifting allowance: Shifting allowance will be provided to all the affected households losing structures and tenants. The unit cost has been derived on a lump sum basis of Rs. 50,000/- as required by LARR ACT, 2013.

Rental Assistance: Rental assistance to titleholder (structures) and tenants in structures will be provided in the form of grants to cover maximum three months rentals @ Rs. 5,000/- per month.

Rehabilitation Assistance to DPs Losing Business Establishment: Title holders losing their business establishment due to displacement will be provided with a lump sum transitional allowance of Rs. 15,000/-. This rate has been fixed based on the estimates of average income for a period of three months.

Training Assistance to Agricultural Titleholders: Training Assistance will be provided for income generating vocational training and skill up-gradation options as per DPs choice at the rate of Rs. 11,500/- per affected household to those households losing their primary source of income.

Rehabilitation Assistance to Employees in Structure: Wage earning employees indirectly affected due to displacement of commercial structure will be provided assistance as per the prevailing local wage rate for 3 plus months i.e. @ Rs. 168/- for 100 days.

Rehabilitation Assistance to Agricultural Labourers/Sharecroppers: Agricultural Labourers/Sharecroppers will be provided with assistance as per the prevailing local wage rate for 100 days @ Rs. 168/- per day.

Assistance to Vulnerable Households: One time lump sum assistance of Rs. 20000/- will be paid to each vulnerable households. (This will be paid above and over the other assistance(s) as per the entitlement matrix).

8.5 Compensation for Community and Government Property

Religious and Community Structures: The religious and community structures are being partially affected and do not require full replacement. However a lump sum provision of Rs. 5,00,000/- per structure is made in the budget to rebuild and enhance the ambience of these structures. However any religious or community structure requires full relocation will be compensated in replacement rate.

8.6 RP Implementation and Support Cost

The unit cost for hiring of the implementing NGO has been calculated on a lump sum basis for Rs. 5,00,000/-. This is based on the similar earlier project experiences and informal consultation and feedback received from the local staff and keeping in

consideration one year duration of NGO s involvement. Costs will be updated during implementation. A 10% contingency has been added in order to adjust any escalation.

For grievance redress process a lump sum of Rs 5,00,000/- is provided for 3 years and cost of other RP implementation and administrative activities will be a part of existing departmental expenditure. The separate fund for grievance redressal for this project is made based on intensity of impacts. In addition the process will involve interdepartmental arrangement and include participation by representatives of DPs, particularly of vulnerable DPs, local government representatives, representative of local NGOs and other interest groups besides PIU and implementing NGO.

8.7 Source of Funding and Fund Flow Management

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

8.8 R&R Budget

As already discussed that there is nearly no Revenue Land in the State of Mizoram and as per LARR Act, 2013 the prevailing market price is taken. The total R&R budget for the proposed project RP works out to Rs. 118 crore.

A detailed indicative R&R cost is given in **Table 13.1**

Table 13.1: Estimates of Entitlements

Sl.	Item	Unit	Rate	Amount
A	Compensation of Land in Hectare in Rupees as per LARR			
1a.	Compensation of Agricultural Land (Average of Irrigated)	Nil		
1b.	Compensation of Agricultural Land (Average of Unirrigated)/ hilly tract	87.67 Ha or 21664.73 decimals	Weighted Average rural rate per (Range Rs.2, 300 to Rs. 3,500) decimal is Rs.3063 including stamp duty of 6% and Registration fees of 2%. For Additional Rate and Solatium the Final discretion lies with the State Government and the District Magistrate	Rs. 6,63,52,163

