



Green National Highways Corridor Project

Two Lane Upgradation with Paved Shoulders
of Paderu- Araku (up to Bhalluguda) Section
of NH 516 E in Andhra Pradesh

Environmental Impact Assessment & Environmental Management Plan

December, 2019

**Ministry of Road Transport and Highways
Government of India**

List of Acronyms

ADT	Average Daily Traffic
AADT	Annual Average Daily Traffic
AH	Asian Highway
AMSL	Above Mean Sea Level
APR&BD	AP Roads and Building Department
APPCB	Andhra Pradesh Pollution Control Board
ASI	Archaeological Survey of India
BDL	Below Detection Limit
BOQ	Bill of Quantities
CCE	Chief Controller of Explosives
CD	Cross Drainage
CFE	Consent for Establish
CFO	Consent for Operate
CE	Chief Engineer
CGWA	Central Ground Water Authority
CoI	Corridor of Impact
CPCB	Central Pollution Control Board
CO	Carbon Monoxide
DEIAA	District Level Environmental Impact Assessment Authority
DFO	Divisional Forest Officer
DPR	Detailed Project Report
EC	Environmental Clearance
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMF	Environment Management Framework
EMP	Environment Management Plan
ESO	Environment & Safety Officer
ESR	Environmental Screening Report
FRO	Forest Range Officer
GHG	Green House Gas
GNHCP	Green National Highways Corridor Project
GoI	Government of India
IRC	Indian Roads Congress
IS	Indian Standards
LCV	Light Commercial Vehicle
LHS	Left Hand Side
Km	Kilometer
MoEFCC	Ministry of Environment, Forest and Climate Change, Govt. of India
MoRTH	Ministry of Road Transport and Highways, Govt. of India
NBWL	National Board for Wildlife
NAAQS	National Ambient Air Quality Standards
NGHM	National Green Highways Mission
NGO	Non-Governmental Organization
NH	National Highways

NHDP	National Highways Development Program
NOC	No Objection Certificate
NO ₂	Nitrogen Dioxide
NRSC	National Remote Sensing Centre
OD	Origin and Destination
OP	Operational Policies
PCU	Passenger Car Units
PIU	Project Implementation Unit
POL	Petroleum, Oil and Lubricants
PMC	Project Management Cell
PROW	Proposed Right of Way
PUP	Pedestrian Under Pass
PWD	Public Works Department
RCC	Reinforced Cement Concrete
RET	Rare, Threaten and Endangered
RHS	Right Hand Side
RoW	Right of Way
ROB	Rail Over Bridge
SEAC	State Expert Appraisal Committee
SEIAA	State Level Environmental Impact Assessment Authority
SEI	Significant Environmental Issues
SO ₂	Sulphur Dioxide
SIA	Social Impact Assessment
SOI	Survey of India
SH	State Highway
TCS	Typical Cross Section
ToR	Terms of Reference
VEC	Valued Ecosystem Components
PUP	Vehicular Under Pass
WB	The World Bank
WMM	Wet Mix Macadam

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

The AP Roads and Building Department (APR&BD), National Highway (NH) Division, under Ministry of Road Transport & Highways, MoRT&H intends to develop and maintain National Highway 516 E connecting to Paderu - Araku Road Section (Km 2+400 to Km 51+912) upto Bhalluguda on SH-39 in the State of Andhra Pradesh.

APR&BD through their letter Lr. No/600/New NH/Pckg-6/EE (NH&CRF) DEE-6/AEE-3/2015-16 dated 30.06.2016 instructed the consultants to commence the assignment, and the project activities thereafter. The Contract agreement for the assignment was signed on 28th July, 2016.

1.1.1 Green National Highways Corridor Project (GNHCP)

Two upgradation with Paved Shoulders of Paderu to Araku Road Section of NH 516E is proposed by constructed under Green National Highways Corridor Project (GNHCP) through its support to the Govt. of India's Bharatmala Pariyojana and financed by the World Bank. It will promote the vision of enhancing effectiveness of the transport network of India with cost and natural resources efficiency and safe high capacity highways. The GNHCP operation is aligned with the Government of India's objective of eliminating poverty and ensuring access to minimum standard of basic needs for all citizens through investing in growth enablers transport & connectivity Infrastructure. The basic proposition of the GNHCP includes strengthening of road pavement in addition to widening to two-lane/two-lane with paved shoulder standards and promoting/ demonstrating green and resilient approaches while doing so. The list of roads (sub-projects) identified for inclusion in this project are given below:

Sr. No.	State	Highway	Section	Length (in kms)
1.	Andhra Pradesh	NH-516E	Bowada to Vizianagram	26.94
2.	Andhra Pradesh	NH-516E	Paderu to Araku	49.37
3.	Himachal Pradesh	NH-707	Poanta Sahib to Gumma	94.99
4.	Himachal Pradesh	NH-707	Gumma to Fediz	9.80
5.	Rajasthan	NH-158	Ras-Beawar-Mandal	116.75

1.1.2 Project Highway : Paderu – Araku Road Section of NH 516E

The project highway starts from Paderu (18°05'58.82"N Latitude, 82°40'20.50 E Longitude) and ends at Bhalluguda (18°17'06.60"N Latitude, 82°56'22.36"E Longitude) on SH-39. The existing length of project highway is 49.512 km. The project stretch traverses through rolling (96%) and hilly terrain (4%%) and have mostly poor geometry except few locations where curve improvement may not be required. The project road is located in Vishakhapattanam district of Andhra Pradesh. The project road connects the important towns / villages like Hukumpeta, Kinchumanda and Dumbriguda, Araku, Araku valley and Kantabamsuguda.

The project road section starts at Km 2+400 at Paderu and ends at Km 51+912 at Bhalluguda village at outskirts of Araku. The proposed project is upgradation to two lane with paved shoulder configuration with a length of 49+512 kms of NH 516E in the state of Andhra Pradesh. The other improvement would include removal of geometric deficiencies, repairs, rehabilitation of bridges, culverts, embankment and providing traffic safety measures.

The index map of the project road has been shown in the **Figure 1.1**. The alignment marked on the Survey of India (SOI) toposheet is presented in the **Figure 1.2**.

EIA Report for Two Lane Upgradation with Paved Shoulders of Paderu- Araku (up to Bhalluguda) Section of NH-516E in Andhra Pradesh under Green National Highway Corridor Project (GNHCP)

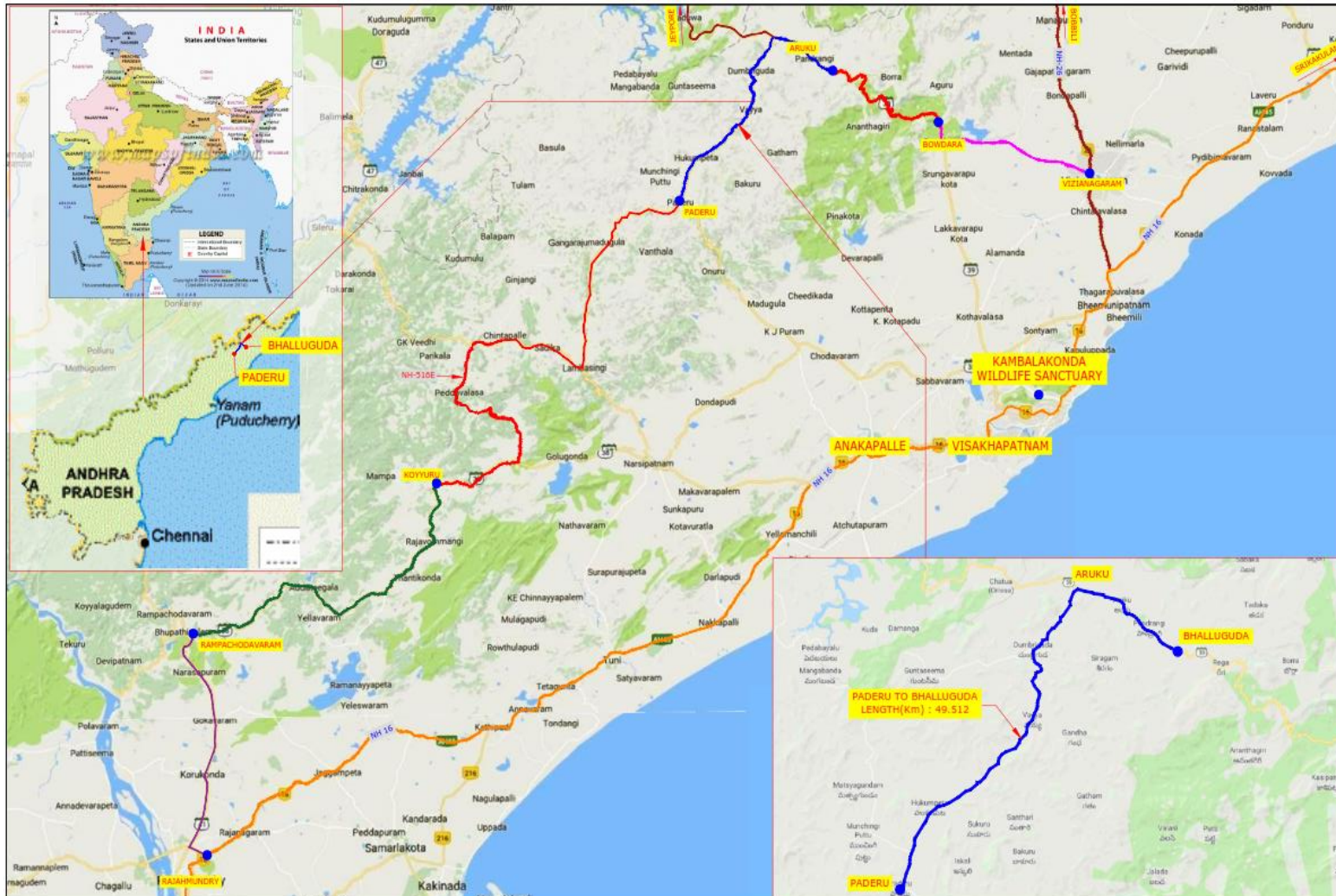


Figure 1.1: Project Road Index Map

EIA Report for Two Lane Upgradation with Paved Shoulders of Paderu- Araku (up to Bhalluguda) Section of NH-516E in Andhra Pradesh under Green National Highway Corridor Project (GNHCP)

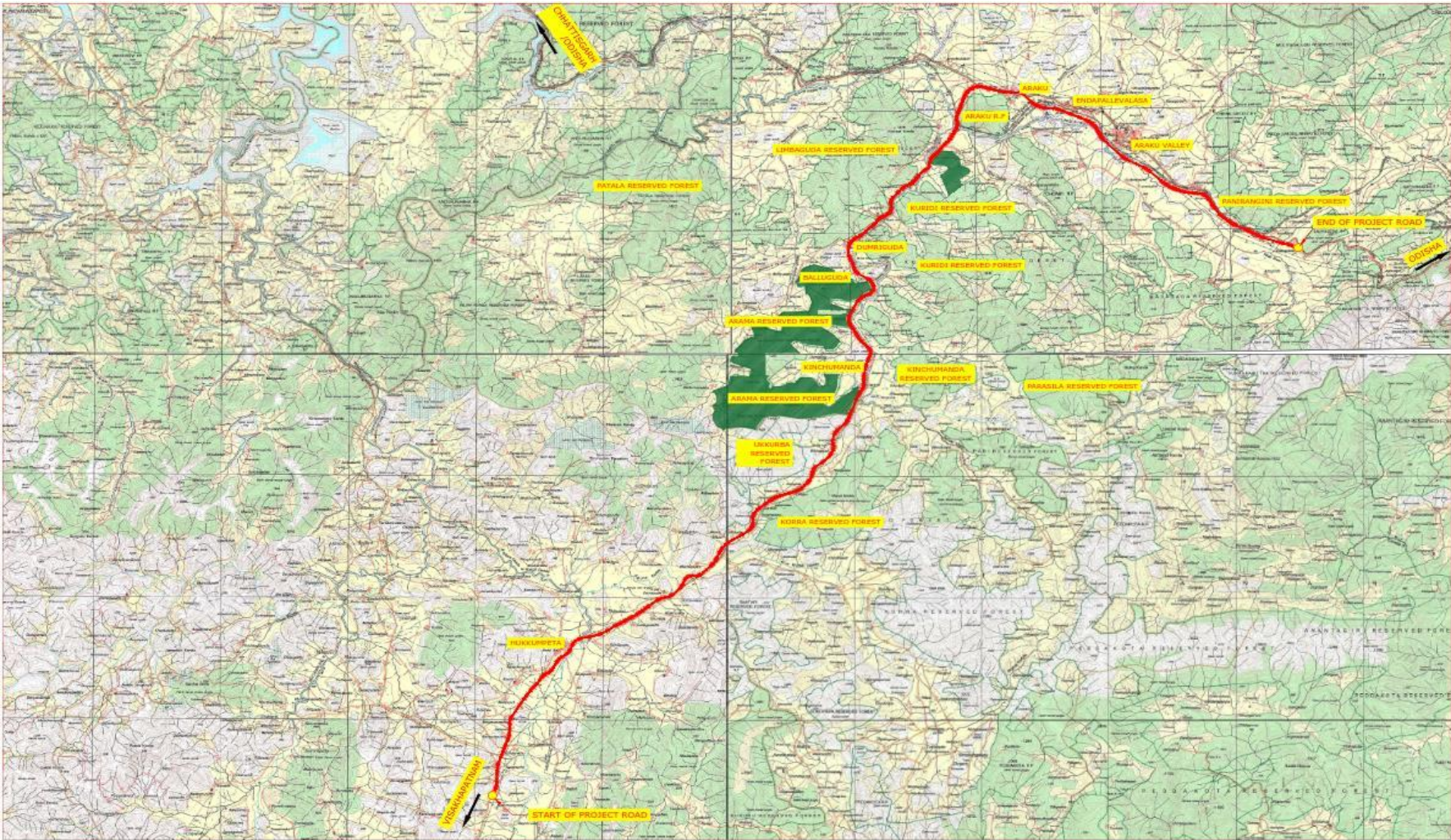


Figure 1.2: Topo Map Showing the Project Road

1.2 Objectives of the Project

The main objective are to upgradation of existing road to two-lanes with paved shoulder configuration; and alleviate the current unsafe and congested conditions of the project road connecting the villages and towns, with one another and to the National Highway network for the benefit of the road users at large. A modest design speed for the safe and efficient movement of people and goods is seen as the objective and the design of consultants reflect this .

The project road is aided aim to provide congestion free, safe and smooth road to the population residing along project road and other users travelling through the project road. The other objective of widening and strengthening the of project road is (with required cost effectiveness, coupled with environmental management standard) for achieving sustainable development of the region, state and ultimately to the country.

1.3 Existing condition of the Project Road

The project road section from Paderu to Araku passes through rural and semi urban sections. The total proposed length of project road is 49.512 km. Major settlements along the project road are Paderu, Hukumpeta, Kinchumanda, Dumbriguda, Araku, Araku Valley and Kantabamsuguda. 71 % of the existing road is in poor condition. 60 % project road is single lane, 28 % road is intermediate lane, 8 % road is intermediate lane and 4 % road is two lane with paved shoulders.



1.4 Major Village/Town on Project Road

The villages and settlements are on either side of the project road. The details of settlements along the project road are presented in **Table 1.1**.

Table 1.1: Details of Settlements along the Project Road in Paderu to Araku up to Bhalluguda Section

S.No.	Name of village/Town/Habitation	District
1	Paderu (Km 2+400)	Visakhapatnam
2	Hukumpeta (Km 8+500)	
3	Kinchumanda (Km 24+700)	
4	Dumbriguda (Km 30+500)	
5	Araku Village (Km 42+100)	
6	Kantabamsuguda (Km 44+000)	

1.5 Need of the Project Road

- a) The proposed project road between Paderu - Araku will facilitate the transportation of agriculture produce from the surrounding areas in Visakhapatnam district to their market places in Andhra Pradesh and Orissa by enabling movement of heavy vehicles in all weather conditions.
- b) At present the connectivity of the area is provided by two State Highways, SH-8 at Paderu to Araku and SH-39 from Araku- Srungavarapukota Kota and NH-16 connects Araku to Visakhapatnam.
- c) Upgradation of the project road will improve the export of the coffee production to Sweden, Switzerland, Italy and UAE as the present condition of the road is single lane with poor geometry, big trucks are not plying on this road.
- d) The project area is a famous tourist location, development of this road will attract more tourists which will help in the economic development of the region.
- e) Improvement of the road geometrics will also attract more traffic to the region which in turn help in the upliftment of the living standards of the people. And also help in reduction of accidents.
- f) To meet the demand of safe travel and accident free travel, upgradation of the present project road is very much needed.

- g) Development of this road will enhance the tourism spots like Araku, Lambasinghi etc.,
- h) To meet the demand of safe travel and accident free travel, upgradation of the present project road is very much needed.

The necessity of the project road is summarised below:

- Connects Bharatmala Corridors viz, NH-16 (AH45) at Rajahmundry and NH-26 at Vizianagaram improving the lower weaker sections of the region.
- Boosts Tourism in hill stations Araku, Lambasinghi and Borra Caves.
- Creates more health facilities, educational opportunities especially for women.
- Improves Road Safety.
- Enhances mobility to remote places.
- Facilitates overall economic development of the region.

1.6 Benefits of the project

The implementation of the project will have the following direct benefits:

- a) The project road widening will help in economic growth in the project road and surroundings.
- b) The road widening will help in regional development of Andhra Pradesh and population residing along the project road.
- c) Improved quality of life is expected for the population in the project influence area. The project road widening will provide economic boost to the local population through facilitation of easy transportation of materials to the commercial centres.
- d) Employment & business opportunities will be available to the locals during construction phase.
- e) Social benefit: The road widening will help in regional development of Andhra Pradesh and population residing along the project road.
- f) Improved quality of life is expected for the population in the project influence area. The project road widening will provide economic boost to the local

population through facilitation of easy transportation of materials to the commercial centres.

- g) Employment & business opportunities will be available to the locals during construction phase.
- h) Improvement in Road Safety: The existing road suffers from many safety issues such as deficient curves, congested habitations etc., The proposed project will help in road improvement and will help in reduction of accidents. The road geometry is being adjusted to improve deficient curves.

The proposed project road (PR) with a total length of ~49 km, is based on its importance of strengthening the road linkage between Paderu and Arakum in Visakhapatnam district, which along with upgradation of Bowdara-Vizianagaram and Koyyuru-Paderu stretches also on NH-516E forms an important artery for movement of main goods (e.g. coffee, spices, agricultural produce and seasonal crops) between Andhra Pradesh and Orissa.

The proposed upgradation would help improve the horizontal and vertical geometry, help develop high level bridges in place of causeways and narrow bridges, and enhance safety features thus enabling movement of heavy vehicles in all weather conditions, reducing travel times, vehicle operating costs, and traffic congestion, and improve the transportation of agricultural products from the surrounding areas to the marketplaces.

The project road, which passes through Paderu, Hukumpet, Vayya, Dumbriguda, Araku, Araku valley, Bowdara, Thatipudi, and Gantayada and also provides connectivity to around 14 villages on the RHS and 7 villages on the LHS, is also important in terms of the connectivity linkages to these towns and villages.

Tourism is already a major contributor to Andhra Pradesh's economy, with a contribution of around 13%. Upgradation of the PR along with upgradation of Bowdara-Vizianagaram and Koyyuru-Paderu stretches of NH-516E, would improve connectivity for tourists visiting various famous tourist destinations in A.P., such as Lambasingi (a small village in the Eastern Ghats of Chintapalli division in A.P. at an altitude of 1,000 m above sea level with a deciduous forest cover consisting of several coffee, pine, and eucalyptus plantations, and known for its diversity of bird life), Araku Valley (located in the Eastern Ghats about 114 kilometres from Visakhapatnam, close to the Odisha state border, and famous for its coffee plantations which are largely in the tribal areas), Borra caves (located in the

Ananthagiri hills of the Araku Valley caves, these are considered the deepest caves in the country, at an elevation of about 705 m). Better connectivity would enable work force participation and tourism related activities in the region.

Other various positive impacts and benefits expected from the proposed project are furnished below.

