

LIST OF CONTENTS

7.1	PROJECT BACKGROUND	1
7.2	NEED OF THE PROJECT	1
7.3	PROJECT ROAD	1
7.4	PROJECT AREA	1
7.5	CORRIDOR OF IMPACT	1
7.6	PROJECT PROPONENT.....	1
7.7	PROPOSED IMPROVEMENTS	1
7.8	ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY IN THE PROJECT	2
7.9	POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK	2
7.10	BASELINE ENVIRONMENTAL PROFILE	2
7.10.1	Physical Environment	2
7.10.2	Biological Environment	5
7.10.3	Social Environment	6
7.11	PUBLIC INTERACTIONS & CONSULTATION	6
7.12	POTENTIAL ENVIRONMENTAL IMPACTS	7
7.12.1	Impacts on Climate	7
7.12.2	Impact on Air Quality.....	7
7.12.3	Impact on Noise Levels	7
7.12.4	Impact on Water Resources and Quality	7
7.12.5	Impact on Ecological Resources.....	8
7.12.6	Impact on Land	8
7.13	ANALYSIS OF ALTERNATIVES	10
7.14	MITIGATION AVOIDANCE AND ENHANCEMENT MEASURES.....	10
7.15	INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN..	11
7.16	ENVIRONMENTAL MANAGEMENT PLAN	11
7.17	ENVIRONMENT IMPACT AND MANAGMENT MATRIX	11
7.18	Project EMP Cost	14

7.19	CONCLUSIONS	28
------	-------------------	----

7.1 PROJECT BACKGROUND

The Ministry of Road Transport and Highway, Government of India (the “Authority”) is engaged in the development of National highways and as part of this endeavor, the Authority has decided to undertake “Consultancy services for Preparation of Feasibility Study and Detailed Project Report for Construction of 2 lane/2 lane with paved shoulder from Kohima to Nagaland/Manipur border section of NH-29 (Old NH-150) in the State of Nagaland under SARDP Phase-B on EPC Mode”. The present study focused on the Environmental Impact Assessment (EIA) from the proposed project during construction and operation phase.

7.2 NEED OF THE PROJECT

- To provide easy access to commuters from Nagaland to Manipur
- The project road links NH 39 and NH 155 and hence provides easy communication between different districts of Nagaland & Manipur

7.3 PROJECT ROAD

Existing Project Highway, NH-29 (old NH-150) starts near Teen Patti Junction (km 3.000) in Kohima (Nagaland) and terminates at its junction with NH-202 near Jessami in Manipur state. The project road is approximately 130.390 km long. The project road is located under the jurisdiction of Nagaland & Manipur State. Major part of the road is in Nagaland where as minor part is in the Manipur state. The existing length of the Project Highway is about 129.110 kms while design length along the proposed alignment of Project Highway is 130.390 kms. The Project Highway passes through districts Kohima and Phek in the state of Nagaland and Ukhrul in the state of Manipur. It connects important Town / Villages namely Kohima, Chakabama, Kiruma, Fpsutsero, Misulumi, Enhulum, Chizami, Losami, Laniye and Jessami etc.

This section of report is limited to 21.9km only i.e from Ch. 29.6 km to Ch. 51.5 km

7.4 PROJECT AREA

The project district is Kohima.

7.5 CORRIDOR OF IMPACT

In general, the existing & proposed Right of Way (RoW) varies from 6-7 m & 20-24 m respectively. The immediate Col thus also varies from 20-24 m. However, for parameters like Noise and air pollution, the impact goes beyond the immediate Col.

7.6 PROJECT PROPONENT

The project proponent is Ministry of Road Transport and Highways, Government of India.

7.7 PROPOSED IMPROVEMENTS

Proposed project improvements are given in technical section of the DPR report.

7.8 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY IN THE PROJECT

The study methodology for the EIA employs a simplistic approach in which the important environmental issues have been identified before initiation of the baseline study. Based on the identification baseline data was generated and then analysed to predict the impacts and quantify them.

7.9 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

As part of the project execution, developer shall take the following clearances and NOCs:

- Project Highway is neither a new national highway nor a NH expansion project with land acquisition of greater than 40m on existing alignments and 60m on re-alignments or by-passes hence environmental clearance not required.
- There is no ecological sensitive area / wildlife sanctuary falls within 5 km radius from the project site hence wild life clearance as per Wildlife (Protection) Act, 1972 is not required. Pulibadze Wildlife sanctuary found approx 5.6km from ch. 15.3 in South West direction.
- No presence and impact on Archaeological features. Thus no archaeological clearances / permissions to be obtained
- Forest Clearance under purview of Forest (Conservation) Act, 1980 shall be required which will be finalized after joint inspection with forest department.
- Trees are needed to be felled due to road widening. Permission to be obtained from Forest/District Authorities before felling

Apart from the clearances developer shall also obtain the required clearances NOCs & licenses from the various agencies & authorities prior to his work initiation. These are:

- NOC and Consents under Air, Water, EP Acts & Noise rules of SPCB for establishing and operating noise generating equipments from Nagaland and Manipur State Pollution Control Board
- NOC under Hazardous Waste (Management and Handling) Rules, 1989 from SPCB
- PUC certificate for use of vehicles for construction from Department of Transport
- NOC for ground water extraction for construction and allied works from Ground Water Authority

Apart from the above clearances, developer also has to comply with the following:

- Clearance of monitoring consultant for location and layout of Worker's Camp, Equipment yard and Storage yard.
- Clearance of monitoring consultant for Traffic Management Plan for each section of the route after it has been handed over for construction.
- An Emergency Action Plan shall be prepared by developer and approved by the Monitoring consultant for accidents responding to involving fuel & lubricants before the construction starts.