Standards Under Phase 'B' of SARDP-NE Package-1

2a.	Compensation of Rural Commercial land (Average of Rural Commercial)	1.85 Ha or 457.403 decimal	Weighted Average rural rate per (Range Rs.25,000 to Rs.1,70,000) decimal is Rs.76,200 including Registration fees of 2% and stamp duty of 6%. For Additional Rate and Solatium the Final discretion lies with the State Government and the District Magistrate	Rs.3,48,54,068
2b.	Compensation of Urban Commercial land (Average of Urban Commercial)	3.70 Ha or 914.805 decimal	Weighted Average rural rate per (Range Rs.3,15,000 to Rs.5,92,020) decimal is	Rs.40,65,76,988
Sl.No.	Item	Unit	Rate	Amount
			Rs.3,65,000 including Registration fees of 2% and stamp duty of 6%. For Additional Rate and Solatium the Final discretion lies with the State Government and the District Magistrate	
3a.	Compensation of Rural Residential land (Average of Rural Residential)	10.67 Ha or 2636.79 decimal	Weighted Average rural rate per (Range Rs.11,000 to Rs.1,25,000) decimal is Rs.58,200 including Registration fees of 2% and stamp duty of 6%. For Additional Rate and Solatium the Final discretion lies with the State Government and the District Magistrate	Rs.13,92,22,551
3b.	Compensation of Urban Residential land (Average of Urban Residential)	4.995 Ha or 1234.245 decimal	Weighted Average rural rate per (Range Rs.1,74,240 to Rs.4,94,208) decimal is Rs.2,56,100 including Registration fees of 2% and stamp duty of 6%. For Additional Rate and Solatium the Final discretion lies with the State Government and the District Magistrate	Rs.5,92,16,351
	Subtotal of A			Rs. 706,222,121
B	Compensation of Private structure in Sq.mtr in Rupees as per Census survey			
1.	Compensation for Permanent Structure	6095.46 Sqm	Average price from 5 to 20 years Rs.10500 (may conform from BSR – PWD Mizoram)	Rs.6,40,02,330
2.	Compensation for Semi-Permanent Structure	10,191.85 Sqm	Average price from 5 to 20 years 7500 (may conform from BSR – PWD Mizoram)	Rs.7,64,38,875

Standards Under Phase 'B' of SARDP-NE Package-1

3.	Compensation for Temporary Structure	6685.80 Sqm	Average price from 5 to 20 years 3500 (may conform from BSR – PWD Mizoram)	Rs.2,34,00,300
4.	Compensation/ Relocation of Community/Religious Structure	18 nos. (the range of the construction cost is Rs.2,50,000 – Rs.15,50,000)	Rs. 5,50,000 Lumpsum (by the method of weighted average)	Rs.99,00,000
	Subtotal of B			Rs.17,37,41,505
C	Assistance to the DPs			
1.	Shifting Assistance to Titleholder (Structures)	546	Rs.50,000	Rs.2,73,00,000
2.	Rental Assistance to Titleholder	546	Rs. 15,000 (@ of Rs.5,000 per month)	Rs.81,90,000
SL.	Item	Unit	Rate	Amount
	(Structures) for 3 months			
3.	Shifting Assistance to Residential Tenants in Structures	42	Rs.50,000	Rs.21,00,000
4.	Shifting Assistance to Commercial Tenants in Structures	51	Rs.50,000	Rs.25,50,000
5.	Rental Assistance to all tenants (Structures) for 3 months	93	Rs. 15,000 (@ of Rs.5,000 per month)	Rs.13,95,000
6.	Rental Assistance Squatters (Structures) for 3 months	95	Rs. 15,000 (@ of Rs.5,000 per month)	Rs.14,25,000
7.	Training assistance to Livelihood loser	287	Rs.11500 (As per norms of DOEACC @Rs.2,500 per month))	Rs.32,77,500
9.	Rehabilitation assistance to Employees of the Commercial and Residential structures	44	Rs.168 @per day for 100 days (as per MGNREGS)	Rs. 739,200
10.	Special Assistance to the Vulnerable Groups	757	Rs.20,000 (as per norms of LARR ACT, 2013)	Rs.1,51,40,000
	Subtotal of C			Rs. 62,116,700
D	RP Implementation Cost			
1.	Hiring of NGO	Lump sum	Rs.95,00,000 Lump sum	Rs.95,00,000
2.	Grievances Redressal Cost	Lump sum	Rs.1,66,667 per annum for 3 years	Rs.5,00,000

Standards Under Phase 'B' of SARDP-NE Package-1

3.	Capacity Building of the Affected Persons by Organizing training and awareness programme throughout the alignment.	9 Blocks and/ or approximately each venue in the midpoint of every 10 Km.	Rs. 25,000 quarterly for three years.	Rs.27,00,000
4.	Monitoring and Evaluation cost	Lump sum	Rs.65 lakhs Lump sum	Rs.65,000,00
	Subtotal of D			19,200,000
	Total (A+B+C+D)			961,280,326
	Contingency (10%)			96,128,033
	GRAND TOTAL			1,057,408,358

Source: Census Survey on January 2014

The above estimate is based on rates vide Entitlement Matrix (Jan 2014). As escalation of 12% on the said matrix is – allowed to arrive at the current cost of R&R = $1.12 \times \text{Rs. } 1,057,408,358 = \text{Rs. } 1,184,297,361/$ - say **Rs.118** crores. This when converted in US\$18948758 or say US\$18 million (US\$1 =Rs.62.50).

The compensation cost of trees and crops would be calculated and reflected in the Environmental Management Plan, so it is deliberately kept aside from the R&R budget, otherwise there would be a possibility of double counting. The Temporary impact during the construction period is to be borne by the contractor and it should be kept in the contract documents of the same.