- Improvement of project road would increase new economic and employment opportunities by catering good connection to new markets, production centre. As a result villagers would be able to transport their produce faster and get more profit margins instead of depending solely on local 'haats' and middlemen.
- With the project, good connectivity would attract industrialists; businessmen to set up agro-based industries and new business centre like fruits, vegetables. It will create opportunity in the uplift of poor farmers.
- Improved connectivity will attract tourists
- Improve the condition of existing traffic flow by removing all bottlenecks at various locations.
- With road improvement, it will reduce the cost of transportation and fuel consumption.
- Increase the carrying capacity of the existing traffic volume and enable it to cater to the future traffic.
- Essential and emergency services like schools, health centre, public distribution system etc can be availed faster.

1.7 NEED OF ENVIRONMENTAL IMPACT ASSESSMENT STUDY (EIA)

The objective of the Environmental Assessment is the characterisation of the existing status of the environment, to identify the probable adverse and positive impacts on the environment and community due to the proposed project and to delineate various measures to mitigate the adverse impacts and to enhance positive environmental impacts.

The Environmental Assessment provides tool for decision-making as well as it helps in ensuring the sustainable development with mitigating adverse environmental impacts by providing site specific Environmental Management Plan (EMP). In order to achieve these objectives, detailed surveys and monitoring have been carried out along the proposed project road to identify Valued Ecosystem Components (VEC) and project specific significant environmental issues (SEI).

1.8 SCOPE OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The scope of EA is to meet the Environmental Framework requirements and environmental assessment guidelines of the World Bank.

- Collecting primary and secondary environmental baseline data within the project boundary and surrounding areas;
- Assessing potential adverse environmental impacts that might arise during design, construction and operation phases with respect to design proposal of the project and using the environmental baseline study;
- Suggesting appropriate mitigation measures to effectively manage potential adverse environmental impacts; and
- Analyse the alternatives in terms of alternatives of upgradation of the alignment, technology, design and operation, including the "without and with project" situation. A detailed analysis for each of the alternatives, was carried out to analyse the feasibility in terms of capital and recurrent costs; their suitability under local conditions and quantify the environmental impacts to the extent possible, and attach economic values where feasible and explain the rationale behind the preferred/chosen option
- Consultation with the Public/key Stakeholders and incorporate their concerns into the project design;
- Developing an Environmental Management Plan (EMP) including environmental monitoring plan to implement suggested mitigation measures and management plans to minimise adverse impacts through effective management systems including formulation of monitoring and reporting requirements;

1.9 APPROACH AND METHODOLOGY OF EIA STUDIES

The methodology for the EIA study employs a traditional approach of identifying the environmental sensitivities along the project corridor and analysing the environmental issues identified. The EIA process simultaneously informs the design of the project road about these issues so that necessary modification can be carried

to minimise these environmental concerns. Thereafter the impact assessment that is carried out would identify the impacts which are still likely and also identify mitigation measures which need to be adopted during the construction and operation of the National highway.

1.9.1 ENVIRONMENTAL SCREENING AND SCOPING

Environmental screening exercise of the project road was undertaken to facilitate inputs on environmental considerations; apart from social, economic and traffic & transport considerations. Further, this report will also provide scoping inputs in determining the major environmental issues and defines the scope of work for conducting environmental assessment.

As per the recommendation of the Environmental Screening report, detailed Environmental Assessment will be taken up as a next step of the consultants in the assignment. The scoping exercise defines geographical boundaries for the project road for impact assessment as well as defining the project influence area to assess the impacts due to project interventions during construction and operation phases.

The environmental screening typically identifies the natural habitats (e.g. national parks, wildlife sanctuaries, sacred groves, protected areas, forests, water bodies etc.), major rivers and waterways, notified cultural heritage sites and any other potentially sensitive areas. The information available from secondary sources along with the inputs from the site visits and consultation with local people are used to identify these issues and sensitive receptors which might be located along the project corridor.

1.9.2 DELINEATION OF THE PROJECT IMPACT ZONE

For carrying out further environmental studies and subsequently the assessment it was required to delineate the Corridor of Impacts (COI) and project influence zone. Depending on the severity of impact the project influence zone has been classified as:

1.9.3 CORRIDOR OF IMPACT (COI) AND PROJECT INFLUENCE ZONE

The area of the proposed Right of Way (ROW) has been considered as the Corridor of Impact. The proposed RoW is 30m at re-alignments and bypasses, 24m at existing and rural areas and 20m in forest area. At Toll plaza it is 40m. The project influence zone has been considered as 10 km either side of the project road.

1.9.4 COLLECTION OF PRIMARY AND SECONDARY ENVIRONMENTAL DATA

Primary and secondary data were collected through field monitoring and various verifiable sources for different environmental components e.g. ambient air, soil, water, noise, climate, physiography, ecology, etc.

1.9.5 COLLECTION OF PRIMARY BASELINE INFORMATION

For gathering the baseline environmental condition along the project corridor baselines studies were conducted. These baseline studies carried out included:

- Baseline environmental surveys for assessing the ambient air, ground and surface water, soil and noise levels;
- Enumeration of trees to identify the location, number, types spread, girth etc. Local name, value of the trees within the proposed RoW;
- Ecological surveys to identify the habitats and the flora and fauna;
- Structure enumeration to identify the one likely to be impacted;
- Socio-economic surveys to identify the condition of the impacted persons.

In addition to the above survey interactions were carried out with the populations along the project corridor to gather local level information on the following:

- Local practices and traditions with respect to conservation and use of natural resources;
- Farming practices and Cropping pattern;
- Perception of the people about the project
- Traffic surveys were used to estimate the present and future traffic
- Preliminary engineering surveys to identify the topographical features

This information was used to develop the baseline environmental condition in the project area and identify the environmental sensitivities which might still get affected by the proposed alignment. The sources from which baseline information gathered are presented in **Table 1.2.**

Table 1.2: Secondary Data Collected for EIA Studies

Environmental and Social Aspect	Parameters of Concern	Source of Information
Climatic Condition in the Project Influence Area	Temperature and Rain Fall	IMD (Indian Metrological Department)
Soil & Geology	Soil type and its stability, Fertility of the Soil potentiality for soil erosion	Geological Survey of India, State Mining Department
Slopes	Direction of slope, Percentage of slope	Contour Survey, Satellite image and Survey of India topographic sheets
Drainage/ Flooding	Existing drainage map and flooding level including its extent of water spread. Identification of drainage channel and its catchments area around the Project stretch	Satellite Imagery/ Toposheet /Hydrology study/State Water Resource Department.
Water Bodies and Water Quality	Identification of water bodies/canal/drainage channels where the run off surface water will flow/due to erosion and also due to spillage oil and other hazardous materials. Status of surface water and ground water quality	Topo sheets/field study. Hydrological data from the CGWA Reports
Air Quality	Air quality status of the project area.	Monitoring of the ambient air quality carried out by the Savant Enviro Tech Pvt. Ltd an NABL Accredited Laboratory.

Environmental and Social Aspect	Parameters of Concern	Source of Information
Ambient Noise levels	Existing noise level in the project area	Monitoring of the ambient noise level carried out by the Savant Enviro Tech Pvt. Ltd an NABL Accredited Laboratory.
Forest Within Proposed ROW Legal Status – Protected Areas, Endangered Plant and Animal, Ecological Sensitive Area, Migratory Corridor/ route,	Status of the forests, Conservation of forest area, & endangered plant and animal and any other species	Department of Forest, Govt. of Andhra Pradesh, DFOs, Discussion with local community and local FRO
Trees and Vegetation Cover	Identification of existing tree species and the project influence area	Forest Department and Field Survey.
Settlements within the PROW	Settlements & its population along the corridor. Its location & numbers	Population/ District Census report 2011. Topographic survey data.
Cultural / Heritage and Ancient Structures.	Conservation areas if any Protected structures, monuments and heritage structures.	Archaeological Survey of India, State Archaeological Department

1.9.6 CONSULTATION WITH KEY STACK HOLDERS

During the EIA process, a preliminary identification of key stakeholders was carried out. An inventory of actual / potential stakeholders, including local groups and individuals, local institutions which may be directly or indirectly affected by the project or with interest in the development activities in the region was made at a preliminary stage. This inventory was arrived through discussions with local AP_R&BD official and also in consultation with members of the local community.

Consultation with the community is a continual process that was carried out during the EIA study and would also be continued during the construction and operation phases of the project. The consultations with community and local institution like panchayat also helped in developing preliminary understanding of the requirement of people in the area and identification of the enhancement proposals.

1.9.7 IMPACTS IDENTIFICATION AND EVALUATION

The principal impact assessment (IA) steps comprise of the following:

- Impact prediction: to determine what could potentially happen to resources/ receptors as a consequence of the project and its associated activities.
- Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/ receptor.
- Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

1.9.8 ENVIRONMENTAL MANAGEMENT AND MONITORING

The final stage in the EIA Process is preparation of the management and monitoring measures that are needed to ensure:

- a) Environmental Impacts and their associated Project components remain in conformance with applicable regulations and standards; and
- b) Mitigation measures are effectively implemented.

An Environmental Management Plan, which is compilation of control and mitigation measures to be implemented with respect to environmental performance for the project road. The Environmental Management Plan includes mitigation measures, budgetary estimates, performance indicators, reporting and monitoring activities.

1.10 The Limitations of EIA Study

The EIA report is based on the preliminary designs which were prepared for the road. The final design would be developed by the Contractor before the initiation of construction. Even though no major changes are expected in the design the EIA

report needs to be verified against the final engineering design. Further, the report has been developed on certain information available at this point of time, scientific principles and professional judgement to certain facts with resultant subjective interpretation. Professional judgement expressed herein is based on the available data and information.

1.11 STRUCTURE OF THE EIA REPORT

The EIA report for the project road has been prepared complying country regulations and The World Bank Guidelines for Environmental Assessment. The EIA report has been structured in the following Chapters:

Chapter 1 as Introduction describes background, brief description of project road, needs and benefits of the project road, scope of environmental assessment, needs of EIA study, approach and methodology adopted and structure for EIA report.

Chapter 2 as Project Description describes existing road conditions and facilities, traffic projections, right of way, proposed bypass and realignment, proposed roadway improvements, bridge and cross drainage structures, junctions improvement, underpass, community facilities, construction materials requirement and sources, way side amenities, road safety improvement proposal, etc.

Chapter 3 as Policy, Legal and Administrative Framework presents the legal and administrative framework of World Bank, Government of India and Government of Andhra Pradesh. This section underlines various clearances, permissions, consents involved for the project road at the State level and at the Central level.

Chapter 4 as Baseline Environmental Conditions presents the existing environmental conditions along the corridor, which were ascertained by conducting a field survey along with collection of secondary information pertaining to the corridor. Primary data for various environmental parameters was generated using suitable monitoring devices. The methodology was strictly adhered to the stipulated guidelines by MOEF&CC and CPCB.

Chapter 5 as Anticipated Environmental Impacts describe identification and evaluation of anticipated environmental impacts caused on various environmental and social parameters by the various activities proposed for the upgradation of the project road.

Chapter 6 as Analysis of Alternatives presents analysis of alternatives carried out during EIA studies considering with and without project, alternatives for bypasses and realignments, pavement technologies, construction materials, etc.

Chapter 7 as Green Initiatives Chapter describes green highway, green initiatives, GHG emissions reductions and climate resilient initiatives adopted in the project and estimated GHG emissions reduction.

Chapter 8 as Consultations with Key Stakeholders provide details of consultation carried out in order to know the feedbacks of local population and the project affected people (PAP). Key stakeholder Consultation meetings were held with the stake holders to record their views on the environmental issues pertaining to the road and the suggested remedies to be adopted for the proposed project road.

Chapter 9 as Environmental Management Plan describes mitigation measures to avoid or minimization of anticipated environmental impacts during design, preconstruction, construction and de-mobilization phases. Environmental Management Plan that include institutional aspects of the project implementation and cost estimates for implementation of EMP.

Annexure referred in the EIA report have been enclosed at the end of EIA report as Annexure.

CHAPTER 2

PROJECT DESCRIPTION

2.1 PROJECT ROAD

The project road starts from (18°5'58.72"N Latitude, 82°40'20.71 E Longitude) and ends at Bhalluguda (18°17'6.45"N Latitude, 82°56'22.27"E Longitude) on SH-39. Approximate length of the project road is 49.512 Km traversing through Hukumpeta, Kinchumanda and Dumbriguda, Araku, Araku Valley, Kantabamsuguda in the district of Vishakhapatnam of Andhra Pradesh State.

The key map of the project road is shown in **Figure 2.1**.

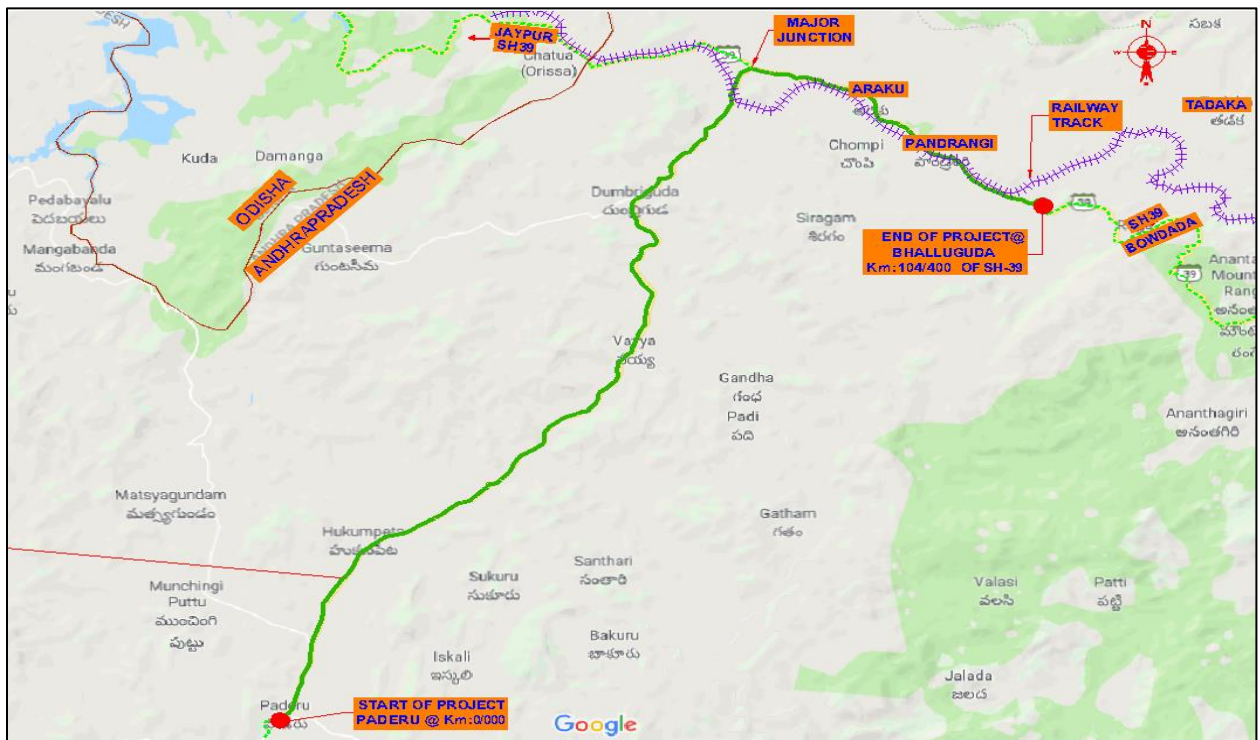


Figure 2-1: Key Map of the Project Road

The project road starts at Km 2+400 at Paderu and End at Bhalluguda at Km 51+912 on SH 39. The project road traverses through rolling and hilly terrain and have mostly poor geometry. The existing length of the road is 49.512 kms. The proposed road is the part of NH 516. District wise project road alignment details are given in **Table 2.1**.

Table 0.1: District wise project Road alignment

Road section	From (km)	To (km)	Length(km)	District
NH-516	2+400	51+912	49+512	Vishakhapatnam

Most of the land along the project road is passing adjacent to agricultural area, built up areas and the forest area, whereas there is nominal barren land. The forest land involved in the proposed project is only 0.642Ha. Educational institutions and religious structures exist in some of the villages and towns along the project road.

2.2 PROJECT FEATURES

The features of the existing road are presented in the following sections.

2.2.1 Right of Way

The Right of Way along the project corridors varies from 13.55 m to 47.66 m. No Encroachments are observed along the existing carriageway.

2.2.2 Settlements

The project road traverses through 6 nos. of major built-up / settlements. The presence of these settlements obstructs the flow of traffic due to reduction in speed. The traffic flowing through these sections also creates potential hazard to pedestrians. The major settlements along the road are listed in **Table 2.2**.

Table 0-2: List of Major Built-Up / Settlements along Project Road

S.No.	Name of village/ Town/ Habitation	District
1.	Paderu (0+00)	Visakhapatnam
2.	Hukumpeta (6+600)	
3.	Kinchumanda (21+300)	
4.	Dumbriguda (28+300)	
5.	Araku (39+700)	
6.	Kantabamsuguda (41+800)	

The constraint of improving or upgrading the current road is the land availability in these built-up sections.

2.2.3 Existing Traffic

During the study 7 days classified traffic volume count survey has been conducted at approved mid-block location of each homogeneous section at Km 8.400 and Km 111+600. From seven days' classified traffic count survey, projected traffic for Paderu- Araku road section in 2017 was calculated at Hukumpet as 4711 ADT, 4034

PCUs, 5123 AADT and PCUs 4373 and at Ravvalaguda the traffic volume count as 5512 ADT PCUs 4376 and AADT 5529 PCUs 4356. The existing traffic data at Km 8.400 (Hukumpeta) and Km 111+600 (Ravvalaguda near Araku) is as given in **Table 2.3**:

Table 0.1: Existing Traffic – ADT and AADT

Moded wise Classification	Km 8+400 (Hukumpeta)			Km 111+600 (Ravvalaguda)			
	ADT	AAADT	%	ADT	AAADT	%	
Car/ Jeep/Van	607	662	12.9%	874	888	16.1%	
Taxi	13	14	0.30%	214	217	3.90%	
Two Wheeler	2535	2763	53.9%	3007	3053	55.2%	
Three Wheeler	970	1058	20.6%	993	958	17.3%	
Minibus	6	6	0.1%	28	27	0.5%	
School Bus	6	7	0.1%	2	2	0.0%	
Bus (Govt)	79	85	1.7%	66	64	1.1%	
Bus (Pvt)	2	3	0.1%	11	11	0.2%	
LMV	171	185	3.6%	93	89	1.6%	
LCV	78	84	1.6%	46	45	0.8%	
2-Axle	61	65	1.3%	29	28	0.5%	
3-Axle	52	56	1.1%	10	10	0.2%	
4-Axle and 6 Axle	19	20	0.4%	14	13	0.2%	
7 Axle Above	0	0	0.0%	1	1	0.0%	
Tractor	13	13	0.2%	8	7	0.1%	
Tractor with Trailer	20	20	0.4%	18	17	0.3%	
Cycle	50	50	1.0%	82	82	1.5%	
Cycle Rickshaw	2	2	0.0%	1	1	0.0%	
Animal cart	0	0	0.0%	0	0	0.0%	
Others	2	2	0.0%	2	2	0.0%	
Toll exempted vehicle	Car/Jeep	14	15	0.30%	9	9	0.17%
	Bus	8	9	0.17%	3	3	0.05%
	LCV	2	3	0.05%	0	0	0.00%
	Truck	2	2	0.04%	0	0	0.00%
Passenger Vehicles	4241	4622	90.22%	5208	5233	94.65%	
Freight Vehicles	417	448	8.74%	218	210	3.81%	
Total Fast Moving Vehicles	4658	5069	99.0%	5427	5443	98.5%	
Total Slow Moving Vehicles	53	53	1.0%	85	85	1.5%	
Total Vehicles	4711	5123		5512	5529		
Total PCU	4034	4373		4376	4356		