7.10 BASELINE ENVIRONMENTAL PROFILE

7.10.1 Physical Environment

Climate

Nagaland has a monsoon climate. The state enjoys a salubrious climate. Annual rainfall ranges around 70–100 inches (1,800–2,500 mm), concentrated in the months of May to September. Temperatures range from 70 °F (21 °C) to 104 °F (40 °C). In winter, temperatures do not generally drop below 39 °F (4 °C), but frost is common at high elevations. Summer is the shortest season in the state that lasts only for a few months. The temperature during the summer season remains between 16 °C (61 °F) to 31 °C (88 °F). Winter makes an early arrival and bitter cold and dry weather strikes certain regions of the state. The maximum average temperature recorded in the winter season is 24 °C (75 °F). Strong north-west winds blow across the state during the months of February and March.

Geology

Facing the Himalayan ranges across the Brahmaputra valley and stretching NE- SW along the eastern margin of Northeast India, bordering Myanmar, lies the Naga Hills. It represents the northern extension of the Indo- Burma Ranges (IBR) linking the Arunachal Himalaya to the north and Andaman-Nicobar Islands to the south. The N-S trending Patkai, Barail and associated ranges with their varied structural styles impart youthful geomorphology to the Naga Hills. The Cenozoic sedimentary cover in Nagaland accounts for nearly 95 percent of the area whereas the rest is being occupied by igneous and crystalline rocks of Mesozoic- Cenozoic age. These exhibit a general trend of NNE-SSW with moderate to steep dips towards NW and SE. Based on the morphotectonic elements, the Naga Hills has been longitudinally divided, from west to east, into three distinct units, namely- the Schuppen Belt, the Inner Fold Belt and the Ophiolite Belt. The Schuppen Belt has been defined as a narrow linear belt of imbricate thrust slices which follows the boundary of Assam valley alluvium for a distance of 350 Km. along the flank of Naga- Patkai hill ranges. It is postulated that this belt comprises of eight or possibly more overthrusts along which the Naga Hills have moved northwestwards relative to the Foreland spur. The total horizontal movement of all the thrusts together is estimated to be over 200 km. The Schuppen belt is delineated on the east by Halflong- Disang thrust and on the west by the Naga thrust which has an end-echelon disposition. Sediments ranging in age between Eocene- Oligocene and Plio-Pleistocene along with total absence of Disang rocks together characterize the Schuppen Belt.

Soil

Based on the report of the Soil Survey Wing of Soil and Water Conservation, Nagaland ,the soil of Nagaland belongs to 4 orders, 7 sub-orders, 10 great groups, 14 sub groups and 72 soil families. The 4 orders of soil found in Nagaland are (i) Alfisols (ii) Entisols (iii) Inceptisols and (iv) Ultisols. Inceptisols dominate the soils of the State with 66% followed by Ultisols 23.8%, Entisols 7.3% and Alfisols 2.9% of the total 16.6 million Ha. of the State geographical area.

Seismicity

The According to GSHAP data, the state of Nagaland falls in a region of high to very high seismic hazard. As per the 2002 Bureau of Indian Standards (BIS) map, this state also falls in Zone V. Historically, parts of this state have experienced seismic activity greater than M6.0. Approximate locations of selected towns and basic political state boundaries are displayed. Nagaland has been hit by many disasters in the past. The most notable ones are the Great Shillong Earthquake on 12th June 1897 which measured 8.7 in the richter scale and the Assam. Tibet earthquake on 15th August 1950 which measured 8.5 in the Richter scale. However, since those days there were no facilities to record and to document, there is no local data supporting the disasters. However interviews with the older generation people reveals that the 1950 earthquake was very much felt by Nagaland, and it even resulted in the destruction of many houses in certain areas. It was even said the earth opened up and buffalos were buried alive

Ambient Air Quality

The air quality in the project area is less polluted. The result from the ambient air quality monitoring at 4 locations it is clear that concentrations of all pollutants are well within the prescribed limits of the National Ambient Air Quality Standards. The 98th percentile value of PM 10 varies between 55.31 $\mu\text{g}/\text{m}^3$ at Rusoma, 54.55 $\mu\text{g}/\text{m}^3$ at Kikruma , 53.18 $\mu\text{g}/\text{m}^3$ at Pfutsero 50.95 $\mu\text{g}/\text{m}^3$ at Chizami (Near Baptist Church). The 98th percentile value of PM 2.5 varies between 23.32 $\mu\text{g}/\text{m}^3$ at Rusoma , 22.51 $\mu\text{g}/\text{m}^3$ at Kikruma, 20.21 $\mu\text{g}/\text{m}^3$ at Pfutsero, 21.25 $\mu\text{g}/\text{m}^3$ at Chizami (Near Baptist Church). The 98th percentile value of SO₂ varies between 8.03 $\mu\text{g}/\text{m}^3$ at Rusoma, 7.17 $\mu\text{g}/\text{m}^3$ at Kikruma, 7.52 $\mu\text{g}/\text{m}^3$ at Pfutsero, 7.72 $\mu\text{g}/\text{m}^3$ at Chizami (Near Baptist Church). The 98th percentile value of NO₂ varies between 12.31 $\mu\text{g}/\text{m}^3$ at Rusoma, 10.45 $\mu\text{g}/\text{m}^3$ at Kikruma, 11.23 $\mu\text{g}/\text{m}^3$ at Pfutsero, 8.84 $\mu\text{g}/\text{m}^3$ at Chizami (Near Baptist Church). The 98th percentile value of CO varies between 0.58 mg/m^3 at Rusoma , 0.54 mg/m^3 at Kikruma , 0.51 mg/m^3 at Pfutsero , 0.51 mg/m^3 at Chizami (Near Baptist Church).