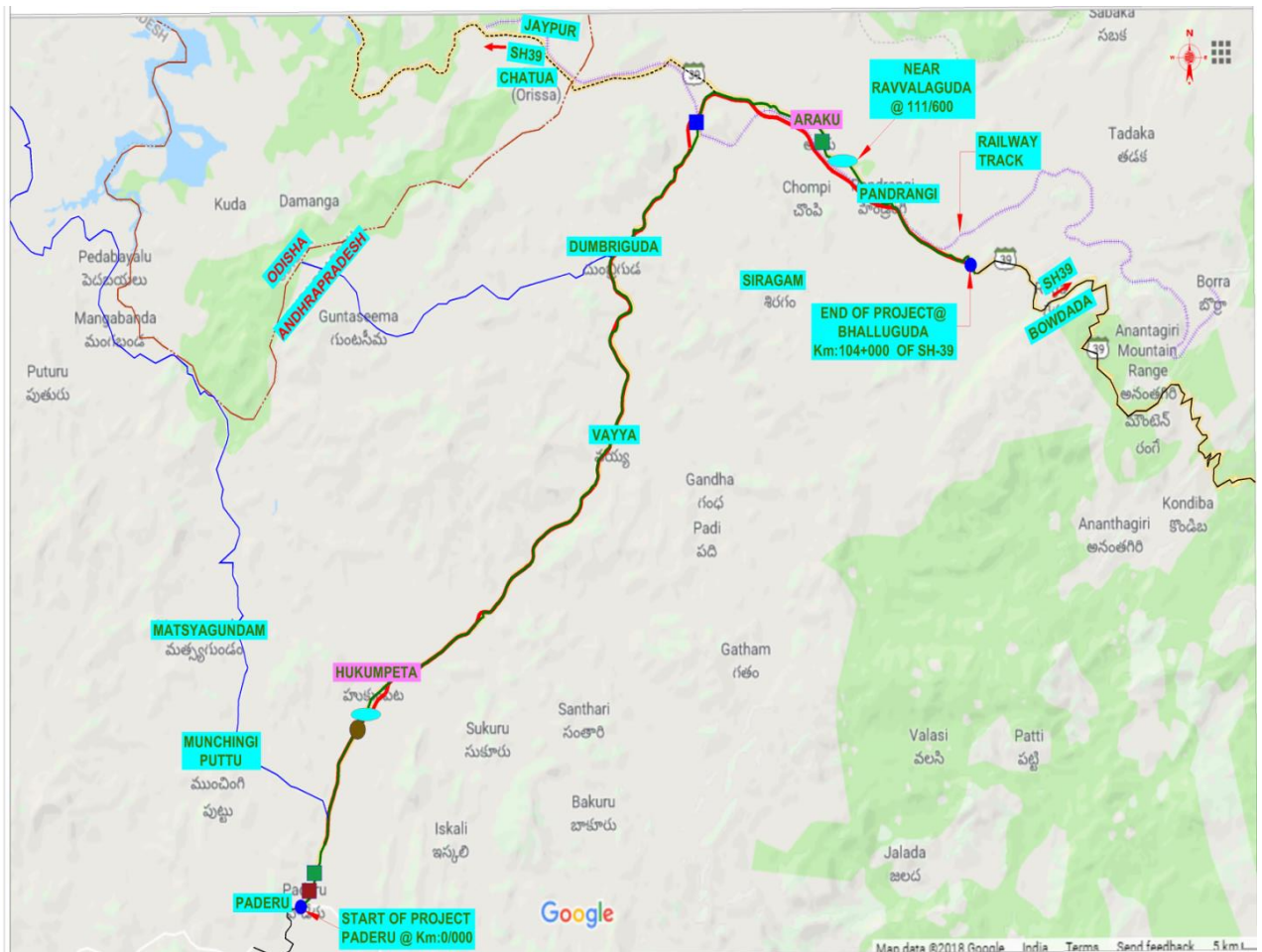


Figure 0.2: Traffic Survey Map

Based on the existing network, traffic intensity, alternative routes and major traffic generation & dispersal points along the project road, the entire project road is categorized as one traffic homogenous section and presented in **Table 2.4**.

Table 0.4: Section wise Summary of ADT and AADT on Project Road

Vehicle Type/ Location	Paderu-Araku Road		Jeypore Jn. Road-Bhalluguda	
	km 8+400		Km 111/400	
	ADT	AADT	ADT	AADT
Total Passenger Vehicles	4241	4665	5208	5233
Total Freight Vehicles	417	455	218	210
Total Fast Moving Vehicles	4658	5121	5427	5443
Total Slow Moving Vehicles	53	53	85	85
Total Vehicles	4711	5174	5512	5529
Total PCU	4034	4422	4376	4356

Source: Design Report and Primary Survey

Estimated Traffic Projections

Normally, the growth potential of passenger traffic in a zone depends on its population and economic growth rates. Therefore, both these parameters have been incorporated in forecasting of passenger traffic. The projected traffic is presented in **Table 2.5**. Threshold for 4-lane for rolling terrain is 8500 PCUs which is reaching after 10 years. Based on traffic projections, the project is proposed to be improved with 2-lane with paved shoulders.

Table 0.5: Projected Traffic

Year	HS-1 (Paderu to Araku)	HS-2 (Araku-Bhalluguda)
2018	4910	4617
2019	5203	4894
2020	5513	5187
2021	5843	5499
2022	6197	5834
2023	6574	6190
2024	6973	6568
2025	7397	6970
2026	7848	7396
2027	8243	7849
2028	8659	8245
2029	9096	8661
2030	9555	9099
2031	10037	9559
2032	10544	10042

Source: Design report

2.2.4 Existing Road

Carriage Way

The present carriageway of the project road varies from single lane to two lane with paved shoulders lane. 60 % project road is single lane, 28 % road is intermediate lane, 8 % road is intermediate lane and 4 % road is two lane with paved shoulders.

The existing pavement of the project road is almost flexible.

Pavement Condition Survey

The existing pavement of project road is bituminous surface. In 4 % of length of the project road, earthen shoulders of width vary from 0.40 m to 1.3 m. It was observed from the studies that the road quality is poor in 71% length. Pavement condition of the project road is shown in **Figure 2.3**.



Figure 0.3: Pavement Condition of the Project Road

2.2.5 Existing Cross Drainage Structures

There are 158 nos. of cross drainage structure including major and minor bridges, causeways and pipe culverts ROB Viaduct in which 7 major and 21 minor bridges along the project highway. Details of existing cross drainage structures are given in **Table 2.6**.

Table 0.6: Existing Cross Drainage structures

S.No	Type of Structures	Numbers
1	Major bridge	07 (1 No. included in ROB Viaduct)
2	Minor bridge	21 (2 No. included in ROB Viaduct)
3	Box / slab culvert	115
4	Pipe culvert	13
5	ROB Viaduct	02
TOTAL		158

2.2.6 Railway Level Crossing

There are two railway crossings along the project road at Km 37+420 and at Km 40+810. The railway lines are connecting GARAPUR railway station in the state of Orissa and Araku and Vishakhapatnam in the state of Andhra Pradesh.

2.2.7 Junctions and Intersections

The existing alignment has 1 major junctions (Y-Junction) at Km 38+700 of design chainage and 24 minor junctions at prominent habitations. Details of the junctions are given in **Table 2.7**.

Table 0.7: Junctions and Intersection details

Sr. No	Existing Chainage	Design Chainage	Cross Road	Type of Junction	Type of Road	Direction	Remarks
1	2/630	2+620	VR	T	BT	RHS	To Panasapali (BT)
2	2/920	2+910	VR	T	BT	LHS	To Cheedimetta (BT)
3	3/420	3+400	VR	Y	BT	LHS	To Chintalaveedi (BT)
4	4/000	4+000	VR	Y	BT	RHS	To Sanaya Samma Palem (BT)
5	5/375	5+400	VR	T	BT	LHS	To Malaguda (BT)
6	7/330	7+300	SH	Y	BT	LHS	To Hukumpet (BT)
7	9/230	9+200	SH	Y	BT	LHS	To Hukumpet (BT)
8	9/700	9+680	VR	Y	BT	RHS	To Bakar (BT)
9	10/785	10+750	VR	T	BT	LHS	To Thadapattur (BT)
10	11/630	11+600	VR	Y	WBM	RHS	Village
11	13/020	13+000	VR	T	WBM	RHS	Kontanapalle
12	15/310	15+300	VR	+	BT	LHS	To Pandimetta (LHS)/ Matchyapuram(RHS)

Sr. No	Existing Chainage	Design Chainage	Cross Road	Type of Junction	Type of Road	Direction	Remarks
13	17/660	17+600	VR	T	WBM	LHS	To Village
14	20/210	20+130	VR	T	WBM	RHS	To Ontipakka (BT Road)
15	23/400	23+290	VR	T	WBM	RHS	To Pattam (BT Road)
16	26/540	26+400	VR	Y	WBM	LHS	Billaputtu
17	29/300	28+920	VR	T	BT	RHS	To Sanbapatty (BT Road)
18	31/040	30+700	VR	T	BT	LHS	To Kunsima (BT Road)
19	36/450	35+900	VR	Y	BT	RHS	To Village
20	38/200	37+750	VR	Y	BT	RHS	To Village
21	117/130	39+950	VR	T	BT	LHS	To Korrai (BT Road)
22	116/700	40+400	VR	Y	BT	RHS	To Araku(BT Road)
23	-	43+600	VR	+	WBM	LHS/RHS	To Araku (LHS)/To Pappuduvalasa (RHS)
24	108800	47+800	SH	T	BT	LHS	To Araku

2.2.8 Tree Cutting

The approximate numbers of trees to be affected in the proposed RoW for the proposed project is 1964.

2.2.9 Embankment Details

High embankments are observed along the existing road where valley areas present and near Chaparai stream running parallel to the road. As the terrain along the road is plain and rolling, the existing road is at grade with natural ground at few locations and has high embankments at location approaching major, minor bridges and in valley areas. The average embankment height varies in between 2m to 4m and at level in built-up areas.

2.2.10 Deficient Vertical and Horizontal Geometry and Improvement

The existing alignment predominantly traverses through barren/open land and through patches of dense urban built up sections and also some patches of forest. The alignment comprises of 128 nos. sharp curves and blind spots. The deficient / substandard horizontal curves will be improved by providing the required radius as per the codal provision for the design speed of 80kmph / 100kmph. The curves will be improved for maximum possible radius.

2.2.11 Safety of the Users

With improvement of existing single lane to two lane with paved shoulder standards, safety of the commuters will be increased as this will improve the visibility and additional carriageway space. Road users will also be facilitated with different project amenities, slope protection measures, road markings and sign etc., which will improve the safety of commuters along the project road.

The project road traverses through 6 nos. of major built-up / settlements. The presence of these settlements obstruct, the flow of traffic due to reduction in speed. The traffic flowing through these sections also creates potential hazard to pedestrians. Hence, realignments and bypass are proposed in order to provide a safe and congestion free passage to road users.

2.2.12 Network Connectivity and Alternate Route Study

The project stretch has no alternate connectivity, but the improvement of this road section will provide connectivity to Lambhasinghi known as Kashmir of Andhra Pradesh. The other end of the project road connects to NH 16 and it is also connected with Orissa at Jaypore Junction.

2.3 Design Speed

The design standards for the project road have been set from IRC SP 73-2015 "Manual of Specifications and Standards for Two-Laning of Highways with Paved shoulders".

The project road is proposed for improvement two lanes with paved shoulders with design speed of 80-100 kmph in throughout the stretch.

2.4 Widening Proposal with Typical Cross Sections

In view of traffic requirements, widening scheme with various typical cross sections have been developed to meet the need of the project road. Details of proposed and widening and upgradation scheme with cross sectional elements for particular typical cross sections and location-wise application of TCS are given in **Table 2.8**. Corresponding typical cross section are shown in **Figure 2.4** to **Figure 2.11**.

Table 0-8: Widening Proposal With Typical Cross Sections

S.No	Existing Chainage		Proposed Chainage		Length (m)	TCS Type	Widening Scheme
	From	To	From	To			
1	2/416	3/015	2+400	3+000	600	TCS- 2	Builtup
2	3/015	4/236	3+000	4+220	1220	TCS- 1 A	Rural Ecc/Concentric
3	4/236	4/531	4+220	4+520	300	TCS- 4	Hill Cutting section
4	4/531	7/330	4+520	7+300	2780	TCS- 1 A	Rural Ecc/Concentric
5	7/330	9/226	7+300	9+200	1900	TCS- 1 B	Realignment / Bypass
6	9/226	11/628	9+200	11+600	2400	TCS- 1 A	Rural Ecc/Concentric
7	11/628	11/828	11+600	11+800	200	TCS- 4	Hill Cutting section
8	11/828	12/630	11+800	12+600	800	TCS- 1 A	Rural Ecc/Concentric
9	12/630	13/432	12+600	13+400	800	TCS- 2	Builtup
10	13/432	13/532	13+400	13+550	150	TCS- 4	Hill Cutting section
11	13/532	-	13+550	13+780	230	TCS- 1 B	Realignment / Bypass
12	-	14/230	13+780	14+200	420	TCS- 3 B	Hill Section - Realignment
13	14/230	14/720	14+200	14+700	500	TCS- 1 A	Rural Ecc/Concentric
14	14/720	15/020	14+700	15+000	300	TCS- 6	Toll Plaza
15	15/020	15/420	15+000	15+400	400	TCS- 2	Builtup
16	15/420	15/525	15+400	15+500	100	TCS- 4	Hill Cutting section
17	15/525	16/050	15+500	16+000	500	TCS -4 A	Hill Cutting section - Realignment
18	16/050	16/265	16+000	16+220	220	TCS- 4	Hill Cutting section
19	16/265	16/545	16+220	16+500	280	TCS- 1 A	Rural Ecc/Concentric
20	16/545	18/060	16+500	18+000	1500	TCS- 3 A	Hill Section
21	18/060	19/400	18+000	19+350	1350	TCS- 1 A	Rural Ecc/Concentric
22	19/400	19/700	19+350	19+600	250	TCS- 1 B	Realignment / Bypass
23	19/700	20/290	19+600	20+200	600	TCS- 3	Hill Section

S.No	Existing Chainage		Proposed Chainage		Length (m)	TCS Type	Widening Scheme
	From	To	From	To			
24	20/290	20/920	20+200	20+800	600	TCS- 1 A	Rural Ecc/Concentric
25	20/920	21/300	20+800	21+200	400	TCS- 3 C	Hill Section - Realignment
26	21/300	21/500	21+200	21+400	200	TCS-3 A	Hill Section
27	21/500	22/520	21+400	22+400	1000	TCS- 1 A	Rural Ecc/Concentric
28	22/520	22/850	22+400	22+750	350	TCS- 1 B	Realignment / Bypass
29	22/850	22/880	22+750	23+040	290	TCS- 4	Hill Cutting section
30	22/880	24/020	23+040	23+900	860	TCS- 1 A	Rural Ecc/Concentric
31	24/020	24/220	23+900	24+100	200	TCS- 3 A	Hill Section
32	24/220	25/422	24+100	25+300	1200	TCS- 1 A	Rural Ecc/Concentric
33	25/422	25/850	25+300	25+700	400	TCS- 1 B	Realignment / Bypass
34	25/850	26/870	25+700	26+720	1020	TCS- 1 A	Rural Ecc/Concentric
35	26/870	27/450	26+720	27+300	580	TCS- 3 A	Hill Section
36	27/450	-	27+300	27+480	180	TCS- 3 C	Hill Section - Realignment
37	-	28/120	27+480	27+900	420	TCS- 1 B	Realignment / Bypass
38	28/120	28/420	27+900	28+200	300	TCS- 1 A	Rural Ecc/Concentric
39	28/420	29/200	28+200	28+850	650	TCS- 1 B	Realignment / Bypass
40	29/200	29/420	28+850	29+100	250	TCS- 4 A	Hill Cutting section - Realignment
41	29/420	29/530	29+100	29+200	100	TCS- 4	Hill Cutting section
42	29/530	30/630	29+200	30+300	1100	TCS- 1 A	Rural Ecc/Concentric
43	30/630	31/720	30+300	31+380	1080	TCS- 2	Builtup
44	31/720	32/300	31+380	31+900	520	TCS- 3 A	Hill Section
45	32/300	33/170	31+900	32+700	800	TCS- 1 B	Realignment / Bypass
46	33/170	35/375	32+700	34+950	2250	TCS- 1 A	Rural Ecc/Concentric
47	35/375	35/950	34+950	35+350	400	TCS- 1 B	Realignment / Bypass

S.No	Existing Chainage		Proposed Chainage		Length (m)	TCS Type	Widening Scheme
	From	To	From	To			
48	35/950	38/200	35+350	37+750	2400	TCS- 1 A	Rural Ecc/Concentric
49	38/200	38/300	37+750	37+860	110	TCS- 4	Hill Cutting section
50	38/300	117/610	37+860	39+380	1520	TCS- 1 A	Rural Ecc/Concentric
51	117/610	116/790	39+380	40+250	870	TCS- 2	Builtup
52	116/790	116/790	40+250	40+654	404	TCS- 1 B	Realignment / Bypass
53	116/790	-	40+654	41+598	944	TCS- 5	VIADUCT
54	-	108/400	41+598	48+000	6402	TCS- 1 B	Realignment / Bypass
55	108/400	105/900	48+000	50+600	2600	TCS- 1 A	Rural Ecc/Concentric
56	105/900	105/300	50+600	51+100	500	TCS- 1 B	Realignment / Bypass
57	105/300	105/050	51+100	51+400	300	TCS- 1 A	Rural Ecc/Concentric
58	105/050	104/400	51+400	51+772	372.336	TCS- 1 B	Realignment / Bypass

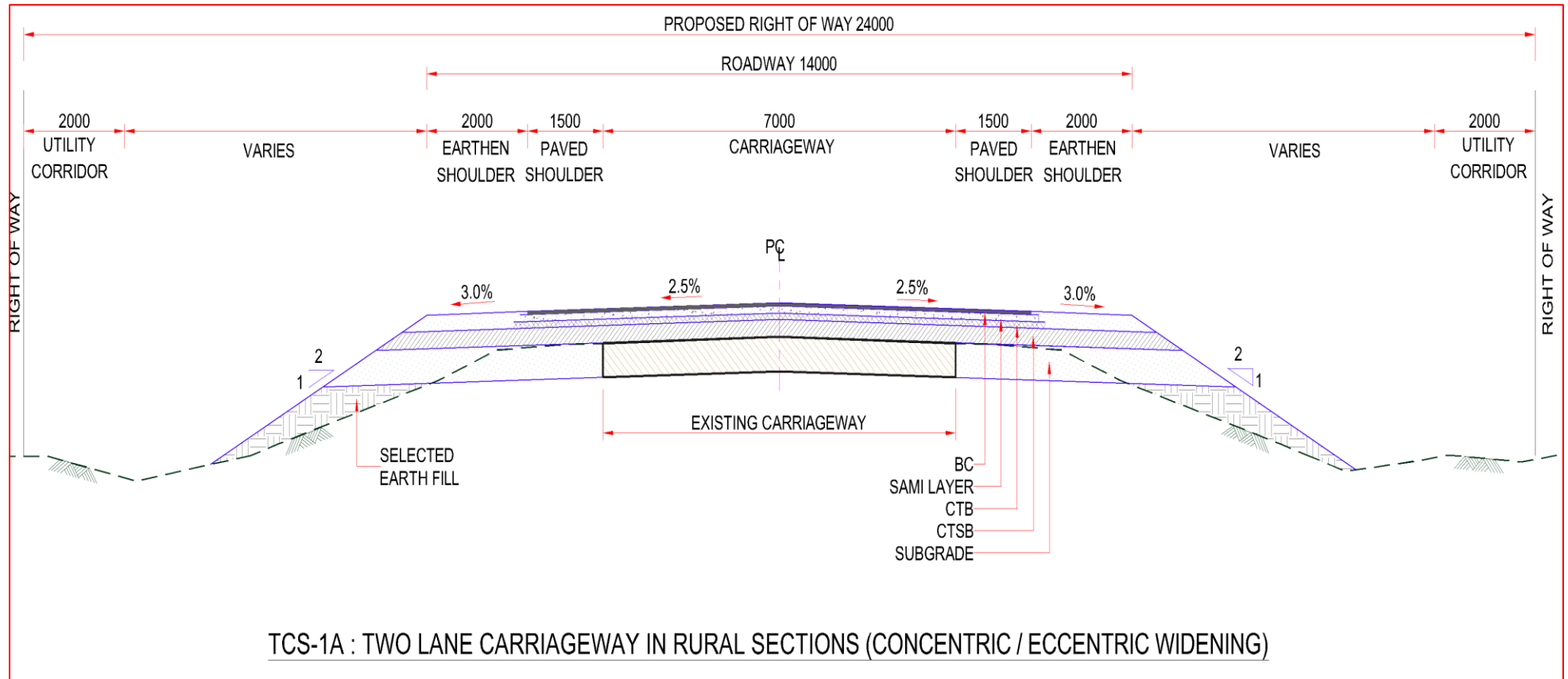


Figure 0.4: Typical Road Cross Section (TCS 1A)

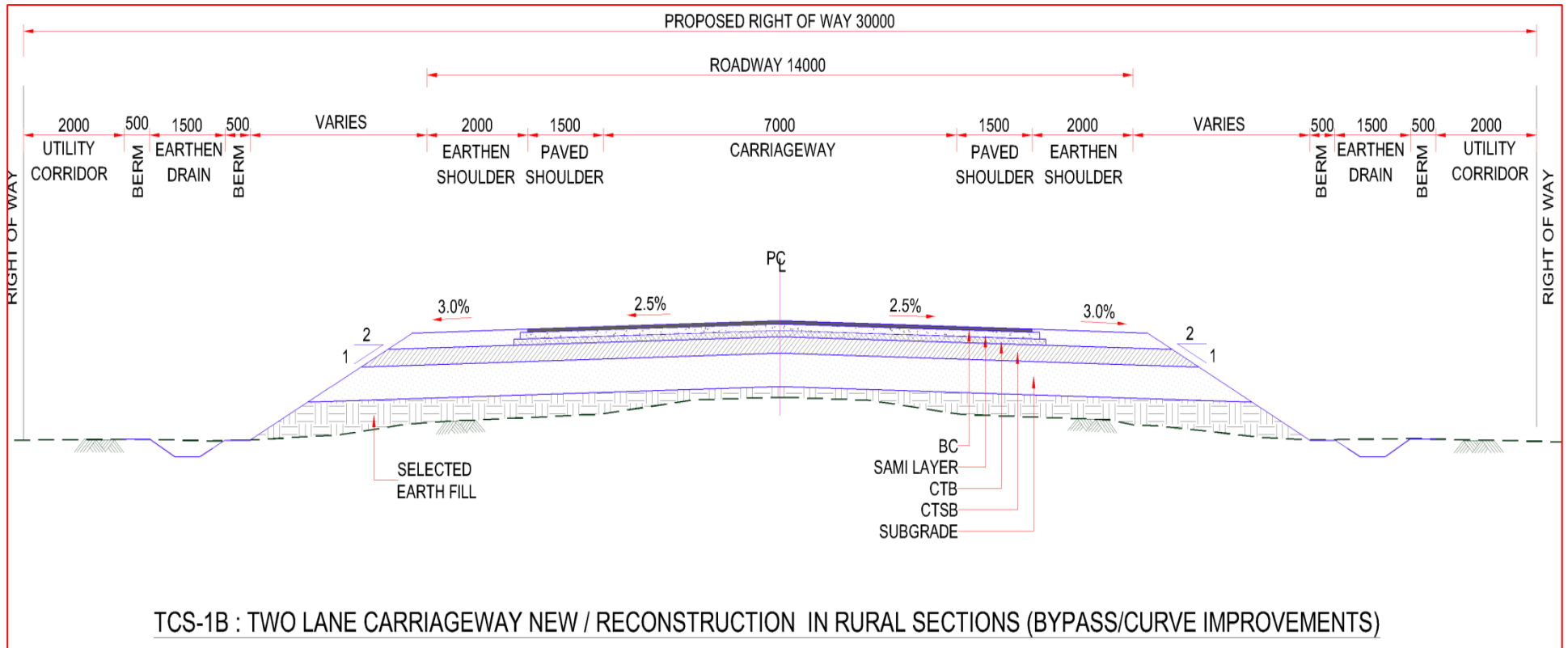


Figure 0.5: Typical Road Cross Section (TCS 1B)

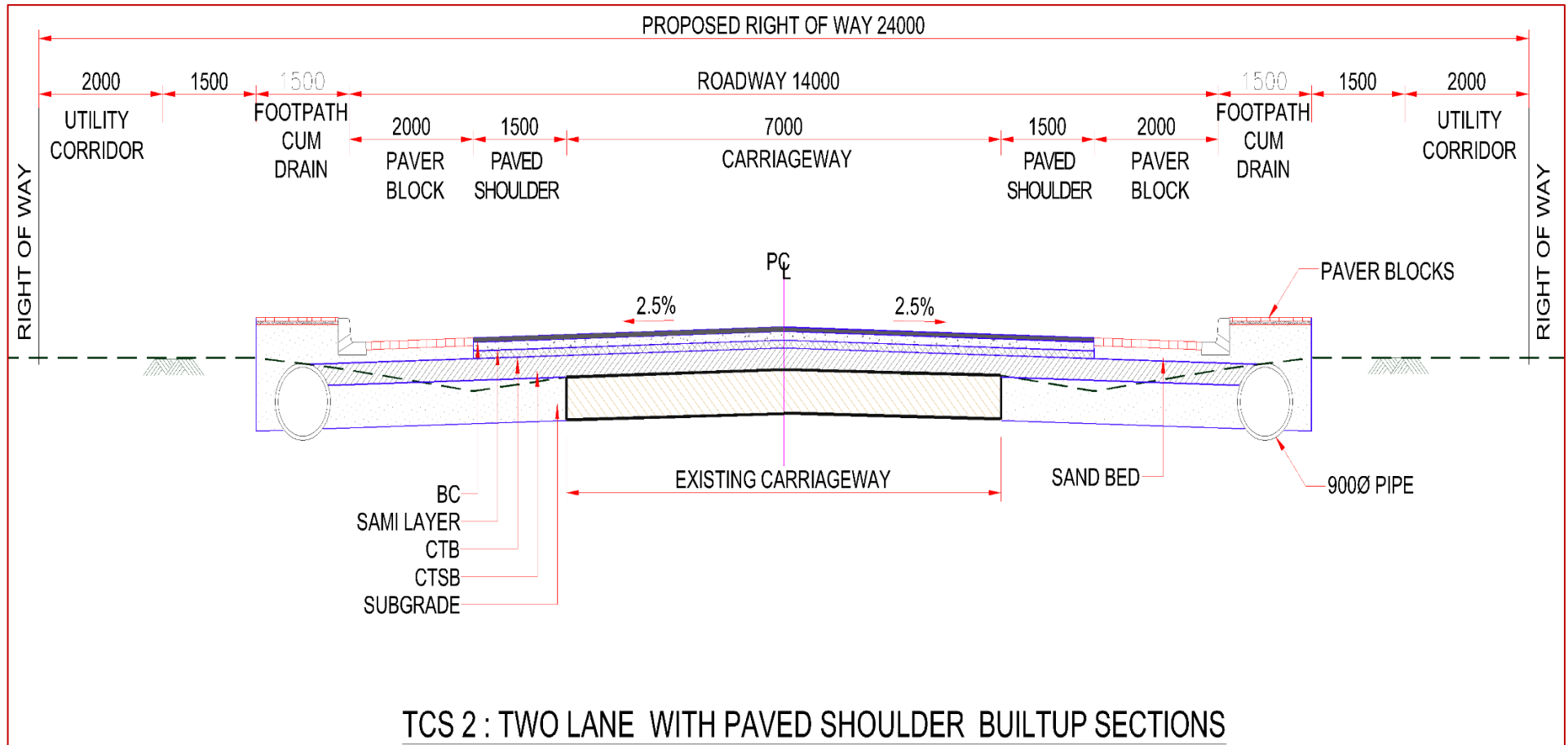


Figure 0.6: Typical Road Cross Section (TCS 2)

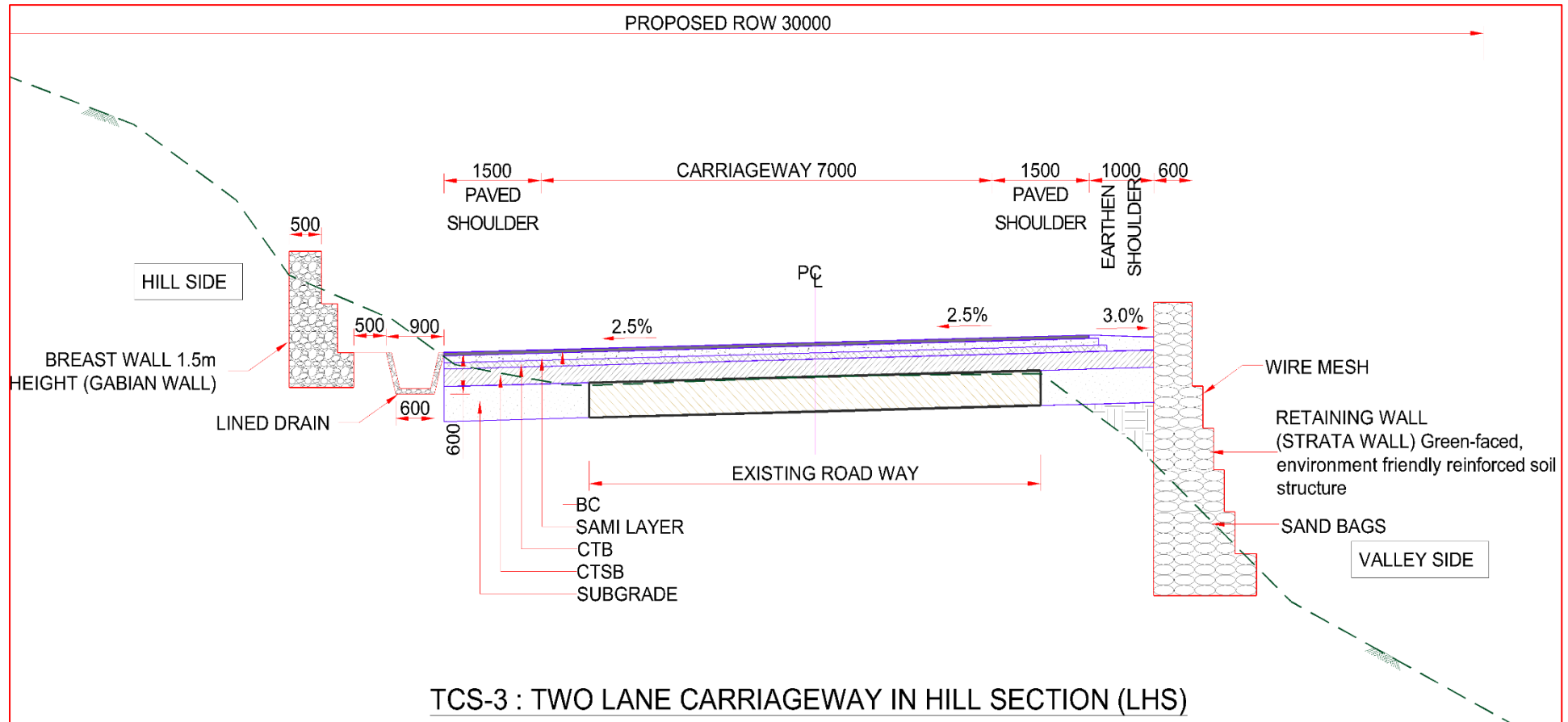


Figure 0.7: Typical Road Cross Section (TCS 3)

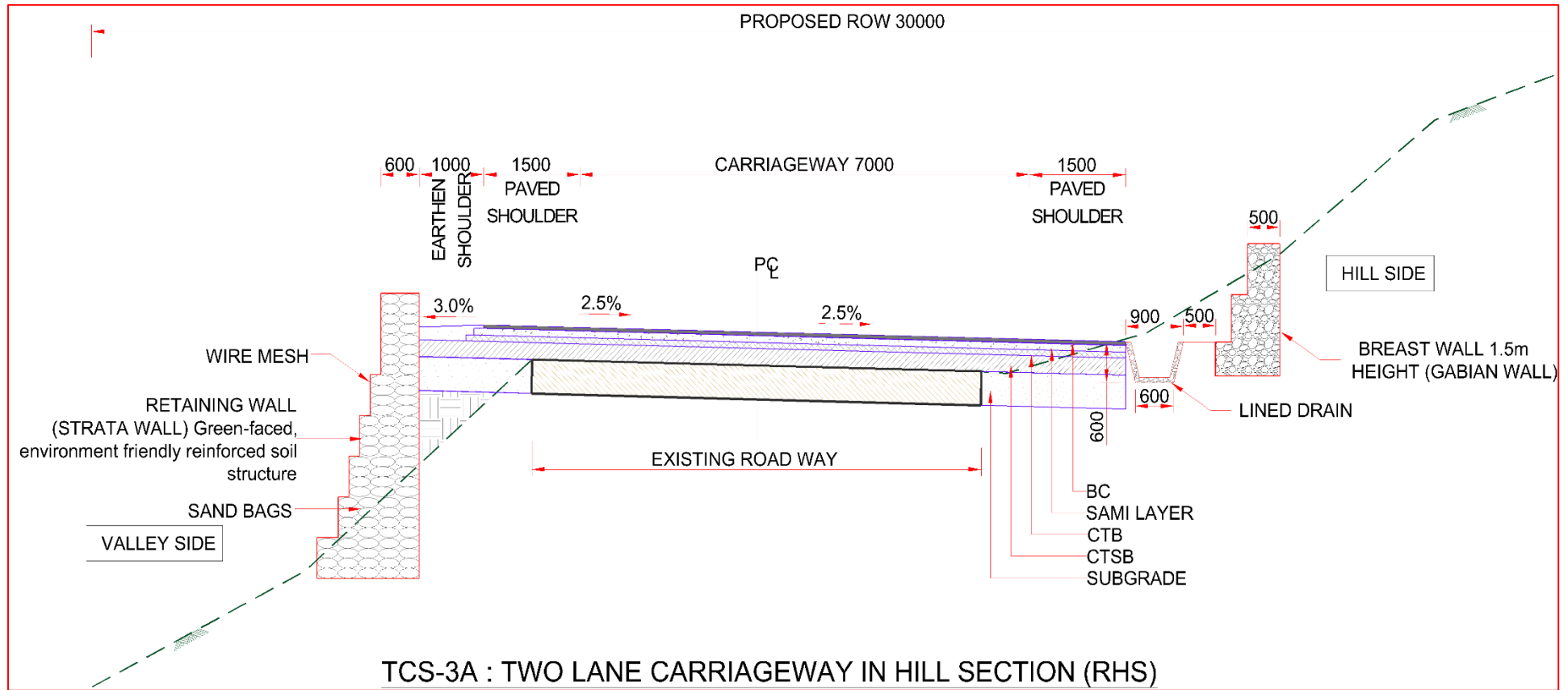


Figure 0.8: Typical Road Cross Section (TCS 3)

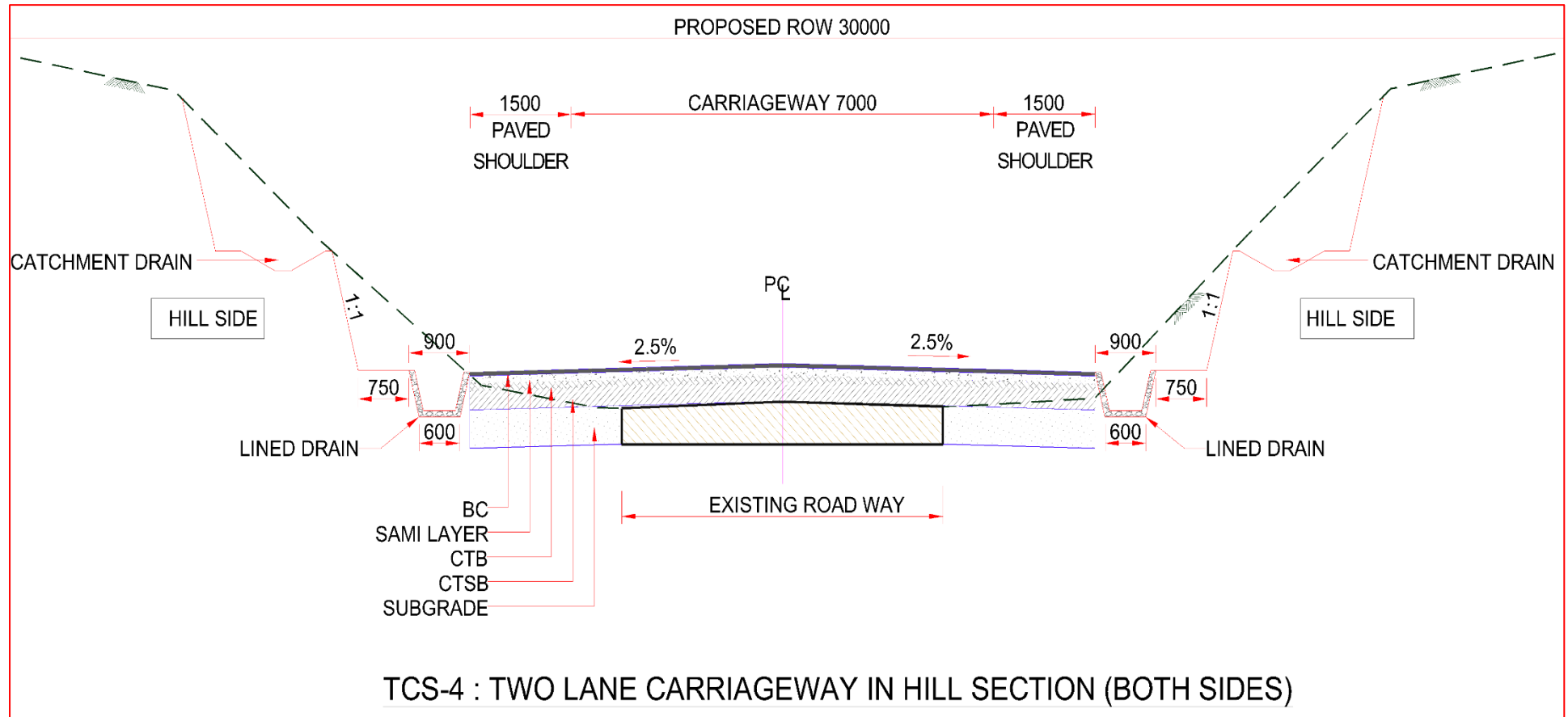


Figure 0.9: Typical Road Cross Section (TCS 4)