Noise Quality

Noise monitoring has been carried out once during the entire study period (over a period of twenty-four hours to obtain L_{eq} values at uniform time intervals of 1 hour. For each location, day and night time L_{eq} values have then been computed from the hourly L_{eq} values such that comparison could be made with the national ambient noise standards. Day & night time L_{eq} has been computed from the hourly L_{eq} values as per standards L_{eq} is varies from 40 dB(A) to 49.9 dB(A).

Surface Water

There are many perennial River and stream found along the project road which may be used for the drinking as well as construction purpose. People along the road use the stream water for drinking purpose after conventional treatment. Two surface water sample was collected in the month of April 2016. Samples were analysed for the parameters as desired for assessment of surface water quality. The results were compared against the Class C water (Water for fish culture and wild life propagation) quality standards as per IS 2296.

Ground Water

The project area falls in hilly area. The sources of ground water are limited. Some of the hand pumps found at the bend of the road at the lower terrain. 2 ground water/Drinking Water samples were collected to assess the ground water quality along the project corridor. The samples were collected in the month of April 2016. Ground water samples were analysed in lines with IS 3025 and APHA 22nd edition 2012. Water quality as analysed is presented in Table below. The water quality was found well within the permissible limits but some of the parameters are crossing desirable limit as per IS: 10500 drinking water quality standards.

7.10.2 Biological Environment

Protected Areas / Eco-sensitive Zones/ Animal Corridor

There is no wildlife sanctuary found along 5 km radius of the project road. Puliebadze is the nearest wildlife sanctuary from the project road, which is approx. 5.6 km from the project road

Flora & Fauna

Nagaland is very rich in bio-diversity, both flora and fauna. Even today some pockets of forests are covered with gigantic trees, where sun-rays can not penetrate. Due to reckless and uncontrolled cutting of trees for timber, firewood. Continued Jhum cultivation and annual fire in vast tracts of land, forest got degraded and barren, which accelerated demining of the most of the original characteristics of the forests.

At least 106 species of mammals are likely to occur in Nagaland, these includes nine insectivores, 34 bats, seven primates, one pangolin, 34 carnivores, one elephant, seven ungulates, one hare and at least 12 rodents. Data from the secondary source shows that about 43 species of Birds found in the Nagaland state.

Forest

Through geographically being a small state. Nagaland has several types of forests, mainly because the state is mostly tropicaly, and the altitudes range from a few hundred meters to about

four thousand meters. The major types of forests found in the state, as per the classification of Champion and Seth, are as follows,

1. Northern Tropical Wet Evergreen Forest.
2. Northern tropical Semi-Evergreen Forest.
3. Northern Sub-Tropical Broad Leaf Wet Hill Forests
4. Northern Sub-Tropical Pine Forests
5. Northern Montane Wet Temperate Forests and
6. Temperate Forests.

7.10.3 Social Environment

Census Profile

The project highway passes through Kohima & Phek District of Nagaland State and Ukhrul District of Manipur. As per the 2011 census, Nagaland has a total population of 1,978,502 and the total male and female population of the state is 1,024,649 and 953,853 respectively. The population density per sq km is 119. The total number of literates of the state is 1,342,434 while the sex ratio is 931.

Whereas, in Manipur the total population is 2,855,794 and the total male and female population of the state is 1,438,586 and 1,417,208 respectively. The population density per sq km is 128. The total number of literates of the state is 1,908,476 while the sex ratio is 985.

Workforce in Project area

The people in the villages are mostly engaged in the agricultural work and economy is largely based on agricultural activities. Some people are also working as a labourer in nearby area.

Settlement

There are a total of 11 settlements varying in size and populations along the project corridor.

Educational Institutes

There are various Schools located along the project road. All structures are outside of proposed Corridor of Impact. Hence no physical impact has been envisaged.

Cultural Properties

Some of the cultural properties found along the project road. Which is out of Col.

7.11 PUBLIC INTERACTIONS & CONSULTATION

Public Interactions & consultations were conducted during the project preparations. The main purpose of these consultations was to know the community's reaction to the perceived impact of

proposed project on the people at individual and settlement level. Drinking water scarcity was the major environmental issue reported during consultation. Sighting of various wildlife species and occurrence of accidental road kill was also confirmed by community as well as institutional stakeholders. However, some people were concerned about other environmental issues, mainly air and noise pollution. The issues raised by the public have been duly incorporated in project design.

7.12 POTENTIAL ENVIRONMENTAL IMPACTS

The environmental components are mainly impacted during the construction and operational stages of the project and have to be mitigated for and incorporated in the engineering design. Environmental mitigation measures represent the project's endeavour to reduce its environmental footprint to the minimum possible. These are conscious efforts from the project to reduce undesirable environmental impacts of the proposed activities and offset these to the degree practicable. Enhancement measures are project's efforts to gain acceptability in its area of influence. They reflect the pro-active approach of the project towards environmental management.

7.12.1 Impacts on Climate

Slight change in the micro-climate of the area is expected due to Heat Island Effect as unpaved area will be converted into the paved road. However, Impact on the climate conditions from the proposed road project widening will not be significant in long run as deforestation and / or removal of vegetation will be compensated by compensatory plantation to the tune of double the area denuded.