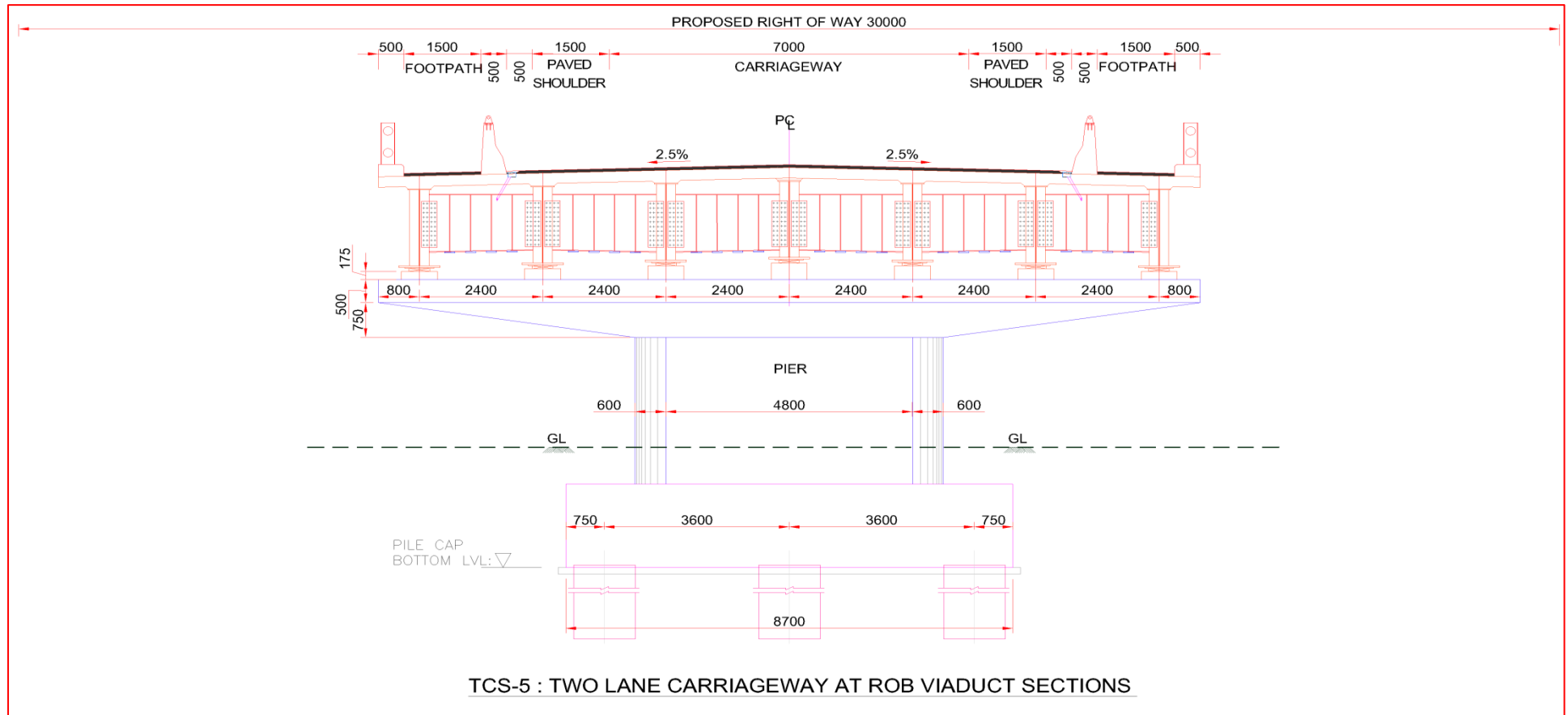
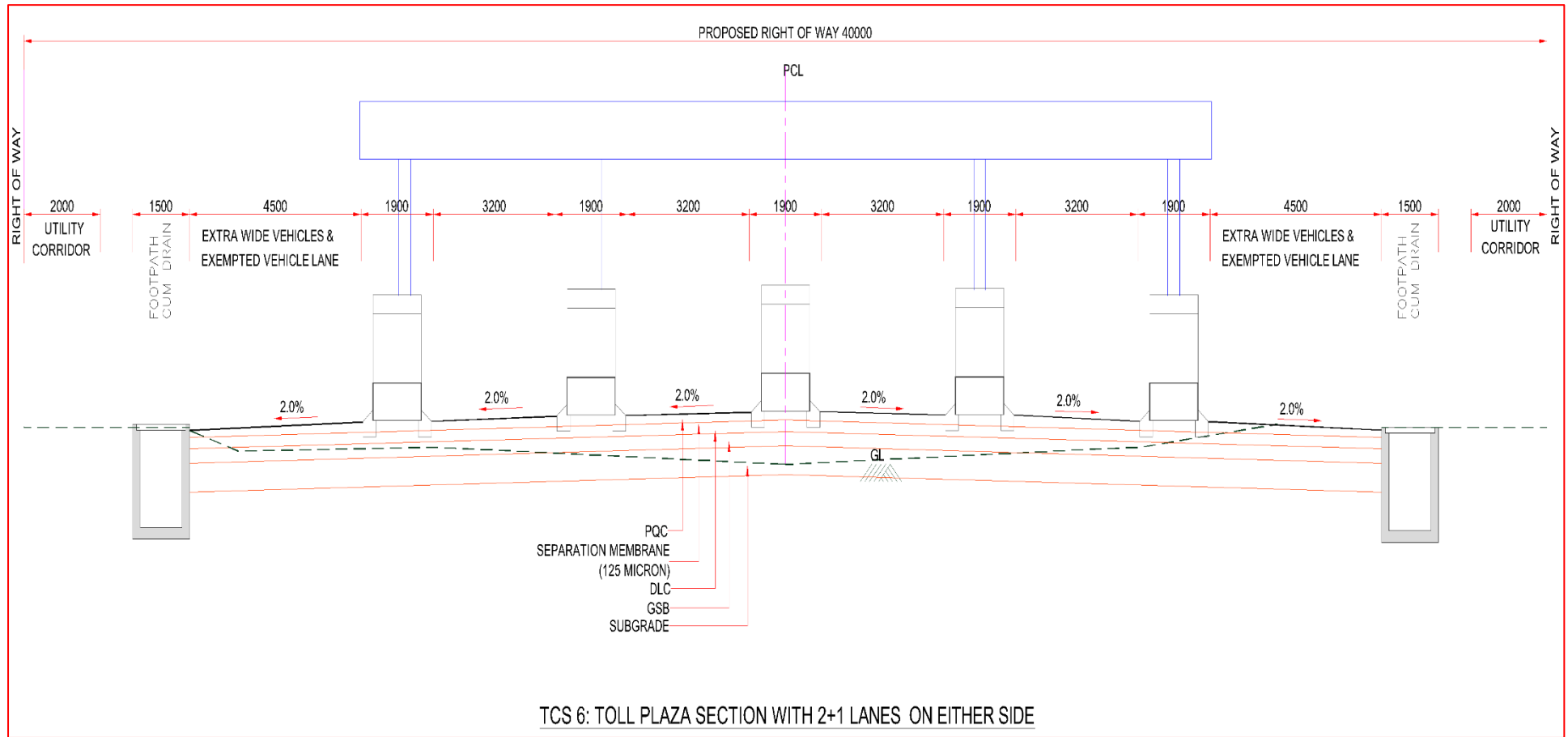


Figure 0.10: Typical Road Cross Section (TCS 5)



2.5 I

Figure 0.11: Typical Road Cross Section (TCS 6)

The pavement conditions have been assessed based on visual observations (formation of cracks, rutting, potholes, ravelling) and pavement investigation. The existing road condition varies from good to very poor, about 63 % road pavement is in poor condition. There are some stretches which are badly damaged because of the poor condition of the sub-grade and other factors. There are also some sections which are overtopped by flood water damaging the pavement. Details of the existing pavement condition survey are given in **Table 2.9**.

The environment concerns associated due to poor pavement are slow movement of vehicles, traffic congestion resulting into generation of high air & noise pollution indirectly affecting the population residing along the road.

Table 0.9: Existing Pavement Condition of the Project Road

S. No.	Percentage of Road.	Pavement Condition
1	62.6	Poor
2	37.4	Good

The pavement condition is poor on majority of road length and is a concern from road user's safety, high vehicle operation and maintenance cost, and increase travel time.

Flexible pavement has been proposed for entire section of the road except at Toll Plaza from chainage 14+700 to 15+100 *i.e.* 400 m rigid pavement is proposed. The flexible pavement design has been done in accordance to IRC 37-2018 & the overlay proposal has been designed according to IRC 81-1997 based on Benkelman beam survey.

2.6 Embankment Design

High embankments are observed along the existing road where hilly, valley areas present and near Chaparai stream running parallel to the road. As the terrain along the road is uneven, the existing road is at grade with natural ground at few locations and has high embankments at location approaching major, minor bridges and hilly, valley areas. The average embankment height varies in between 2m to 4m in rural areas, 5m to 10m in hilly, valley areas and at level in built-up areas. The details of embankment heights for every 100m interval are provided road inventory

Embankment has been designed for ensuring the stability of the roadway. High embankments in all soils has been designed from stability consideration as per IRC-75, IRC SP-58 & MoRTH-Guidelines for Design of High Embankments.

2.7 Bypasses and Realignments

Total two bypasses (Hukumpet Bypass and Araku Bypass) and 12 realignments have been proposed in the project road. Details of bypasses proposed, are given in **Table 2.10**.

Table 0-10: Proposed Bypasses, Realignment and Curve Improvement Locations

S. no	Existing Chainage		Proposed Chainage		Length	Description
	From	To	From	To		
1	7/330	9/226	7+300	9+200	1900	Hukumpet Bypass
2	13/532	14/230	13+550	14+200	650	Tadgiri Realignment/Curve improvements
3	15/520	16/240	15+500	16+000	500	Realignment/Curve improvements
4	19/400	19/700	19+350	19+600	250	Realignment/Curve improvements
5	20/900	21/300	20+800	21+200	400	Realignment/Curve improvements
6	22/520	22/850	22+400	22+750	350	Realignment/Curve improvements
7	25/422	25/850	25+300	25+700	400	Realignment/Curve improvements
8	27/450	28/120	27+300	27+900	600	Realignment/Curve improvements
9	28/420	29/420	28+200	29+100	900	Realignment/Curve improvements
10	32/300	33/170	31+900	32+700	800	Realignment/Curve improvements
11	35/350	35/900	34+950	35+350	400	Realignment/Curve improvements
12	116/720	108/400	40+250	48+000	7750	Araku Bypass
13	105/900	105/300	50+600	51+100	500	Realignment/Curve improvements
14	105/100	104/400	51+400	51+772	300	Realignment/Curve improvements
Total Length					15772	

2.8 Service roads

No service road is proposed in the project road as the traffic volume and the settlement areas are very less.

2.9 Proposed Structures

On the existing Out of 17 nos of minor bridges, 3 nos of bridges are having insufficient linear water way, 2 nos are of substructure in poor condition, 1 no of superstructure in poor condition, 3 nos are made of stone masonry structures, 1 no. is having insufficient HFL, 5 nos are in realignment and remaining 2 nos are in good condition.

The proposed project road will have 5 major bridges, 20 minor bridges, 128 Box culverts. Two new major bridges are proposed on project road, 1 retained and reconstruction of 2 bridges. Out of twenty minor bridges, seven are new constructions and 11 bridges are proposed for reconstructions. One new ROB is proposed at Km 40+986. Total 128 numbers of culverts are proposed including pipe and box culverts. No VUP and pedestrian subways are proposed in proposed two lane with paved shoulders project road. The summary of proposed structures on the project road is presented in **Table 2.11**.

Table 0.2: List of Structures on the Project Road

S. No.	Type of proposed structure	Retained with Repair	Repair & Widening	Reconstruction	New Structures	Total Structures
1	Major Bridge	1	0	2	2	5
2	Minor Bridge	2	0	11	7	20
3	Box Culvert	0	0	79	49	128
4	ROB	0	0	0	1	1
Total		3	0	92	59	154

Source: Design report

2.9.1 Major and Minor Bridge

The existing 2 nos. major bridges have the superstructure as RCC girder type, and RCC wall type abutment and circular pier resting on open foundation. 3 Nos. new bridges are proposed. The details are given in the **Table 2.12**.

Table 0.12: Proposed Major Bridges in the Project Road

S. No.	Existing Chainage (km)	Design Chainage (km)	Existing Structure Details			Proposed Structure Details			Improvement Proposal
			Type	Span / Length	Width (m)	Span (C/C of exp.)	Width (m)	Type	
1	9+650	9+575	RCC Girder	4 x 17	8.5	-	-	-	Retained
2	New	32+033	-	-	-	5 x 25	16	RCC Girder	New construction
3	34+621	34+852	RCC Girder	4 x 17	8.5	5 x 20	16	RCC Girder	Reconstruction
4	New	43+813	-	-	-	10 x 20	16	RCC Girder	New construction
5	105/100	51+116	RCC T Beam & Slab	1	7.5	4 x 20	16	RCC Girder	Reconstruction

Source: Design Report

Minor bridges reconstruction details are given in **Table 2.13**.

Table 0.13: Minor Bridges To Be Repaired and Widened

Sl. No	Existing Chainage (km)	Design Chainage (km)	Existing Structure Details			Proposed Structure Details			Improvement Proposal
			Type	Span / Length	Width	Span (C/C of exp.)	Width (m)	Type	
1	4/942	4+945	MNB R	7.2	7.8	25	16	RCC Girder	Reconstruction
2	6/018	5+960	MNB R	2.6+3.0+2.6	7.5	16	16	RCC Girder	Reconstruction
3	6/193	6+134	MNB R	3.4	7.3	14	16	Solid Slab	Reconstruction
4	7/003	6+943	MNB R	2.8	7.2	12	16	Solid Slab	Reconstruction
5	12/445	12+337	MNB R	16.3	8.5	20	16	RCC Girder	Reconstruction
6	14/150	14+232	MNB R	15	8.5	15	16	RCC Girder	Retained
7	15/843	15+928	MNB R	7.5	8.5	10	16	Solid Slab	Reconstruction
8	17/550	17+666	MNB R	7.2	8.5	20	16	RCC Girder	Reconstruction
9	21/455	21+708	MNB R	-	7.5	18	16	RCC Girder	Reconstruction
10	23/921	24+162	MNB R	1.2	8.5	20	16	RCC Girder	Reconstruction
11	26/074	26+293	MNB R	9.5	7.2	14	16	RCC Girder	Reconstruction
12	26/278	26+512	MNB R	7	7.2	14	16	RCC Girder	Reconstruction
13	37/900	36+661	MNB R	4	8.5	-	-	RCC Girder	Retained

Source: Design report and primary survey

Details of new construction of minor bridges are given in **Table 2.14**.

Table 0-14: Minor Bridges in New-Construction

Sl. No	Existing Chainage (km)	Design Chainage (km)	Existing Structure Details			Proposed Structure Details			Improvement Proposal
			Type	Span / Length	Width	Span (C/C of exp.)	Width (m)	Type	
1	New	8+706	-	-	-	17	16	RCC Girder	New Construction
2	New	8+831	-	-	-	17	16	RCC Girder	New Construction
3	-	13+927	-	-	-	16	16	RCC Girder	New construction
4	-	19+504	MNB R	16.5	9.8	18	16	RCC Girder	New construction
5	New	43+158	-	17	-	15	16	RCC Girder	New Construction
6	New	44+513	-	-	-	15	16	RCC Girder	New Construction
7	New	47+799	-	-	-	10	16	Solid Slab	New Construction

2.9.2 Culverts

There are total 128 culverts in the alignment, which will be widened, retention or reconstructed during up-gradation of the project road. This include construction of 48 new culverts in the project road. Details of culverts in the alignment are given **Table 2.15**.

Table 0-15: Details of Reconstruction and New Construction of Culvert in the Proposed Road

S. No.	Existing Chainage (Km)	Design Chainage (Km)	Existing Structure Details				Improvement Proposals					
			Type	No. of Vents	Clear span (m)	Existing Width (m)	Improvement Proposals	Type	No. of Vents	Clear span (m)	Clear Height (m)	Remarks
1	New	2+484	-	-	-	-	New Construction	Box	1	1.5	1.5	-
2	3/021	3+003	Pipe	1	0.9	7.5	Reconstruction	Box	1	1.5	1.5	-
3	3/228	3+213	Slab	1	3	7.2	Reconstruction	Box	1	3	2	-
4	3/321	3+295	Pipe	1	0.45	7.5	Reconstruction	Box	1	1.5	1.5	-
5	3/532	3+517	Slab	1	1	12	Reconstruction	Box	1	2	2	-
6	3/956	3+941	Slab	1	1.5	12	Reconstruction	Box	1	2	2	-
7	New	4+561	-	-	-	-	New Construction	Box	1	1.5	1.5	-
8	4/859	4+842	Pipe	1	1	-	Reconstruction	Box	1	1.5	1.5	-
9	New	5+661	-	-	-	-	New Construction	Box	1	1.5	1.5	-
10	New	5+860	-	-	-	-	New Construction	Box	1	2	2	-
11	6/090	6+056	Pipe	1	1	7.5	Reconstruction	Box	1	1.5	1.5	-
12	6/287	6+257	Slab	1	1	12	Reconstruction	Box	1	1.5	1.5	-
13	6/483	6+453	Slab	1	1	12	Reconstruction	Box	1	1.5	1.5	-
14	6/575	6+546	Slab	1	0.8	12	Reconstruction	Box	1	1.5	1.5	-
15	6/770	6+740	Slab	1	2.5	12	Reconstruction	Box	1	2.5	2	-
16	7/091	7+061	Slab	1	1	12	Reconstruction	Box	1	1.5	1.5	-

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S. No.	Existing Chainage (Km)	Design Chainage (Km)	Existing Structure Details				Improvement Proposals					
			Type	No. of Vents	Clear span (m)	Existing Width (m)	Improvement Proposals	Type	No. of Vents	Clear span (m)	Clear Height (m)	Remarks
17	7/405	7+381	Slab	1	2.5	12	Reconstruction	Box	1	2.5	2	-
18	7/879	7+874	Slab	1	1.8	12	Reconstruction	Box	1	2	2	-
19	New	8+082	-	-	-	-	New Construction	Box	1	1.5	1.5	-
20	New	8+660	-	-	-	-	New Construction	Box	1	2	3	-
21	New	9+206	-	-	-	-	New Construction	Box	1	1.5	1.5	-
22	New	10+373	-	-	-	-	New Construction	Box	1	1.5	1.5	-
23	10/594	10+566	Slab	1	1	7.5	Reconstruction	Box	1	2	2	-
24	10/682	10+655	Slab	1	2.8	9.8	Reconstruction	Box	1	3	3	-
25	10/748	10+722	Slab	1	0.8	7.5	Reconstruction	Box	1	1.5	1.5	-
26	10/970	10+942	Slab	1	1.8	9.8	Reconstruction	Box	1	2	2	-
27	11/260	11+231	Slab	1	1	7.3	Reconstruction	Box	1	1.5	1.5	-
28	11/935	11+907	Slab	1	1	10.1	Reconstruction	Box	1	1.5	1.5	-
29	12/120	12+088	Slab	1	1	7.5	Reconstruction	Box	1	1.5	1.5	-
30	12/587	12+556	Slab	1	0.9	9.8	Reconstruction	Box	1	1.5	1.5	-
31	New	14+086	-	-	-	-	New Construction	Box	1	3	1.5	-
32	New	14+598	-	-	-	-	New Construction	Box	1	2	2	-
33	New	14+933	-	-	-	-	New Construction	Box	1	1.5	1.5	-
34	New	15+222	-	-	-	-	New Construction	Box	1	1.5	1.5	-

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S. No.	Existing Chainage (Km)	Design Chainage (Km)	Existing Structure Details				Improvement Proposals					
			Type	No. of Vents	Clear span (m)	Existing Width (m)	Improvement Proposals	Type	No. of Vents	Clear span (m)	Clear Height (m)	Remarks
35	15/623	15+599	slab	1	1	9.8	Reconstruction	Box	1	2	2	-
36	16/389	16+345	Slab	1	3	9.8	Reconstruction	Box	1	3	3	-
37	16/750	16+707	Slab	1	1	9.8	Reconstruction	Box	1	2	2	-
38	New	16+898	-	-	-	-	New Construction	Box	1	2	2	-
39	17/579	17+524	Slab	1	3	9.9	Reconstruction	Box	1	3	4	-
40	17/891	17+837	Slab	1	1	9.8	Reconstruction	Box	1	2	2	-
41	New	18+283	-	-	-	-	New Construction	Box	1	1.5	1.5	-
42	18/711	18+654	Slab	1	1.75	9.8	Reconstruction	Box	1	2	2	-
43	19/096	19+040	Slab	1	4	9.9	Reconstruction	Box	1	4	3	-
44	19/215	19+159	Slab	1	1	9.9	Reconstruction	Box	1	2	2	-
45	19/365	19+300	Slab	1	1	9.8	Reconstruction	Box	1	2	2	-
46	New	20+277	-	-	-	-	New Construction	Box	1	2	2	-
47	20/507	20+410	Slab	1	3	9.8	Reconstruction	Box	1	3	3	-
48	New	20+938	-	-	-	-	New Construction	Box	1	2	2	-
49	21/217	21+113	Slab	1	2	7.5	Reconstruction	Box	1	2	3	-
50	New	21+467	-	-	-	-	New Construction	Box	1	2	2	-
51	New	22+095	-	-	-	-	New Construction	Box	1	2	2	-
52	22/578	22+451	Slab	1	2.3	7.5	Reconstruction	Box	1	2.5	2	-

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S. No.	Existing Chainage (Km)	Design Chainage (Km)	Existing Structure Details				Improvement Proposals					
			Type	No. of Vents	Clear span (m)	Existing Width (m)	Improvement Proposals	Type	No. of Vents	Clear span (m)	Clear Height (m)	Remarks
53	New	22+589	-	-	-	-	New Construction	Box	1	2	2	-
54	New	23+217	-	-	-	-	New Construction	Box	1	1.5	1.5	-
55	23/561	23+440	Slab	1	2	10	Reconstruction	Box	1	2	2	-
56	23/868	23+746	Slab	1	1.8	7.5	Reconstruction	Box	1	2	2	-
57	New	24+957	-	-	-	-	New Construction	Box	1	1.5	1.5	-
58	25/338	25+217	Slab	1	1.8	7.2	Reconstruction	Box	1	2	2	-
59	25/770	25+621	Slab	1	3.6	10	Reconstruction	Box	1	4	4	-
60	25/922	25+775	Slab	1	2	7.4	Reconstruction	Box	1	2	2	-
61	26/969	26+819	Slab	1	2	--	Reconstruction	Box	1	2	2	-
62	27/100	26+950	Slab	1	1.8	7.4	Reconstruction	Box	1	2	2	-
63	27/166	27+016	Slab	1	2	7.5	Reconstruction	Box	1	2	2	-
64	New	27+517	-	-	-	-	New Construction	Box	1	3	3	-
65	New	27+805	-	-	-	-	New Construction	Box	1	1.5	1.5	-
66	28/380	28+164	Slab	1	2	7.2	Reconstruction	Box	1	2	2	-
67	New	28+639	-	-	-	-	New Construction	Box	1	1.5	1.5	-
68	29/093	28+783	Slab	1	1	7.4	Reconstruction	Box	1	2	2	-
69	New	29+387	-	-	-	-	New Construction	Box	1	1.5	1.5	-
70	New	29+567	-	-	-	-	New Construction	Box	1	3	1.5	-

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S. No.	Existing Chainage (Km)	Design Chainage (Km)	Existing Structure Details				Improvement Proposals					
			Type	No. of Vents	Clear span (m)	Existing Width (m)	Improvement Proposals	Type	No. of Vents	Clear span (m)	Clear Height (m)	Remarks
71	30/171	29+837	Slab	1	4	10	Reconstruction	Box	1	4	3	-
72	30/638	30+303	Slab	1	1.8	7.4	Reconstruction	Box	1	2	2	-
73	31/252	30+916	Slab	1	2.5	7.4	Reconstruction	Box	1	3	4	-
74	31/575	31+236	Slab	1	1.8	7.4	Reconstruction	Box	1	2	3	-
75	31/705	31+365	Slab	1	1.8	10	Reconstruction	Box	1	2.5	2	-
76	31/784	31+441	Slab	1	1.8	8.4	Reconstruction	Box	1	2	2	-
77	32/077	31+734	Slab	1	1.8	8.4	Reconstruction	Box	1	2.5	2	-
78	New	32+521	-	-	-	-	New Construction	Box	1	2	3	-
79	33/445	32+971	Arch	1	4.7	10	Reconstruction	Box	1	5	3	-
80	33/987	33+517	Slab	1	2.5	7.5	Reconstruction	Box	1	2.5	2	-
81	34/409	33+936	Slab	1	0.9	7.4	Reconstruction	Box	1	2	2	-
82	34/777	34+300	Slab	1	1.8	7.4	Reconstruction	Box	1	2	2	-
83	34/917	34+444	Pipe	1	0.9	10.1	Reconstruction	Box	1	1.5	1.5	-
84	35/232	34+758	Pipe	1	0.9	12.1	Reconstruction	Box	1	1.5	1.5	-
85	35/620	35+115	Slab	1	1.5	7.5	Reconstruction	Box	1	2	2	-
86	35/891	35+341	Slab	1	2.2	7.5	Reconstruction	Box	1	2.5	2	-
87	New	35+634	-	-	-	-	New Construction	Box	1	1.5	1.5	-
88	36/550	35+999	Slab	1	1.8	7.4	Reconstruction	Box	1	2	2	-

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S. No.	Existing Chainage (Km)	Design Chainage (Km)	Existing Structure Details				Improvement Proposals					
			Type	No. of Vents	Clear span (m)	Existing Width (m)	Improvement Proposals	Type	No. of Vents	Clear span (m)	Clear Height (m)	Remarks
89	37/626	37+067	Pipe	1	1.2	7.5	Reconstruction	Box	1	1.5	1.5	-
90	38/047	37+481	Slab	1	2	7.5	Reconstruction	Box	1	2	2	-
91	38/392	37+828	Slab	1	1.8	7.5	Reconstruction	Box	1	6	3	-
92	38/825	38+258	Slab	1	1.8	7.5	Reconstruction	Box	1	2	2	-
93	39/015	38+435	Slab	1	1.8	7.5	Reconstruction	Box	1	2	2	-
94	118/116	38+858	Pipe	1	1	11.9	Reconstruction	Box	1	1.5	1.5	-
95	New	39+020	-	-	-	-	New Construction	Box	1	1.5	1.5	-
96	117/236	39+725	Pipe	1	0.9	12.1	Reconstruction	Box	1	2	2	-
97	117/096	39+870	Pipe	1	0.9	12.1	Reconstruction	Box	1	2.5	2	-
98	116/876	40+065	Pipe	1	0.9	12.1	Reconstruction	Box	1	1.5	1.5	-
99	New	40+289	-	-	-	-	New Construction	Box	1	1.5	1.5	-
100	New	40+434	-	-	-	-	New Construction	Box	1	1.5	1.5	-
101	New	41+980	-	-	-	-	New Construction	Box	1	1.5	1.5	-
102	New	42+751	-	-	-	-	New Construction	Box	1	1.5	1.5	-
103	New	43+518	-	-	-	-	New Construction	Box	1	1.5	1.5	-
104	New	44+760	-	-	-	-	New Construction	Box	1	1.5	1.5	-
105	New	44+942	-	-	-	-	New Construction	Box	1	1.5	1.5	-
106	New	45+211	-	-	-	-	New Construction	Box	1	2	3	-

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S. No.	Existing Chainage (Km)	Design Chainage (Km)	Existing Structure Details				Improvement Proposals					
			Type	No. of Vents	Clear span (m)	Existing Width (m)	Improvement Proposals	Type	No. of Vents	Clear span (m)	Clear Height (m)	Remarks
107	New	45+591	-	-	-	-	New Construction	Box	1	1.5	1.5	-
108	New	45+981	-	-	-	-	New Construction	Box	1	1.5	1.5	-
109	New	46+300	-	-	-	-	New Construction	Box	1	1.5	1.5	-
110	New	46+447	-	-	-	-	New Construction	Box	1	1.5	1.5	-
111	New	46+636	-	-	-	-	New Construction	Box	1	1.5	1.5	-
112	New	46+865	-	-	-	-	New Construction	Box	1	1.5	1.5	-
113	New	47+064	-	-	-	-	New Construction	Box	1	1.5	1.5	-
114	New	47+147	-	-	-	-	New Construction	Box	1	1.5	1.5	-
115	New	47+447	-	-	-	-	New Construction	Box	1	1.5	1.5	-
116	108/256	48+245	Pipe	1	1	11	Reconstruction	Box	1	1.5	1.5	-
117	108/052	48+449	Pipe	1	1	9.3	Reconstruction	Box	1	1.5	1.5	-
118	107/710	48+792	Pipe	1	1	11	Reconstruction	Box	1	1.5	1.5	-
119	107/560	48+934	Pipe	1	1	11	Reconstruction	Box	1	1.5	1.5	-
120	107/377	49+119	Slab	4	0.5	7.5	Reconstruction	Box	1	3	3	-
121	New	49+360	-	-	-	-	New Construction	Box	1	2	2	-
122	106/600	49+889	Pipe	1	1	11	Reconstruction	Box	1	1.5	1.5	-
123	106/477	50+017	Pipe	1	1	11	Reconstruction	Box	1	1.5	1.5	-
124	106/329	50+159	Pipe	1	1	10.7	Reconstruction	Box	1	1.5	1.5	-

S. No.	Existing Chainage (Km)	Design Chainage (Km)	Existing Structure Details				Improvement Proposals					
			Type	No. of Vents	Clear span (m)	Existing Width (m)	Improvement Proposals	Type	No. of Vents	Clear span (m)	Clear Height (m)	Remarks
125	106/062	50+420	Pipe	1	1	11	Reconstruction	Box	1	1.5	1.5	-
126	105/820	50+656	Pipe	1	1	11	Reconstruction	Box	1	1.5	1.5	-
127	New	50+847	-	-	-	-	New Construction	Box	1	1.5	1.5	-
128	New	51+297	-	-	-	-	New Construction	Box	1	1.5	1.5	

2.9.3 Vehicular Under Pass (VUP)

Vehicular Under Passes is not provided for the proposed road.

2.9.4 Rail Over Bridge

During up-gradation of the project road, one ROB will be constructed at the following locations as per details given **Table 2.16**.

Table 2.16: Summary of Improvement Proposals of ROB Viaduct

S. No	Existing Chainage	Design Chainage	Span Arrangement (m)	Minimum Vertical Clearance (m)	Total width* (m)
1	-	40+986	4x25+(1x25+3x37.2+1x25)+27x25	6.6	16

Source: Design Report

2.9.5 Major and Minor Junction Improvement

On the basis of intersection traffic, neighboring landuse, physical constraints, Appropriate control has been proposed for major intersections along the project road. The improvements, in form of grade separation, signalisation and priority control are analysed based on the Indian Road Congress guidelines.

The type of intersection to be adopted is decided on the basis of parameters like number of intersecting legs, traffic volume/speed, available right of way, type of traffic control (signalized/non-signalized) etc. Necessary traffic surveys were carried out as per IRC: SP 19.

One major Junction has been identified on the proposed road. Detail of major junctions improvement in the project road is presented in **Table 2.17**.

Table 2.17: Major Junction on the Project Road

S.No	Existing Chainage	Design Chainage	Cross Road	Type of Junction	Type of Road	Direction	Remarks
1	39/160	38+600	SH	Y	BT	LHS	To Jaipur

There are 20 minor junctions proposed in the alignment which will be improved as per IRC guidelines as per details given **Table 2.18**.

Table 2.18: Minor Junctions Improvement Proposal

S. No	Existing Chainage	Design Chainage	Cross Road	Type of Junction	Direction	Remarks
1	2/630	2+620	VR	T	RHS	To Panasapali (BT)
2	2/920	2+910	VR	T	LHS	To Cheedimetta (BT)
3	4/000	4+000	VR	Y	RHS	To Sanaya Samma Palem (BT)
4	5/375	5+350	VR	T	LHS	To Malaguda (BT)
5	7/330	7+440	SH	Y	LHS	To Hukumpet (BT)
6	9/230	9+055	SH	Y	LHS	To Hukumpet (BT)
7	9/700	9+660	VR	Y	RHS	To Bakar (BT)
8	10/785	10+750	VR	T	LHS	To Thadapattur (BT)
9	13/020	13+000	VR	T	RHS	Kontanapalle
10	15/310	15+300	VR	+	LHS	To Pandimetta (LHS)/Matchyapuram(RHS)
11	17/660	17+625	VR	T	LHS	To Village
12	20/210	20+130	VR	T	RHS	To Ontipakka (BT Road)
13	23/400	23+285	VR	T	RHS	To Pattam (BT Road)
14	26/540	26+400	VR	Y	LHS	Billaputtu
15	29/300	28+987	VR	T	RHS	To Sanbapatty (BT Road)
16	31/040	30+700	VR	T	LHS	To Kunsima (BT Road)
17	117/130	39+830	VR	T	LHS	To Korrai (BT Road)
18	116/700	40+300	VR	Y	RHS	To Araku(BT Road)
19	-	43+400	VR	+	LHS/RHS	To Araku (LHS)/To Pappuduvalasa (RHS)
20	108800	47+680	SH	T	LHS	To Araku

2.9.6 Toll Plazas

There is one toll plaza proposed in the project road as per details given below in the **Table 2.19**.

Table 0-3: Proposed Toll Plaza

S.No	Proposed Chainage		Length (m)	Remarks
	From	To		

1	14+700	15+100	300	Toll Plaza @ 14+850
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Source: Design report

2.10 Other Structures and Improvements

2.10.1 Bus Stops and Truck lay-bys

Bus shelters are proposed at the locations given in **Table 2.20**.

Table 0-20: Locations of Proposed Bus Bays and Bus Shelters

S.No	Existing Chainage	Design Chainage	Side	Side	Remarks
1	2/920	2+900	LHS	-	
2	3/450	3+430	LHS	-	
3	5/400	5+300	LHS	-	Burmanguda
4	7/180	7+160	-	RHS	
5	-	8+410	LHS	-	Hukumpet
6	11/200	11+280	-	RHS	D. Chintalaveedi
7	13/000	15+250	LHS	-	
8	15/300	15+335	-	RHS	
9	20/210	20+085	-	RHS	
10	24/800	24+725	LHS	RHS	Kusumavalasa
11	31/050	30+745	LHS	RHS	
12	31/700	31+315	LHS	RHS	Chaparai
13	39/160	38+615	LHS	RHS	Jaipurjunction
14	117/100	39+785	LHS	RHS	Araku Village
15	-	43+690	LHS	RHS	Araku Vally
16	106/900	49+600	LHS	RHS	Village
17	104/550	51+677	-	RHS	Bhalluguda

Truck lay bye has been proposed to cater trucks traversing on project road. The location detail of truck lay bye is given in **Table 2.21**.

Table 0-21: Location of Proposed Truck Lay Bay

S. No.	Design Chainage	Side
1	Km 42+200	LHS

2.10.2 Drainage

The IRC: SP 42 have been followed for design of highway drainage. The planning of highway and drainage is intricately linked with the terrain, alignment of the highway and the proposed cross drainage works. The planning and designing of adequate drainage system is a primary requirement for maintaining a structural soundness and functional efficiency of a road. Pavement structure including sub-grade must be

protected from any ingress of water; otherwise over a period of time it may weaken the sub-grade by saturating it and cause distress in the pavement structure. Hence, disposal of water from the pavement and sub-grade is a basic consideration in road design. Over and above quick drainage takes away the water from pavement surface and reduces chances of skidding of vehicles. In order to guard the pavement from the poorly drained conditions, planning, designing, construction and maintenance of longitudinal drains on either side of the roads is very much essential. The surface water from the pavement and shoulders will be made to flow in to the drains by providing suitable cross slopes / camber.

Earthen drains will be provided through-out the project road to ensure efficient drainage from carriageway to drain. All drains will be connected to cross drainage structure. Median drains will be provided with rain water harvesting structure.

a) Surface Drains

Surface drainage is proposed for the road stretch in the built-up sections to carry the surface water in to the percolation pits / rainwater harvesting pits will be provided. The details of the surface drains are shown in **Table 2.22**.

Table 0.22: Location of Lined Drainage

S.No	Chainage (km)		Length (km)	Type of Drain	
	From	To		Left Side	Right Side
1	2+400	3+000	600	Lined Drain	Lined Drain
2	4+220	4+520	300	Lined Drain(CRS)	Lined Drain(CRS)
3	11+600	11+800	200	Lined Drain(CRS)	Lined Drain(CRS)
4	12+600	13+400	800	Lined Drain	Lined Drain
5	13+400	13+550	150	Lined Drain(CRS)	Lined Drain(CRS)
6	13+780	14+200	420	Lined Drain(CRS)	-
7	14+700	15+400	700	Lined Drain	Lined Drain
8	15+400	16+220	820	Lined Drain(CRS)	Lined Drain(CRS)
9	16+500	18+000	1500	-	Lined Drain(CRS)
10	19+580	20+200	620	Lined Drain(CRS)	-
11	20+820	21+400	580	-	Lined Drain(CRS)
12	22+800	23+040	240	Lined Drain(CRS)	Lined Drain(CRS)
13	23+900	24+100	200	-	Lined Drain(CRS)
14	26+720	27+480	760	-	Lined Drain(CRS)
15	28+850	29+200	350	Lined Drain(CRS)	Lined Drain(CRS)
16	30+300	31+380	1080	Lined Drain	Lined Drain
17	31+380	31+920	540	-	Lined Drain(CRS)
18	34+900	35+400	500	Lined Drain	Lined Drain
19	37+750	37+860	110	Lined Drain(CRS)	Lined Drain(CRS)
20	39+500	40+350	850	Lined Drain	Lined Drain

Proper drainage arrangement earthen drain length of 76288m, V drain 9344m length at hill locations and RCC drain length of 9044m (both sides) at built up locations are proposed.

2.10.3 Rain Water Harvesting Units

In the project road, 200 nos. of rain water harvesting units have been proposed.

2.10.4 Wire Roped Crash Barriers

At high embankment locations Wire roped crash barriers are proposed with a length of 39738 m.

2.10.5 Energy dissipation units

1928 nos. of Energy dissipation units have been proposed at high embankment locations

2.11 Road Safety

2.11.1 Road Accidents

Based on the analysis of the accident data, along the project road is as given below:

- One of the biggest concerns regarding accident data base is that most road accidents are not reported to the Police. Police accident data needs to be treated with caution because of doubts about its reliability – this is a problem everywhere not just in India. Another major difficulty with Police accident data is that the location of the accident is not always described precisely.
- As the accident data is maintained by Police stations and is only source for any engineering investigations. Accident data was collected for all roads from various police stations/SP offices and the road wise analysis is presented in the succeeding section.
- In order to identify the accident spots, accident records were collected from various police stations with who lays the jurisdiction of project corridor.

Paderu Araku Road:-

- Data for three consecutive years (2014-2016) was collected. Accident-prone area/hazardous locations are identified based on the study of indicator termed as Accident Severity Index (ASI). The location is termed as accident prone where the ASI for a particular stretch exceeds the threshold value of ASI.

- The ASI for various stretches is calculated by assigning severity weightage of 6 to fatal, 4 to non-fatal accidents. Threshold values of ASI for the whole stretch are taken as " $x+1.5\delta$ ", where 'x' is the mean of ASI for the whole section and 'δ' is the standard deviation from the mean value.
- Based on analysis of accidents for the past 3 years, it can be seen that ASI value of all the stations are below the threshold value.
- The year wise Accident Severity Index for various sections falling within the jurisdiction of Paderu and Dumbriguda police stations are presented in the Table 0..

Table 0.23: Accident Severity Indices

Police Station	Year	Nature of Accidents		ASI
		Fatal	Non-Fatal	
Paderu	2014	2	2	20
	2015	1	2	14
	2016	1	1	10
Dumbri guda	2014	2	2	20
	2015	2	6	36
	2016	5	4	46

2.11.2 Road User Safety Solutions

a) Highway Design: Geometry of the road have been designed as per the applicable Design speed and relevant codes and standards.

Adequate sight distances will be provided in order to avoid blind spots both horizontally and vertically.

46 no locations sharp curves (radius < 90m) are observed. Further, at 116 no. locations vertical gradient is varying from 3.3%-5% in 11.017km length and at 19 no. locations vertical gradient is more than 5% in 1146 m length. Due to the aforesaid factors these locations have become accident prone. The deficient curves (horizontal and vertical) along the existing geometry will be improved. Super elevation as per the curve radius will be provided in order to avoid overturning of vehicles due to speed.

b) Road Signs: As per the applicability and requirement, road signs will be placed all along the road in order to guide the road user to traverse safely. A combination of road signs like Mandatory – Regulatory signs, Cautionary-Warning signs and Informatory signs will be installed. Variable Message signs will also be placed at identified locations in order to inform road user about various details like climatic conditions ahead, diversions, accident zones, speed reduction zones etc.

c) Mast Lights and Traffic Lights / Signals: Traffic signals will be generally installed at intersections to control the movement of vehicles. All traffic must move in conformity with the traffic lights or signals. Traffic Signals, Pedestrian Signals and Lane Marking signals,

2 High mast lights at toll plaza locations, 612 nos of single arm lights are proposed at built up and Junctions locations.

d) Pavement Markings: Pavement markings will be provided to delineate the centre of road, identify travel lane, define road edge. Pavement markings also provide information about special lane use. Markings can also be in the form of patterns, arrows, or other devices set into or attached to the carriageway or kerbs or to objects within or adjacent to the carriageway, for control, warning, guidance or information of road users.

2.11.3 Pedestrian Safety

1) Pedestrian Signals

Pedestrian Signals will be installed at the urban locations where pedestrian movement is heavy.

At crossings with medium pedestrian crossings a push button traffic light can be installed. Pedestrians can push the button and wait for the light to turn green and then move on and cross cautiously.

2) Guard Rails and Lighting

Pedestrian Guard Rails will be installed at the following locations.

a) Hazardous locations on Straight Sections: In particularly busy reaches where the road is congested and vehicles move at a fast pace, guard rails should be provided on both sides of the carriageway so as to channelize the pedestrian on to the planned crossing locations.

b) At Junctions/Intersections: Railing barriers will be provided to prevent people from crossing the junctions diagonally at signalised intersections. The barrier must open only at planned crossing facility (at zebra crossing). At Signalised junctions' sufficient length of guard rail will be provided to guide the pedestrian to the neared planned pedestrian crossing.

c) School Colleges: Guard rails will be provided near schools in order to prevent children's to run straight into the road.

d) Bus Stops, Railway Stations, Temple etc: Guard rails will be provided alongside walks with suitable access at bus stops, railway stations and other areas of heavy pedestrian activity such as cinema houses, stadiums etc.

e) Overpass, Subway etc.: Guard-rails is to be provided at Overpasses and subways in order to compel the pedestrians to use the facilities provided for them.

3) Pedestrian Crossings

a) Zebra Crossings: Zebra crossings will be provided along with stop lines as per IRC 35 for safe crossing of pedestrians.

b) Hump Subways: Hump subways are provided by providing the subway partially under ground and partially over the ground in order to reduce the walking length.

c) Full Subways: Full subways are provided by providing the subway fully under the ground.

d) Foot Overbridge: FoB will be provided where there are space constraints and heavy pedestrian movement.