7.12.2 Impact on Air Quality

There will be rise in PM levels during the construction activities, which shall again be within prescribed limit after the construction activities are over. The level of CO is likely to increase compared to the present scenario. However, CO level shall remain within prescribed standards.

7.12.3 Impact on Noise Levels

The area is likely to experience an increment in noise level due to increase in vehicle density after road strengthening. Locations of sensitive receptors were identified and noise barriers in the form of compound wall are proposed at these locations to mitigate the noise level up to acceptable levels.

7.12.4 Impact on Water Resources and Quality

The construction and operation of the proposed project roads will not have any major impacts on the surface water and the ground water quality in the area. Retaining wall will be provided along the bridge to avoid natural flow of the water body.

Contamination to water bodies may result due to spilling of construction materials, oil, grease, fuel and paint in the equipment yards and asphalt plants. This will be more prominent in case of locations where the project road crosses rivers, nallahs, etc. Oil interceptor will be provide at the construction camp nr. Workshop area. Mitigation measures have been planned to avoid contamination of these water bodies.

7.12.5 Impact on Ecological Resources

Roadside trees are likely to be affected due to the proposed development leading temporally loss of micro ecosystem. However, on the long run the impacts will be compensated in terms of compensatory afforestation and avenue plantation.

Need for diversion of forest land will be finalized after joint inspection with forest department. Hence Forest Clearance under the purview of Forest (Conservation) Act, 1980 may be applicable. The actual extent of forest land to be diverted shall be furnished after completion of Land Acquisition Plan.

7.12.6 Impact on Land

The complete road stretch found in the hilly region. Hence cutting of rocks/hills will be envisaged. Breast wall and retention wall will be provided to avoid land slide. During the construction of the proposed project, the topography will change due to cuts & fills for project road and construction of project related structures etc. Provision of construction yard for material handling will also alter the existing topography. The change in topography will also be due to the probable induced developments of the project. Land acquisition is proposed at realignment and bypass locations.

Sl. No	Potential impact	Mitigation / Enhancement
1.	Change in Geology	Blasting to be done as per requirement and with proper safegaurds is envisaged. Quarry Development Plan need to be enforced.
2.	Change in Seismology	All structures to be checked and complied with the seismological settings of the region (Zone)
3.	Loss of land	Land acquisition minimized Design restricted to within 24m of ROW in Rural Area and 20m in Urban Area
4.	Generation of Debris	Disposed properly to avoid contamination.
5.	Soil Erosion	Embankment protection through stone pitching, Turfing & , retaining walls Residual spoil need to be disposed properly Silt Fencing need to be provided Quarries need to be reclaimed
6.	Contamination of Soil	Hazardous Wastes (Management and Handling) Rules, 1989 to be enforced. Oil Interceptor will be provided for accidental spill of oil and diesel Rejected material will be laid as directed by engineer. Septic tank will be constructed for waste disposal.
7.	Soil quality monitoring	Measures will be revised & improved to mitigate / enhance environment due to any unforeseen impact.
8.	Scarified Bituminous Wastes	No scarification involved. In case contractor decides to scarify then the material to be reused in the GSB

Sl. No	Potential impact	Mitigation / Enhancement
		layer. Non re-usable Bituminous wastes to be dumped in 30cm thick clay lined pits with the top 30cm layer covered with good earth for supporting vegetation growth over a period only after obtaining permission of Independent Consultant.
9.	Scarified Non Bituminous Material	Used in the normal GSB layer (not the drainage layer)
10.	Cut material	Reused as embankment, median & shoulder fill materials Excess material to be used for filling up of borrow areas identified by the Contractor and approved by the Independent Consultant
11.	Construction debris generated from dismantling of structures	Guidelines for Identification of Debris Disposal Sites & Precautions and Guidelines for Rehabilitation of Dumpsites, Quarries and Borrow Areas shall be framed
12.	Soil Contamination due to accident spills	An emergency response team to be created. The team shall contain members of the district and police administration and also have specialist in remediation. Responsibility of Contractor to inform the team to take actions. The roles and responsibility of the members of the team shall be framed in conjunction with all the parties to address the situation arising out of the accidental spills resulting in situation like water and soil contamination, health hazards in the vicinity of the accident spot, fire and explosions etc. During construction, the contractor and the Contractor 's described previously. Fuel storage will be in proper bunded areas. All spills and collected petroleum products to be disposed off in accordance with MoEF and SPCB guidelines and as per the directions of the Emergency Response team. Fuel storage and fuelling areas will be located at least 300m from all cross drainage structures and significant water bodies.
13	Runoff and drainage	Improvements of design shall lead to less accidents and hence less spillage of oil and grease Silt fencing to be provided Recharge well to be provided to compensate the loss of pervious surface
14.	Operation of residential facilities for labour camps, Vehicle parking areas	Vehicle parking area will be made impervious using 75 mm thick P.C.C. bed over 150 mm thick rammed brick bats. The ground will be uniformly sloped towards to adjacent edges towards the road. A drain will take all the spilled material to the oil interceptor
15.	Meteorological factors and climate	Comprehensive afforestation Avenue plantation Shrub plantation in the median / island
16.	Dust generation	Sprinkling of Water Fine materials to be completely covered, during transport and stocking. Plant to be installed in down wind direction from nearby settlement.
17.	Gaseous pollutants	Air pollution Norms will be enforced. Labourers will be provided mask. Local people will be educated on safety and precaution on access roads, newly constructed embankment etc.
18.	Air quality emissions	Compliance with future statutory regulatory requirements
19.	Air quality monitoring	Measures will be revised & improved to mitigate enhance
20.	Alteration of Cross Drainage	Widening & construction of bridges, there will be an improvement in the drainage characteristics of the project area.
21.	Water requirement for project	Contractor needs to obtain approvals for taking adequate quantities of water from surface and ground water sources. This is required to avoid depletion of water sources. Water harvesting structures to be provided.