4) Footpath

Footpath with Kerb and pedestrian guard rail will be proposed continuously throughout the urban and built-up sections in order to provide a safe passage for pedestrians to walk along the traffic.

2.11.4 Road Safety Schedule and Traffic Calming Measures

Detailed road safety schedule and traffic calming measures are provided in the form of detailed design report. The schedule contains the provision and locations of road markings and road Signs for all the major junctions, minor junctions, schools, temples, Govt. Offices, other community buildings etc.

2.11.5 Construction Materials

In this project, the cutting /excavated materials are proposed to be reused in construction of pavement, structure and slope protection work. The existing bituminous surface will be scrapped and reused after proper treatment in new construction of pavement. The excess lime quantity present around the vicinity of project road is proposed to be used in stabilization of sub-base layer. Details of Materials are:-

Construction materials quantities required for the project is given below

Earthen Soil : 19,00,353 Cum

Granular sub base: 2,59,570 Cum

Bituminous BC layer: 18450 Cum

DBM: 37080 Cum

Concrete: 1,01,363 Cum

Excavated material from existing road: 1,21,151 Cum

2.12 Construction Schedule

The project will be completed in 24 months time from the date of start the construction.

CHAPTER 3

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This section presents the national and state level environmental legislations and regulations; and World Bank Policies relevant to the “Improvement and upgradation of Paderu - Araku Road Section (Km 2+400 to Km 51+912) upto Bhalluguda on SH-39 in the State of Andhra Pradesh”. The various environmental regulations applicable and regulatory consents and clearances required for the proposed up-gradation project are also been incorporated in this section.

3.1 Legal Framework

The Government of India has laid out various policy guidelines, acts and regulations pertaining to environment. The Environment (Protection) Act, 1986 provides umbrella legislation for the protection of environment. As per this Act, the responsibility to administer, the legislation has been jointly entrusted to the Ministry of Environment, Forests and Climate Change (MoEF&CC) at National level, whereas Andhra Pradesh Pollution Control Board (APPCB) at State level in the present context to “Improvement and upgradation of Paderu - Araku Road Section (Km 2+400 to Km 51+912) upto Bhalluguda on SH-39 in the State of Andhra Pradesh”.

3.2 Applicable National and State Regulations

The key environmental and other regulations relevant to Improvement and upgradation of Paderu - Araku Road Section of NH 516 E in the State of Andhra Pradesh is presented in **Table 3.1**.

Table 3.1: Environmental Regulations Relevant to the Project Road

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
1	Environment (Protection) Act- 1986	To protect and improve overall environment	Yes	It is umbrella legislation. Various notifications, rules and schedules are promulgated under this act.	--	MoEF&CC, APPCB
2	Environmental Impact Assessment Notification,	Prior environmental clearance for designated	Yes	The project road is not covered under the preview of EIA Notification	No	SEIAA/ DEIAA

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
	2006 & subsequent activities	activities for category A and B projects under the Environmental Impact Assessment Notification, 2006 & subsequent activities		2006 and subsequent amendment. However, for opening of new borrow areas and stone quarry, prior environmental clearance will be required from SEIAA/DEIAA.	Prior Environmental Clearance for opening borrow areas and stone quarry	
3	Notification for use of Fly ash, 3 rd November, 2009 and its amendment on 25 th January 2016	"No agency, person or organization shall, within a radius of 300 Kilometres of a thermal power plant undertake construction or approve design for construction of roads or flyover embankments with top soils; the guidelines or specifications issued by the Indian Road Congress (IRC) as contained in IRC specification No. SP: 58 of 2001 as amended from time to time regarding use of fly ash	Yes	Simahadry Thermal power plant near Vishakhapatanam is nearest to the project highway & is located at a distance of about 130 km from project Highway. Flyash can provide technically viable, environmentally sound & cost effective alternative to natural borrow soil.	Essential Use of Fly ash in the Road	MORTH
4	Forest Conservation Act, 1980	To check deforestation by restricting conversion of forested areas into non-forested areas	Yes	The project area does not pass through any forest area.	Prior Forest Clearance for diversion of forest land for non forest activities	Dept. of Forest, Govt. of Andhra Pradesh

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
5	The Schedule Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006'	Recognition of Forest Rights of Schedule Tribes and Other Traditional Forest Dwellers along the project road	Yes	In case any schedule tribes and other traditional forest dwellers, have been given forest rights for forest land to be diverted for the project road.	NOC through Gram Sabha	
6	The Wildlife Protection Act, 1972	To protect wildlife, if occurred along the project	No	This act is applicable for wildlife protection in the Wildlife Sanctuary, National Park, wildlife corridors, etc.	As there is no Wildlife Sanctuary, National Park, wildlife corridors, etc. within 10 km from the project road, hence no clearance is required.	NBWL, MOEF&CC
7	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution & controlling emission of air pollutants as per the prescribed standards.	Yes	This act is applicable for construction phase to control stack/fugitive emissions and to manage ambient air quality at project site and ancillary activities like crusher plant, hot mix plant, concrete batch mix plant, WMM Plants, DG Set etc, for the road The NAAQ standards (CPCB) for Ambient Air Quality have been promulgated by the MoEF&CC for various land uses.	Consent For Establish (CFE) and Consent For Operate (CFO) for hot mix plant, batching plant and WMM Plants, DG sets, etc.	APPCB
8	Water Prevention and Control of Pollution) Act1974	To control water pollution by controlling discharge of liquid pollutants as per the	Yes	This act is applicable for construction phase of the road to manage to liquid effluent discharges from worker camp,	Consent for Establish (CFE) and Consent for Operate (CFO) for plants and workers camps, etc.	APPCB

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
		prescribed standards		concrete batch mix plant, etc.		
9	Noise Pollution (Regulation and Control) Rule 2000	The standards for noise for day and night have been promulgated by the MoEF&CC for various land uses.	Yes	This act will be applicable for all construction equipment/ plant and machinery including vehicles deployed for construction of the proposed road to regulate ambient noise levels This act will be applicable to regulate noise nuisance during construction phase	None	APPCB
10	Hazardous and Other Wastes (Management, & Trans-boundary Movement) Rules, 2016 and amended thereof	Protection to the general public against improper handling and disposal of hazardous wastes	Yes	The rules will be applicable to used oil generated from construction equipment/ machinery during construction works. The rule includes storage, handling, transportation procedures and requirements for safe disposal of hazardous wastes	Hazardous Waste Authorization with CFE and CFO	APPCB
11	Construction and Demolition Waste Management Rules, 2016	Safe disposal and management of construction and demolition wastes	Yes	This rule shall be applicable to generation of wastes resulting from demolition of bridge and culvert structures and scarifying of surface of existing road and from road construction activities.	Construction and Demolition Waste Management Plan should be prepared , prior to commencement of works	Local Municipal Corporation

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
12	Solid Waste Management Rules 2016	Collection and disposal of municipal solid waste	Yes	This rule is applicable to all forms/types of solid waste generated at construction activities, camp site, plant sites, etc..	Solid Waste Management Plan should be prepared , prior to commencement of works	Local Municipal Corporation
13	Guidelines to Regulate and Control Ground Water Extraction in India (With effect from 01.06.2019)	Regulate and control ground water extraction for various purpose.	Yes	NOC is required for infrastructure, mining projects, others requiring water withdrawal	NOC from CGWA	CGWA
14	Mines and Minerals (Development and Regulation) Amendment Act, 2015	This act has been notified for safe and sound mining activity.	Yes	The construction of project road will require aggregate through mining from riverbeds and quarries	Permit and mining lease for stone quarry	Department of mining, State Government
15	Minor Mineral and concession Rules, 2015	For opening new borrow / quarry	Yes	Regulate use of minor minerals like stone, soil, river sand etc.	Permit and mining lease for stone quarry	District Collector
16	Ancient Monuments and Archaeological Sites and Remains Act, 1958	Protection of Archaeological Monuments sites and Remains	Yes	No notified Archaeological Monuments is located within 300m of the project highway. However for chance finds the said act will be applicable.	Permission from ASI	Archaeological Survey of India
17	Explosive Act 1984	An Act to regulate the manufacture, possession, use, sale, [transport, import and export] of Explosives	Yes	If contractor open stone quarry and use explosive for quarrying	License for storage and handling of explosive.	Chief Controller of Explosives
18	The Building and Other Construction Workers	To regulate the employment and conditions of construction	Yes	To ensure safety and welfare measures for workers	None. Safety and welfare	State Labour Department

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
	(regulation of employment and conditions of service) Act, 1996	workers and to provide for their safety, health and welfare measure and for other matter incidental thereto		employed at construction sites. Compliance to provisions of health and safety measures for the construction workers in conformity with BOCW rule concerning safety and health in construction. These regulations to be complied with during the construction of proposed road works.	measures for work force employed at construction sites are to be regulated in conformity with this act.	
19	Bonded Labour System (Abolition) Act, 1976 along with Rules, 1976	An Act to provide for the abolition of bonded labour system with a view to preventing the economic and physical exploitation of the weaker sections of the people and for matters connected therewith or incidental thereto	Yes	Contractors shall employ numbers of Labours during Construction Phase. Contractor will ensure that there is no Bonded Labour by him or sub contractors.	Labour License	State Labour Department
20	Contract Labour (Regulation and Abolition) Act 1970 along with rules, 1971	The Object of the Contract Labour Regulation and Abolition) Act, 1970 is to prevent exploitation of contract labour and also to introduce	Yes	Contractors shall employ numbers of work-force during Construction Phase. The Act applies to the Principal Employer of an Establishment and the	Labour License	State Labour Department

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
		better conditions of work		Contractor where in 20 or more workmen are employed or were employed even for one day during preceding 12 months as Contract Labour.		
21	Employees Provident Funds and Miscellaneous Provisions Act 1952 along with EPF Scheme Rules and Forms	It is a beneficent piece of social welfare legislation aimed at promoting and securing the well-being of the employees	Yes	Contractors shall be employing Workman more than 20 persons during Construction Phase	Compliance of regulations	State Labour Department
22	Employees State Insurance Act 1948 along with Rules and Regulations	Protect the interest of workers in contingencies such as sickness, maternity, temporary or permanent physical disablement, death due to employment injury resulting in loss of wages or earning capacity. the Act also guarantees reasonably good medical care to workers and their immediate dependents.	Yes	Contractor shall be applying large number of labours during construction which will include both Men and Women	Insurance	State Labour Department
23	Equal Remuneration Act, 1976 along with allied Rules	An Act to provide for the payment of equal remuneration to men and women	Yes	Contractor shall be applying large number of labours during construction which will include	Compliance of regulations	State Labour Department

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
		workers and for the prevention of discrimination, on the ground of sex, against women in the matter of employment and for matters, connected therewith or incidental thereto.		both Men and Women.		
24	Inter State Migrant Workmen (Regulation of Employment and Conditions Service Act, 1979	Act of the Parliament of India enacted to regulate the condition of service of inter- state labourers in Indian labour law. The Act's purpose is to protect workers whose services are requisitioned outside their native states in India. Whenever an employer faces shortage of skills among the locally available workers, the act creates provision to employ better skilled workers available outside the state	Yes	Contractor Shall be employing large number of workers during Construction from other States also.	Compliance of regulations	State Labour Department
25	Minimum Wages Act 1948 along with Central Rules 1950	To ensure that workman gets at least minimum wages as fixed by Govt.	Yes	Contractor Shall be employing large number of workers during Construction	Compliance of regulations	State Labour Department

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
		Minimum wages sets the lowest limit below which wages cannot be allowed to sink.				
26	Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participations) Act, 1995 along with Rules,1996 and National Trust for Welfare of Persons with Disabilities Act,1999 with rules 2000.	It gives effect to the proclamation on the full participation and equality of the persons with disabilities in the Asian & Pacific Region and provides for their education, employment, creation of barrier free environment, social security, etc.	Yes	Contractor Shall be employing large number of workers during Construction.	Compliance of regulations	State Labour Department
27	Central Motor Vehicle Act 2019	The Act provides in detail the legislative provisions regarding licensing of drivers/ conductors, registration of motor vehicles, control of motor vehicles through permits, special provisions relating to state transport undertakings, traffic regulation, insurance, liability, offences and penalties.	Yes	These rules will be applicable to road users		Motor Vehicle Department

3.2.1 Other Applicable National Laws and Regulations

Other key laws, including amendments thereof, pertaining to environment, health and safety aspects that are applicable to proposed interventions under GNHCP include:

- a) Easement Act, 1882, as amended
- b) Wetland (Conservation and Management) Rules 2017
- c) Public Liability Insurance Act, 1991, as amended
- d) The Public Liability Insurance Rules, 1991, as amended
- e) Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996
- f) Plastic Waste Management Rules, 2016, as amended
- g) Batteries (Management and Handling) Rules, 2001, as amended
- h) Petroleum Rules, 2002, as amended
- i) Gas Cylinder Rules, 2004, as amended
- j) The Insecticides Act, 1968 and Insecticides Rules, 1971 and as amended

Environmental issues during road construction stage generally involve equity, safety and public health issues. The following laws will also apply to GNHCP:

- i) Workmen's Compensation Act 1923: The Act provides for compensation in case of injury by accident arising out of and during employment.
- ii) Payment of Wages Act, 1936: It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- iii) Child Labour (Prohibition and Regulation) Act, 1986: The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry.

3.3 Key Statutory Clearances/Permissions Requirements – Construction Stage

During the construction stage, some of the key statutory requirements that need to be obtained by the Contractor as part of mobilization (pre-construction) have been listed in **Table 3.2**.

Table 3.2: Key Statutory Clearances to be Obtained by the Contractor

Sr. No.	Clearance/ Consents Requirement	Statute under which clearance/permission is required	Statutory Authority
1.	Borrow Area for Sand and Earth	EIA Notification, 2006 and subsequent amendments there after	DEIAA/SEIAA
2.	Stone Quarry	EIA Notification, 2006 + Mines and Minerals (Development and Regulation) Amendment Act, 2015	DEIAA/SEIAA + Department of Mines
3.	Hot mix plant, Crusher and Batch Mix Plant	Air (Prevention and Control of Pollution) Act, 1981	AP Pollution Control Board
4.	Storage, Handling and Transport of Hazardous Wastes	Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016	AP Pollution Control Board
5.	Storage and Handling Fuel/Oil (such as Diesel)	Manufacture, Storage and Import of Hazardous Chemicals (Amendment) Rules, 2000	Chief Controller of Explosives
6.	Location, emissions, sewage/waste water discharge from plants, labour camps and construction camp sites	Water (Prevention and Control of Pollution) Act, 1974 + Air (Prevention and Control of Pollution) Act, 1981	AP Pollution Control Board
7.	Permission for Withdrawal of Groundwater for Construction	Guidelines to Regulate and Control Ground Water Extraction in India, 2019	Central Ground Water Board
8.	Disposal of Bituminous Wastes	Construction and Demolition (C&D) Waste Management Rules, 2016	Local Civic Body
9.	Traffic Management and Regulation during construction and maintenance	National Road Safety Policy + Guidelines of Indian Roads Congress	Traffic Police Department and District Administration
10.	Construction over Waterways/Canals	Guidelines to Regulate and Control Road Construction over Waterways, as applicable at the State Level	Irrigation Department + Inland Waterways Association

3.4 World Bank Safeguard Policies Applicable to Project Road

The safeguard policies of the World Bank relevant to the Improvement and upgradation of Paderu - Araku Road Section of NH 516 E in the State of Andhra Pradesh are given in **Table 3.3**.

Table 3.3: Relevant and Applicability of WB Safeguard Policies for Upgradation of Paderu - Araku Road Section of NH 516 E in Andhra Pradesh

S. No	World Bank Safeguard Policy	Key Features	Policy Applicability to Sub Project	Policy Triggered Or Not
1.	OP/BP 4.01 Environmental Assessment	Overall governing policy intended to ensure Bank-financed projects are environmentally sound and sustainable	All potential impacts due to the improvement and up-gradation project road are to be assessed and necessary mitigation measures are to be incorporated accordingly.	Triggered
2.	OP/BP 4.36 Forests	Policy is intended to support sustainable and conservation-oriented forest management, harness potential of forests to reduce poverty in a sustainable manner, integrate forests into sustainable economic development, and protect vital local and global environmental services and values of forests.	The proposed improvement and upgradation of the project road does not pass through forest area.	Not Triggered
3.	OP/BP 4.11 Physical Cultural Resources	Policy is intended to ensure that projects identify and inventory cultural resources that are potentially affected by the project. Projects should include mitigation measures, when there are adverse impacts on physical cultural resources.	Construction of road will be on existing road corridor and will avoid cultural property resources (CPR) and therefore does NOT warrant shifting or affect CPRs. However, there may be direct or indirect impact on nearby cultural properties along the road.	Triggered
4.	OP/BP 4.11 Involuntary Resettlement	Involuntary Resettlement Policy addresses direct economic and social impacts from project activities that may cause involuntary taking of land resulting in: (i) relocation or loss of shelter, (ii) loss of assets or access to assets, and/or (iii) loss of income sources or livelihoods	The proposed improvement and upgradation of the project road require land acquisition and Involuntary Resettlement.	Triggered
5.	Natural Habitats OP 4.04	This policy supports the protection, maintenance and rehabilitation of natural	If project is likely to be in proximity to sensitive natural habitats with wildlife	Not Triggered

S. No	World Bank Safeguard Policy	Key Features	Policy Applicability to Sub Project	Policy Triggered Or Not
		habitats. The Bank doesn't finance projects that involve the conversion of designated critical Natural Habitats.	crossing or movement. However, the project road are not located within protected domains.	
6.	Access to Information	<p>The policy governs the public accessibility of information in the Bank's possession. The Bank allows access to any information in its possession that is not on a list of exceptions. Documents such as EMF, all EIAs and EMPs will be disclosed both by the Borrower and the Bank.</p> <p>The policy requires the Borrower to consult Project Affected People and local NGOs through various phases of the project cycle. It requires that groups being consulted be provided on-time, comprehensible and easily accessible information.</p>	For the sub- project road, consultations with key stakeholder have been carried out during the planning and design stages, to determine the baseline conditions and issues; locally viable mitigation measures for addressing environmental impacts; consensus on engineering designs especially where realignments are concerned and to provide for community and stakeholder involvement in designing sub-project propositions.	Triggered

3.5 Indian Road Congress (IRC) Code of Practices applicable for the Project Road

Key Indian Road Congress (IRC) Code of Practices applicable for the project road with respect to environment are given in **Table 3.4**:

Table 3.4: Indian Road Congress Code of Practices for Project Road

S.No.	IRC Code Theme	Year	Purpose
1.	Recommendations for Road Construction in Areas Affected by Water Logging, Flooding and/or Salts Infestation	IRC:34-2011	Construction in water logged areas

S.No.	IRC Code Theme	Year	Purpose
2.	Recommended Practice for Construction of Earth Embankments and Sub-Grade for Road Works (First Revision)	IRC:36-2010	Issues relating to Borrow pits
3.	Guidelines for Pedestrian Facilities	IRC: 103 -1988	Safety of pedestrians
4.	Recommended Practice for Recycling of Bituminous Pavements	IRC:120-2015	For recycling of bituminous pavements
5.	Guidelines for Use of Construction and Demolition Waste in Road Sector	IRC:121-2017	Use of Construction and Demolition Waste in Road Sector
6.	Guidelines on Landscaping and Tree Plantation	IRC:SP:21-2009	Landscaping and Tree Plantation along of the road
7.	Guidelines on Road Drainage	IRC: SP: 42-1994	Drainage
8.	Highway Safety Code	IRC: SP: 44-1994	Highways safety
9.	Guidelines for Traffic Management in Work Zones	IRC:SP-55-2014	Worksite Safety Management
10.	Guidelines for Use of Flyash in Road Embankments	IRC:SP:58-2001	Use of Flyash in Road Embankments
11.	Guidelines for Use of Geotextiles in Road Pavements and Associated Works	IRC:SP:59-2002	Use of Geotextiles in Road Pavements and Associated Works
12.	Guidelines for Soil and Granular Material Stabilization Using Cement Lime and Fly Ash	IRC:SP-89-2010	Soil and Granular Material Stabilization Using Cement Lime and Fly Ash
13.	Guidelines on Requirements for Environmental Clearance for Road Projects	IRC:SP-93-2017	Requirements for Environmental Clearance for Road Projects
14.	Guidelines for the use of Waste Plastic in Hot Bituminous Mixes (Dry Process) in Wearing Courses	IRC:SP-98-2013	Use of waste plastic in hot bituminous mixes (dry process) in wearing courses
15.	Use of Cold Mix Technology in Construction and Maintenance of Roads Using Bitumen Emulsion	IRC:SP-100-2014	Use of Cold Mix Technology in Construction and Maintenance of Roads Using Bitumen Emulsion
16.	Interim Guidelines for Warm Mix Asphalt	IRC:SP-101-2014	Warm Mix Asphalt
17.	Guidelines on Preparation and Implementation of Environment Management Plan	IRC:SP-108-2015	Preparation and Implementation of Environment Management Plan