Sl. No	Potential impact	Mitigation / Enhancement
22.	Increased sedimentation	Silt fencing to be provided Guidelines for Sediment Control to be framed
23.	Contamination of Water	Hazardous wastes (Management and Handling) Rules, 1989 to be enforced. Oil Interceptor will be provided for accidental spill of oil and diesel. Rejected material will be laid as directed by IC. Septic tank will be construction for waste disposal.
24.	Water quality monitoring	Measures will be revised and improved to mitigate / enhance environment due to any unforeseen impact.
25.	Noise mitigation for Sensitive receptors	Options for Noise barriers to be analysed No Horn Zone sign Post.
26.	Noise Pollution (Pre-Construction Stage)	Machinery to be checked and complied with noise pollution regulations. Camps to be setup away from the settlements, in the down wind direction
27.	Noise Pollution (Construction Stage)	Camps to be setup away from the settlements, in the down wind direction. Noise pollution regulation to be monitored and enforced. Temporary as the work zones will be changing with completion of construction.
28.	Noise Pollution (Operation Stage)	Will be compensated with the uninterrupted movement of vehicles
29.	Noise Pollution Monitoring	Measures will be revised and improved to mitigate / enhance environment due to any unforeseen impact.
30.	Forest area	Minimum acquisition of land Permission for acquisition from forest department as per Forest Act Plantation of trees as per Forest Department
31.	Trees Cutting	Compulsory tree plantation in the ratio of 1:2. Option of compensatory afforestation through Forest Department. Identification of incidental spaces for plantation along corridor, where ever possible
32.	Vegetation	Clearing and grubbing will be minimized Exposed surface like embankment slopes will be protected with stone pitching and turfing. Open land in and around plant will be vegetated.

7.13 ANALYSIS OF ALTERNATIVES

Detailed analyses of the alternatives have been conducted taking into account both with and without project. Comparative analysis of Bypass Locations has also been conducted. The proposed strengthening of the road is likely to have a positive impact on the economic value of the region. There is no bypass/realignment proposed for the project road. However, there are certain environment and social issue, these needs to be mitigated for sustainable development.

7.14 MITIGATION AVOIDANCE AND ENHANCEMENT MEASURES

Mitigation and enhancement measures have been planned for identified adverse environmental impacts. The construction workers camp will be located at least 500m away from nearby habitations. Construction yard, hot mix plants, etc. will also be located more than 500m away from habitations and in downwind directions. Existing cross drainage structures have been planned to maintain for proper cross drainage. In order to compensate negative impacts on flora due to cutting of trees the project plans compensatory plantation in the ratio of 1:2 i.e. for every tree to be cut, two trees will be planted. The project shall also witness the plantation of trees for

providing aesthetic beauty and shade. As the space for compensatory afforestation might not be adequate along the project road, this plantation shall be taken up by the forest department, after payment of the cost for raising and maintaining the saplings for three years. The project will take an opportunity to provide environmental enhancement measures to improve aesthetics in the project area. The planned environmental enhancement measures include plantation in available clear space in ROW, enhancement of water bodies etc. In order to avoid contamination of water bodies during construction Silt fencing, oil interceptors at storage areas and at construction yard have been proposed.

7.15 INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

The responsibility of implementing the mitigation measures lies with Environment Team duly appointed by the Contractor. The overall supervision of Environmental monitoring works during construction and operation stage shall be carried out by PWD, Nagaland and Manipur with the help of the Monitoring Consultant.

To mitigate the potential negative impacts of proposed development and measurement the performance of mitigation measures, an Environmental Monitoring and Management Plan is developed. The formulation of an appropriate environmental monitoring plan and its diligent implementation are keys to overall success for the project.

7.16 ENVIRONMENTAL MANAGEMENT PLAN

Project specific environmental management plan have been prepared for ensuring the implementation of the proposed measures during construction phase of the project, implementation and supervision responsibilities. The cost for environmental management during construction has been indicated in EMP. The project impacts and management plan suggested thereof are summarized in next section.

7.17 ENVIRONMENT IMPACT AND MANAGMENT MATRIX

Particulars	Stages	Potential Impacts	Mitigation Measures
Physiographic Environment			
Topography	Preconstruction & Construction	<ul style="list-style-type: none"> Slight changes are expected due to widening and improvement of the road Impacts are marginal, but permanent. 	<ul style="list-style-type: none"> Proper planning to keep the land reformation up to bare minimum No new quarry for the project
Geology	Preconstruction & Construction	<ul style="list-style-type: none"> Impacts are moderate because of extraction of sand 	<ul style="list-style-type: none"> No mitigation measure is required.
Climate			
Temperature/Rain fall/Humidity	Preconstruction & Construction	<ul style="list-style-type: none"> Tree felling will have an impact of micro-climate 	<ul style="list-style-type: none"> Compensatory afforestation of double of the trees to be cut

Particulars	Stages	Potential Impacts	Mitigation Measures
		<ul style="list-style-type: none"> of the area Heat island effect due to increase in paved roads Low spatially restricted short-term impact 	<ul style="list-style-type: none"> With the proposed avenue plantation scheme, the micro climate of the project corridor will be smoothening
Land			
Loss of Forest & Trees	Design, Preconstruction & Construction	<ul style="list-style-type: none"> Diversion of Forest & Conservation Reserve Land 	<ul style="list-style-type: none"> Forest & WL Clearance to be obtained Recommendation of concerned authorities must be followed Payment of NPV & Compensatory Afforestation
Loss of Other Land	Design, Preconstruction & Construction	<ul style="list-style-type: none"> Loss of Property & Livelihood 	<ul style="list-style-type: none"> Compensation as per RAP
Induced Development	Preconstruction & Construction	<ul style="list-style-type: none"> Insignificant change in the land use pattern 	<ul style="list-style-type: none"> Civil authorities to plan and guide any induced development using the prevailing regulatory framework
Soil			
Soil Erosion	Preconstruction, Construction & Operation	<ul style="list-style-type: none"> In Road slopes and spoils Erosion in excavated areas 	<ul style="list-style-type: none"> Embankment protection through pitching & turfing Regular water sprinkling in excavated areas
Contamination of Soil	Preconstruction, Construction & Operation	<ul style="list-style-type: none"> Scarified bitumen wastes Oil and diesel spills Emulsion sprayer and laying of hot mix Production of hot mix and rejected materials Residential facilities for the labour and officers 	<ul style="list-style-type: none"> Hazardous Wastes (Management and Handling) Rules, 1989 to be enforced. Oil Interceptor will be provided in storage areas for accidental spill of oil and diesel Rejected material to be laid as directed by monitoring consultant. Septic tank to be constructed for waste disposal.
Water			
Impact on Water Resource	Design, Preconstruction, Construction & Operation	<ul style="list-style-type: none"> Depletion of ground water recharge Contamination from fuel and lubricants & waste disposal in camp area Contamination of surface water system due to run-off from road construction area 	<ul style="list-style-type: none"> Provision of Storage/harvesting structure of water, wherever feasible Oil Interceptor and Septic tank in construction camp Enforcement of Hazardous wastes (Management and Handling) Rules, 1989 Both side drain facility to suitably divert the run-off from

Particulars	Stages	Potential Impacts	Mitigation Measures
			roads
Air			
Dust generation	Preconstruction & Construction	<ul style="list-style-type: none"> Shifting of utilities, removal of trees & vegetation, transportation of material 	<ul style="list-style-type: none"> Regular Sprinkling of Water Fine materials to be completely covered, during transport and stocking. Hot mix plant to be installed in down wind direction with at least 500m distance from nearby settlement. Regular monitoring of particulate matter in Ambient Air
Gaseous pollutants	Preconstruction, Construction & Operation	<ul style="list-style-type: none"> Operation of Hot mix plant and vehicle operation for material transportation 	<ul style="list-style-type: none"> Air pollution Norms will be enforced. Only PUC certified vehicle shall be deployed Labourers will be provided with mask. Regular gaseous pollution monitoring in ambient air
Ambient air quality	Operation	<ul style="list-style-type: none"> Air pollution from traffic CO level is likely to increase 	<ul style="list-style-type: none"> Compliance with statutory regulatory requirements
Noise			
Pre-Construction Activity	Pre-Construction	<ul style="list-style-type: none"> Man, material and machinery movements Establishment of labour camps, onsite offices, stock yards and construction plants 	<ul style="list-style-type: none"> No Horn Zone sign, Speed Barriers near sensitive receptors Camps will be setup more than 500m away from settlements.
Construction Activity	Construction	<ul style="list-style-type: none"> Operation of high noise equipment like hot mix plant, diesel generators etc. Community residing near to the work zones. 	<ul style="list-style-type: none"> Camp will be setup more than 500m away from the settlements, in down wind direction. Noise pollution regulation to be monitored and enforced.
Operation Stage	Operation	<ul style="list-style-type: none"> Indiscriminate blowing of horn near sensitive area 	<ul style="list-style-type: none"> Restriction on use of horns No Horn Zone sign.
Ecology			
Flora	Preconstruction, Construction	<ul style="list-style-type: none"> Loss of vegetation cover 	<ul style="list-style-type: none"> Felling of only unavoidable trees Compensatory Afforestation in the ratio of 1:2
Fauna	Preconstruction, Construction & Operation	<ul style="list-style-type: none"> Loss of insect, avian and small mammalian species due to felling of 	<ul style="list-style-type: none"> Compensatory Afforestation Speed breaker, Signage and limit in sensitive areas

Particulars	Stages	Potential Impacts	Mitigation Measures
		trees • Accidental run over	
Social			
Socio Environment	Design, Preconstruction & Construction	<ul style="list-style-type: none"> • Loss of Property & Livelihood • Loss of CPRs, Religious Structures 	<ul style="list-style-type: none"> • Compensation as per RAP • Relocation of CPRs, Religious Structures to suitable place
Public Health and Road Safety			
Health and safety	<ul style="list-style-type: none"> • Preconstruction, Construction & Operation 	<ul style="list-style-type: none"> • Psychological impacts on project affected people • Migration of worker may lead to sanitation problem creating congenial condition for disease vectors • Discomfort arising of air and noise pollution • Hazards of accident 	<ul style="list-style-type: none"> • Continued consultation with PAPs and the competent authority for speedier settlements of appropriate compensation package and resettlement. • Ensuring sanitary measures at construction camp to prevent water borne disease and vector borne disease. • Provision for appropriate personal protective equipments like earplugs, gloves gumboot, and mask to the work force. • Safe traffic management at construction area. • Drive slow sign and speed barriers near community facilities like school, hospital and hair pin bend etc.

7.18 Project EMP Cost

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
1	MITIGATION / ENHANCEMENT COST						
1.1	Pre-construction Stage						
1.1.1	Land acquisition		Covered in RAP Budget			0.00	0.000
1.1.2	Water	Relocation and construction of affected hand pumps, water storage tanks, open wells, water taps, OHT etc. as	Covered in Utility Shifting Budget			0.00	0.000

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
		per directions of the Engineer.					
1.2	Construction Stage						
1.2.1	Horticulture	Compensatory Re-plantation to offset the loss of trees due to widening of the project corridor in accordance to the relevant forest laws (Minimum of 2 trees planted for every tree cut) including Plantation and maintenance at locations & as per directions of the forest department or administrative department	No.	0	-	-	0.000
1.2.2		Planting of flowering, shade, medicinal, ornamental & fruit bearing trees in suitable area @ 167 numbers per Km. (single row on hill side) in rural areas	No.	3657	2,000.00	73,14,600.00	0.731
1.2.3		circular tree guard & /other for protection of plantation	No.	3657	1,000.00	36,57,300.00	0.366

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
1.2.4		Landscaping and aesthetics of junctions and at other locations as per design, drawings and direction of the Environmental Engineer / Environmental Specialist of the Engineer	LS	-	-	-	0.000
1.2.5	Slope / Embankment protection	Turfing of embankment with grasses and herbs.	sq. m. (Covered in Engineering Cost)			0.00	0.000
1.2.6	Soil & Ground Water	Providing Oil Interceptors as per design and drawing at vehicle areas workshop area and as per directions of the Environmental Specialist / Environmental Engineer of the Engineer.	Nos.	2	30,000.00	60,000.00	0.006
1.2.7	Surface Water	Silt Fencing for Water Bodies adjacent to the road	running m	0	-	-	0.000
1.2.8	Flora	Cost of transport & distribution of cooking fuel to construction workers to prevent indiscriminate felling of trees	Months	30	20,000.00	6,00,000.00	0.060

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
1.2.9	Air	Dust Management with sprinkling of water, covers for vehicles transporting construction material	Km	21.900	30,000.00	6,57,000.00	0.066
1.2.10	Noise	1) provision of and 2) Dismantleling and new construction of compound wall of noise sensitive features upto a height of total 2m above ground level complete in all respect as per Technical Specifications and as per the direction of the Engineer.	running m	50	2,500.00	1,25,000.00	0.013
1.2.11	Solid Waste Disposal	Disposal of Sewage and other wastes in the construction yard and labour camps as per directions of the Environmental Specialist / Environmental Engineer of the Engineer.	Month	30	15,000.00	450000.00	0.045
1.2.1	Cultural	Relocation of	Covered in RAP Budget				0.000

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
2	properties	cultural properties					
1.2.13	Roadside amenities	Construction of Bus Bays	Covered in Engineering Cost			0.00	0.000
1.2.14	Wildlife	Signage – Information (size 900 x 1800 mm) including lettering as per IRC code: for every Km at both Sides/ as per the direction of Environmental Specialist / Environmental Engineer of the Engineer	No	0	0	0.00	0.000
1.2.15		Signage – Information (size 1200 x 600 mm) including lettering as per IRC code for every Km at alternate Sides/ as per the direction of Environmental Specialist / Environmental Engineer of the Engineer	No	0	0	0.00	0.000
1.2.16		Cautionary/ Warning signs (900 mm Eq. triangle) as per IRC code: for every Km at both Sides/ as per the	No	0	0	0.00	0.000

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
		direction of Environmental Specialist / Environmental Engineer of the Engineer					
1.2.17		Mandatory / Regulatory sign (60 cm circular) as per IRC code: for entire section of project road for every 2 Km at alternate side / as per the direction of Environmental Specialist / Environmental Engineer of the Engineer	No	0	0	0.00	0.000
1.3	Operation Stage						
1.3.1	Horticulture	Maintenance of flowering, shade, medicinal, ornamental & fruit bearing trees in suitable area @ 400 numbers per Km. (single row of 200 on each side) in rural areas for 3 Years	No.	0	-	-	0.000
TOTAL MITIGATION / ENHANCEMENT COST						1,28,63,900.00	1.286
2	MONITORING COST						
2.1	Construction Stage						

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
2.1.1	Air	Sampling and monitoring ambient Air Quality and gaseous pollutants as per CPCB Standard Procedures at 2 locations including approved hot mix plant locations, sensitive area and chainages as per direction by Environmental Specialist / Environmental Engineer of the Monitoring Consultant for three seasons a year for 2.5 years as per the Monitoring Plan given in EMP	No. of Samples	360	2,000.00	7,20,000.00	0.072
2.1.2		Analysis charges of Ambient air from samples collected for parameters as per AAQ Standards Notification, 2009 in consultations and directions of the Engineer and NH-9 as	No. of Samples	360	8,000.00	28,80,000.00	0.288

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
		per MoEF charges.					
2.1.3	Water Quality	Collection of grab samples of water quality at 2 locations at chainages identified by the engineer for 2.5 years (twice a year) in pre & post monsoon seasons as per the Monitoring Plan given in EMP /as per direction of Environmental Specialist / Environmental Engineer of the Monitoring Consultant	No. of Samples	10	400.00	4,000.00	0.000
2.1.4		Analysis of water quality at locations in the monitoring plan for pH, Turbidity, total solids, turbidity COD, BOD, DO, Chlorides, Hardness, Oil & Grease, TSS, TDS, Total Coliform, Iron, Fluorides, Nitrates, E. coli, Total coliform and	No. of Samples	10	6,000.00	60,000.00	0.006

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
		faecal coliform as specified in "Standard Methods for Examination of Water and Wastewater" published by WEF, AWWA and APHA as per direction of Environmental Specialist / Environmental Engineer of the Engineer and as per MoEF rate list.					
2.1.5	Noise	Monitoring Noise level at Equipment Yards, Sensitive area and Settlements using hand held noise meters at 2 locations at chainages identified by the Engineer as per directions of Environmental Specialist / Environmental Engineer of the Monitoring Consultant for three seasons in a year for 2.5 years as per the	Nos.	15	2,500.00	37,500.00	0.004

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
		Monitoring Plan given in EMP					
2.1.6	Soil	Monitoring Soil at 2 locations at chainages identified by the Engineer as per directions of Environmental Specialist / Environmental Engineer of the Monitoring Consultant for twice a year for 1.5 years as per the Monitoring Plan given in EMP	Nos.	10	2,501.00	25,010.00	0.003
2.1.7	Transportation Cost	Transportation cost for monitoring of noise, air and water during construction period	L.S.	-	1,87,500.00	1,87,500.00	0.019
2.1.8	Environmental Enhancement	Enhancement of Pond at Dudhiya village at Ch 58.700 on LHS in consultation with Local Authority	LS		25,00,000.00	25,00,000.00	0.250
2.1.9		Facility for Roadside Drinking Water	10		2,00,000.00	2,00,000.00	0.020

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
2.2	Operation Stage						
2.2.1	Air	Sampling and monitoring ambient Air Quality and gaseous pollutants as per CPCB Standard Procedures at 1 locations including sensitive area and chainages as per direction by Environmental Specialist of Consultant for once in a month for 3 months x 3 season in every alternate year for 4 years	No. of Samples	36	2,000.00	72,000.00	0.007
2.2.2		Analysis charges of Ambient air from samples collected for parameters as per AAQ Standards Notification, 2009 in consultations and directions of the Consultant and PWD as per MoEF charges.	No. of Samples	36	8,000.00	2,88,000.00	0.029

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
2.2.3	Water Quality	Collection of grab samples of water quality at 1 locations at chainages for twice a year in pre & post monsoon seasons in every alternate year for 4 years as per direction of Environmental Specialist / Environmental Engineer of the Consultant	No. of Samples	8	400	3,200.00	0.000
2.2.4		Analysis of water quality at locations in the monitoring plan for pH, Turbidity, total solids, COD, BOD, DO, Chlorides, Hardness, Oil & Grease, TSS, TDS, Total Coliform, Iron, Fluorides, Nitrates, E. coli, Total coliform and faecal coliform etc. as specified in "Standard Methods for Examination of Water and Wastewater" published by	No. of Samples	8	6,000.00	48,000.00	0.005

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
		WEF, AWWA and APHA as per direction of Environmental Specialist / Environmental Engineer of the Consultant and as per MoEF rate list.					
2.2.5	Noise	Monitoring Noise level at Sensitive area and Settlements using hand held noise meters at 1 locations for once a year for every alternate year for 4 years as per directions of Environmental Specialist / Environmental Engineer of the Monitoring Consultant	Nos.	4	2,500.00	2,25,000.00	0.023
2.2.6	Soil	Monitoring Soil at 1 locations at chainages identified by the Engineer as per directions of Environmental Specialist / Environmental Engineer of the Engineer for once a year for 1 year as per	Nos.	8	2,501.00	20,008.00	0.002

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
		the Monitoring Plan given in EMP					
2.2.7	Transportation Cost	Transportation cost for monitoring of noise, air and water during operation period for 4 years considering every alternate year.	L.S.	-	3,75,000.00	3,75,000.00	0.038
TOTAL MONITORING COST						76,45,218.00	0.765
3	MISCELLANEOUS COST						
3.1	Training	Training	L.S.	-	2,50,000.00	2,50,000.00	0.025
3.2	Advocacy and Policy Making	Holding meetings for policy planning and subsequent review meetings with Revenue Department, Forest Department, local representatives, NGOs, etc. regarding development controls.	Year	12	15,000.00	1,80,000.00	0.018
3.3	Administrative Charges including logistics	Maintenance of vehicle with the Environment Cell, Data processing, administrative support, stationery etc.	Months	30	35,000.00	10,50,000.00	0.105

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
3.4	Miscellaneous Items	Digital Camera for the Environment Cell	No.	1	15,000.00	15,000.00	0.002
3.5		Portable sound level meter	No.	1	2,50,000.00	2,50,000.00	0.025
TOTAL MISCELLANEOUS COST						17,45,000.00	0.175
TOTAL COST						2,22,54,118.00	2.225
Contingency @ 5% on Total Environmental Cost						1112705.90	0.111
GRAND TOTAL						23366823.90	2.337
Rate per kilometer						1066978.26	0.11

7.19 CONCLUSIONS

Based on the EIA study and surveys conducted for the Project, it can be safely concluded that associated potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the EIA Report. Adequate provisions shall be made in the Project to cover the environmental mitigation and monitoring requirements, and their associated costs as suggested in environmental budget. The proposed project shall improve Road efficiency and bring economic growth in the hilly region. Better connectivity between Nagaland and Manipur. In terms of air and noise quality, the project shall bring considerable improvement to possible exposure levels to population.