3.6 Environmental Standards and IS Codes

Environmental standards applicable to the Improvement and upgradation of Paderu - Araku Road Section of NH 516 E in the State of Andhra Pradesh are as given below:

- National Ambient Air Quality Standards, 2009
- Measurement of Air Pollution - IS: 5182-1977
- Ambient Noise Standards
- Measurement of Noise from Moving Road Vehicles - IS: 3028-1980
- Measurement of Noise from Stationery Road Vehicles - IS: 10399-1982
- Measurement of Noise Pollution from Machines - IS: 4758-1968
- Stack Emissions of CPCB for Hot Mix Plants
- Discharge Standards of CPCB for Disposal of Treated Sewage
- Drinking Water Quality Standards - IS:10500:2012
- CPCB Standards for Surface Water Use

3.7 Applicable MoRTH and IRC Specifications

All road works in India are to be in accordance with the MoRTH specifications for Road and Bridge works and guidelines of Indian Roads Congress (IRC). The MoRTH specifications have special provisions towards protection of environment under Clause 501, Annexure A and the contractor is to satisfy the provisions. Apart from the Annexure A to clause 501, there are provisions for control of erosion, drainage, dust suppression, borrow area and haul road management under relevant sections. A few other key applicable clauses include:

Section 111	Precautions for safeguarding the environment
Clause 201.2	Preservation of Property/Amenities during clearing and grubbing
Clause 301.3.2	Stripping and storing of topsoil for reuse during excavation for roadway and drains
Clause 302.4	Restriction on timings for blasting operations
Clause 304.3.6	Public safety near towns/villages where excavation is carried out
Clause 305.2.2.2	Location of borrowing and relevant regulations
Clause 305.3.3	Stripping and storing of topsoil at borrow locations
Section 306	Soil erosion and sedimentation control
Clause 407.4.2	Provisions for turfing on median and islands
Section 517	Recycling of bituminous pavement and excavated material
Clause 701.2.1	Use of geo-textiles for control of soil erosion
Section 810	Use of Metal beam crash barriers for safety, relevant regulations and specifications
Clause 2501	Precautions during river training works

CHAPTER 4

BASELINE ENVIRONMENTAL CONDITIONS

4.1 GENERAL

The project road, two lane upgradation with paved shoulders of Paderu- Araku (up to Bhalluguda) Section of NH-516E is situated in Visakhapatnam district of Andhra Pradesh. The baseline environmental conditions along the project road are discussed in the following sub sections:

The collection of baseline information on physical, biological and socio-economic aspects of the project area is the most important reference for carrying out environmental impact assessment studies. The description of environmental settings includes the characteristic of area in which the activity of project road would occur and cover area likely to be impacted by anticipated environmental impacts. For environmental assessment along the project road, information and data have been obtained by intensive site visits, primary data collection by monitoring and analysis, secondary data from published sources, and various government agencies. Important ecosystem components have been systematically analyzed in this environmental assessment report.

The primary data for ambient air quality, ambient noise level, water quality (ground and surface) and soil quality were collected through environment monitoring undertaken by Savant Envirotech Pvt. Ltd an NABL Accredited Laboratory.

In order to understand and collect the baseline environmental conditions in the study area, relevant primary and secondary data were collected through sampling, monitoring, actual field visits and published secondary sources. The methodologies adopted are classified below:

- The preparation of questionnaire for environmental surveys.
- Field observations of these questionnaires.
- Sampling, monitoring and analysis of environmental components like ambient air, ground and surface water, soil and the noise level.
- Collection of secondary data for various environmental components from various departments.
- Compilation, analysis and presentation in the report.

Baseline data was collected during March to May months of 2018.

4.2 Study Area

The proposed Right of Way (RoW) of the project road has been considered as Corridor of Impact (CoI) for baseline environmental study, while 10 km area on either side (aerial distance) from the project road have been considered as project influence area (PIA) for collection of primary and secondary data. The primary environmental monitoring and field survey were carried out along the project road.

4.3 PHYSICAL ENVIRONMENT

The physical environmental profile along the project road has been discussed in the following subsections:

4.3.1 Topography and Physiography

The project road entirely traverses within Dumbriguda, Hukumpet and Araku valley of Visakhapatnam district of Andhra Pradesh. Topography along the project road is mostly hilly, rolling and plain. Digital elevation model of the project area is shown in **Figure 4.1**.

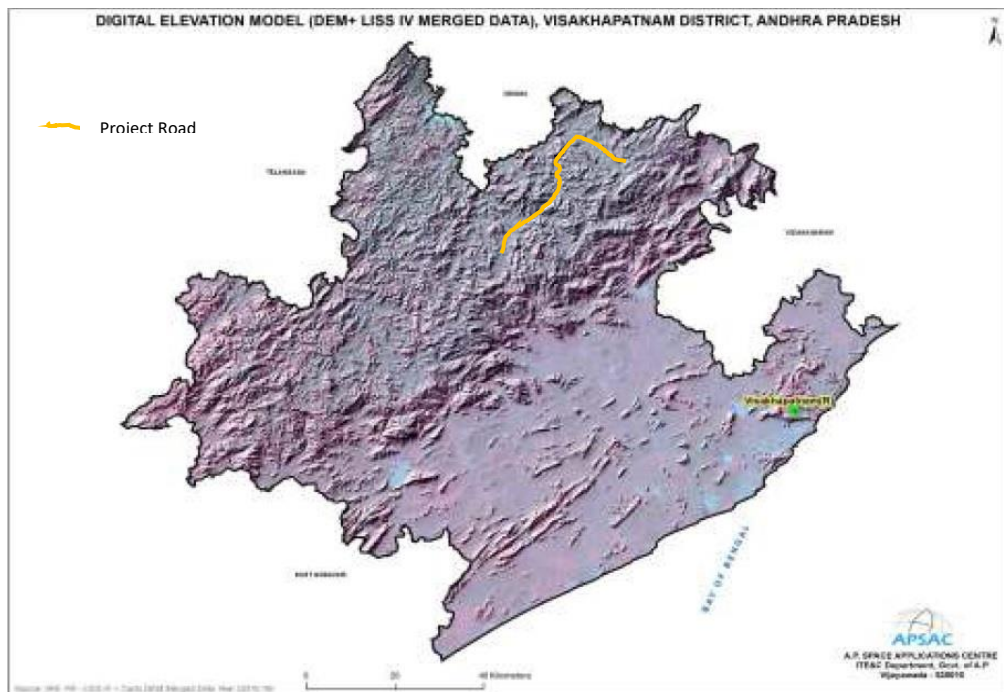


Figure 4.1: Digital Elevation Model Map of the Area

Source : AP Space Application Center, Vijayawada

4.3.2 GEOLOGY

The study area geologically belongs to Precambrian age and is characterized by the occurrence of meta sediments and intrusive meta igneous bodies.

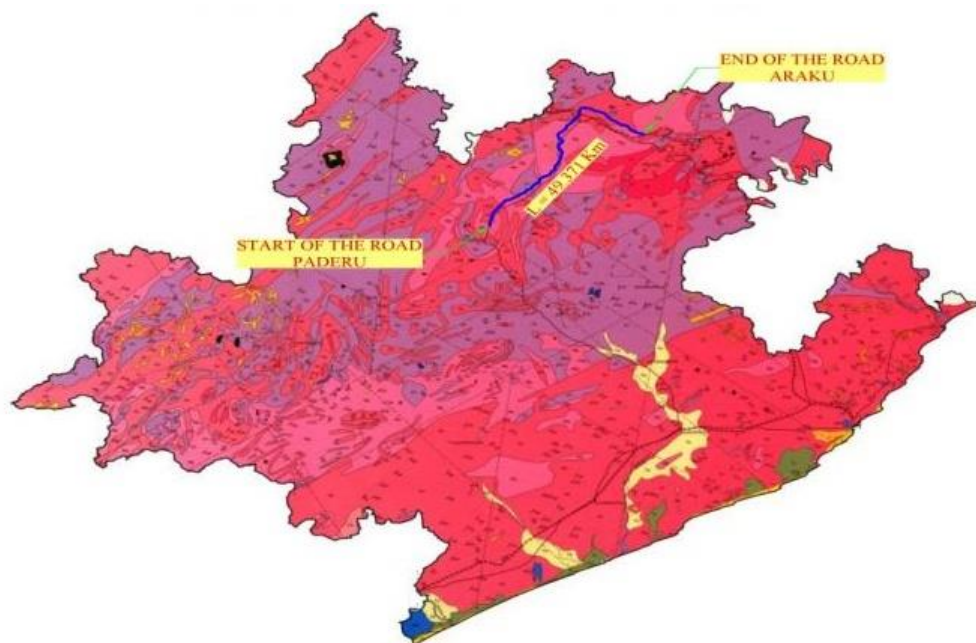


Figure 4.2: Geological Map of Vishakhapatnam District Showing Project Road

4.3.3 HYDROGEOLOGY

The district is underlain by variety of geological formations from the oldest Archaeans to Recent Alluvium. The Archaean group of rocks includes Khondalites and Charnockites of Eastern Ghat super group and Granitic gneisses of Migmatite group. The Gondwana rocks which are represented by sandstones are in very limited aerial extent.

Ground water occurs in almost all geological formations. Ground water occurs under unconfined to semi-confined conditions in the hard formations, while it occurs under unconfined to confined conditions in soft formations. The yields in the weathered zones of hard formations range from 25 to 100 m³/day. The bore wells drilled in the hard formations, generally tap the fractured and fissured zones. The yields of the bore wells in these formations range between 5 to 25m³/hr.

The transmissivity values of the aquifers in the consolidated formations generally vary from 1 to 772 m²/day, whereas specific capacity ranges from 1 to 290 lpm/mdd.

Hydro geological map of Vishakhapatnam District Showing Project Road is shown in **Figure 4.3**

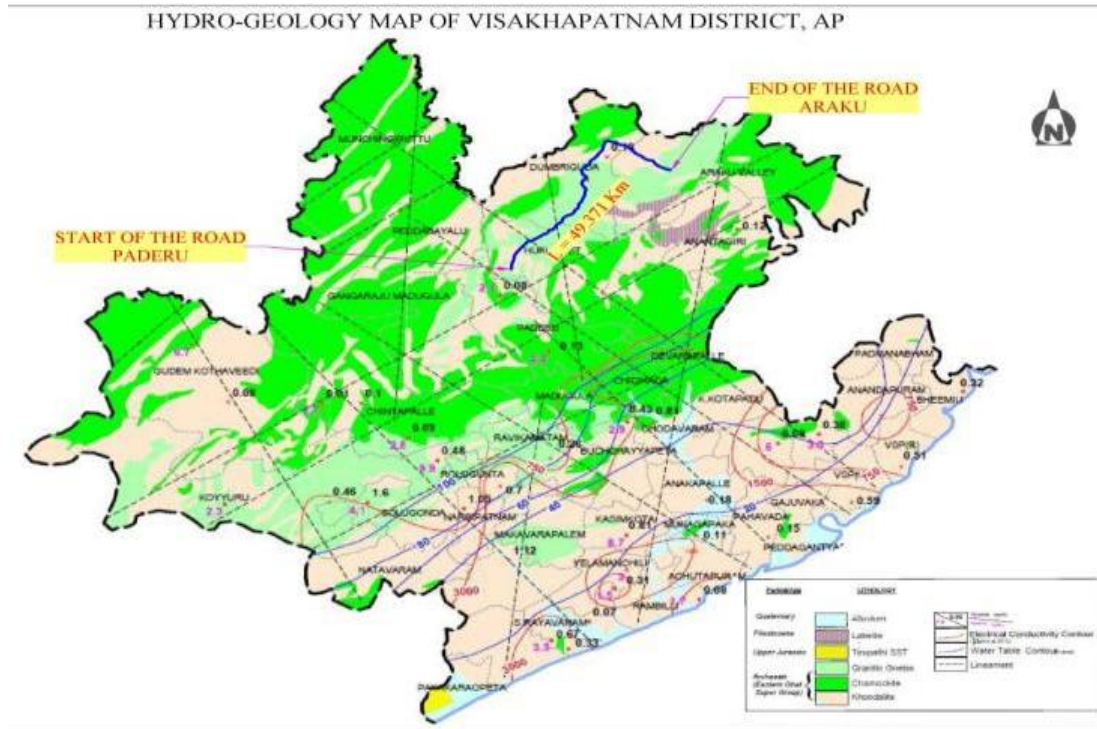


Figure 4.3: Hydro Geological Map of Vishakhapatnam District Showing Project Road

4.3.4 CLIMATE AND RAINFALL

Climatologically the district experiences tropical sub-humid type of climate with moderate summer and good seasonal rainfall. October and November receive rainfall from northeast monsoon. Winter season with cool and fine weather prevails from December to February followed by summer season upto early June.

The average annual rainfall of the district is 1116 mm. and monthly rainfall ranges from nil rainfall in January to 207.5 mm in October. The percentage distribution of rainfall, season-wise, is 60.36% in southwest monsoon, 24.36 % in northeast monsoon, 0.97 percentage in winter and 14.3 % in summer.

Site Specific climate data form the study period of March to May 2018, the temperature varying from 21.50C -37.60C, wind speed is 00 to 11 m/sec and the annual rainfall of the area is 1013mm.

4.3.5 GEOMORPHOLOGY

Geomorphologically the district can be divided into three regions, viz., northern hilly terrain with valleys, middle pediplains and alluvial coastal plains. The northern half of the district is mainly occupied by the structural hills and valleys, which is part of the Eastern Ghats. The hill range trends parallel to coast. The average altitude of hills is over 900 m amsl. The hills are densely forested. By virtue of their topography, these hilly terrains largely form run off areas and are not suitable for ground water development. The valley fill areas underlain by weathered formations in the Araku and Paderu areas possess high infiltration and high permeability.

The different soils in the district are red loams, sandy loams, sandy soils and black cotton soils. Red loamy soils are predominant and occupy about 70% in the district. Sandy loamy soils are largely confined to the coastal areas and to certain stretches in the interior mandals of Chodavaram, Narsipatnam, K.Kotapadu and Madugula. Black cotton soils occur in parts of K.Kotapadu, Devarapalli, Chedikada, Paderu and Hukumpeta mandals.

Geomorphological map of Vishakhapatnam District showing project road is presented in **Figure 4.4**.

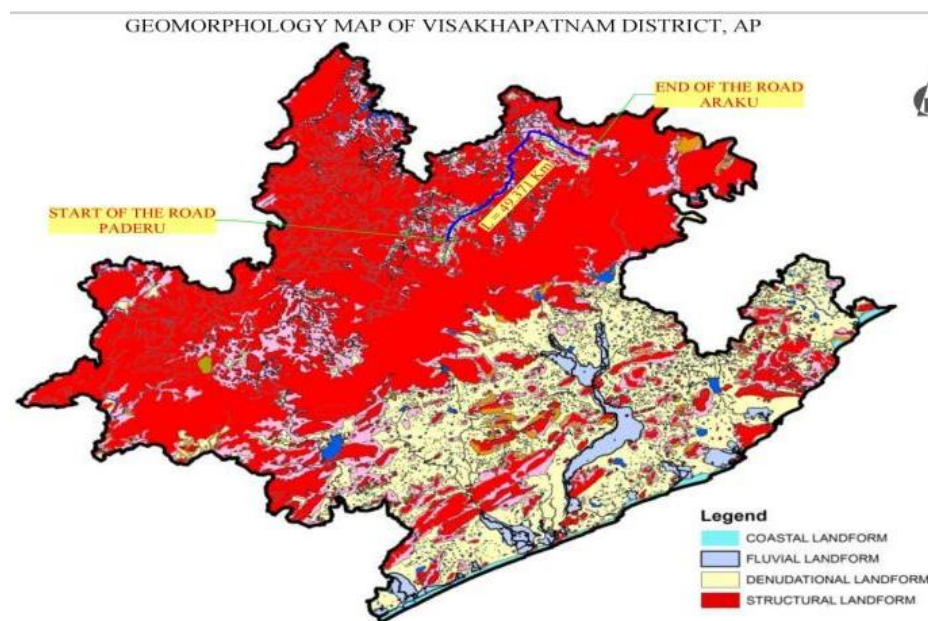


Figure 4.4: Geomorphological Map of Vishakhapatnam District Showing Project Road

Soil map of Vishakhapatnam district showing project road is presented in **Figure 4.5**.

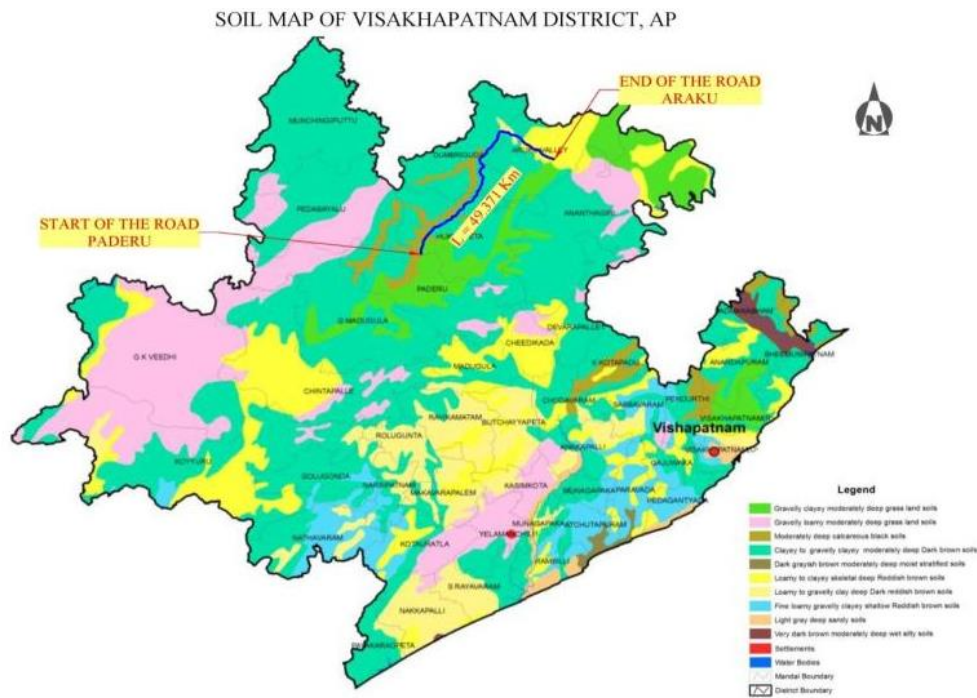


Figure 4.5: Soil Map of Vishakhapatnam District Showing Project Road

4.3.6 Land use / Land cover Classification of the Study area








Using the standard land use classification system proposed by National Remote Sensing Centre (NRSC), about seven classes of level I, land use / land cover classes were identified and mapped using satellite data along the project corridor. Further, the imagery is interpreted and ground checked for corrections.

Built –up land occupies about 12.28 Sq km, Agriculture Plantation land occupies 51.61 Sq km, Water bodies occupy around 2.91 Sq km, Agriculture Crop Land occupy 319.32 Sq km, Forest Land occupy around 398.95 Sq km, Fallow Land occupy around 312.05 Sq km, Barren around 127.79 Sq km.

Land use land cover map of study area along the road is presented in **Figure 4.6**.

Table 4.1 : Shows Land use / Land Cover of the 10km Study area

EIA Report for Two Lane Upgradation with Paved Shoulders of Paderu- Araku (up to Bhalluguda) Section of NH-516E in Andhra Pradesh under Green National Highway Corridor Project (GNHCP)

Classification	Area in Sqkm	%
 Agriculture Crop Land	319.32	26.07
 Agriculture Fallow Land	51.61	4.21
 Forest	398.95	32.57
 Forest, Forest Plantation	312.05	25.48
 Barren/Unculturable/Waste Lands, Scrub Land	127.79	10.43
 Builtup Land	12.28	1.00
 Water Body	2.91	0.24

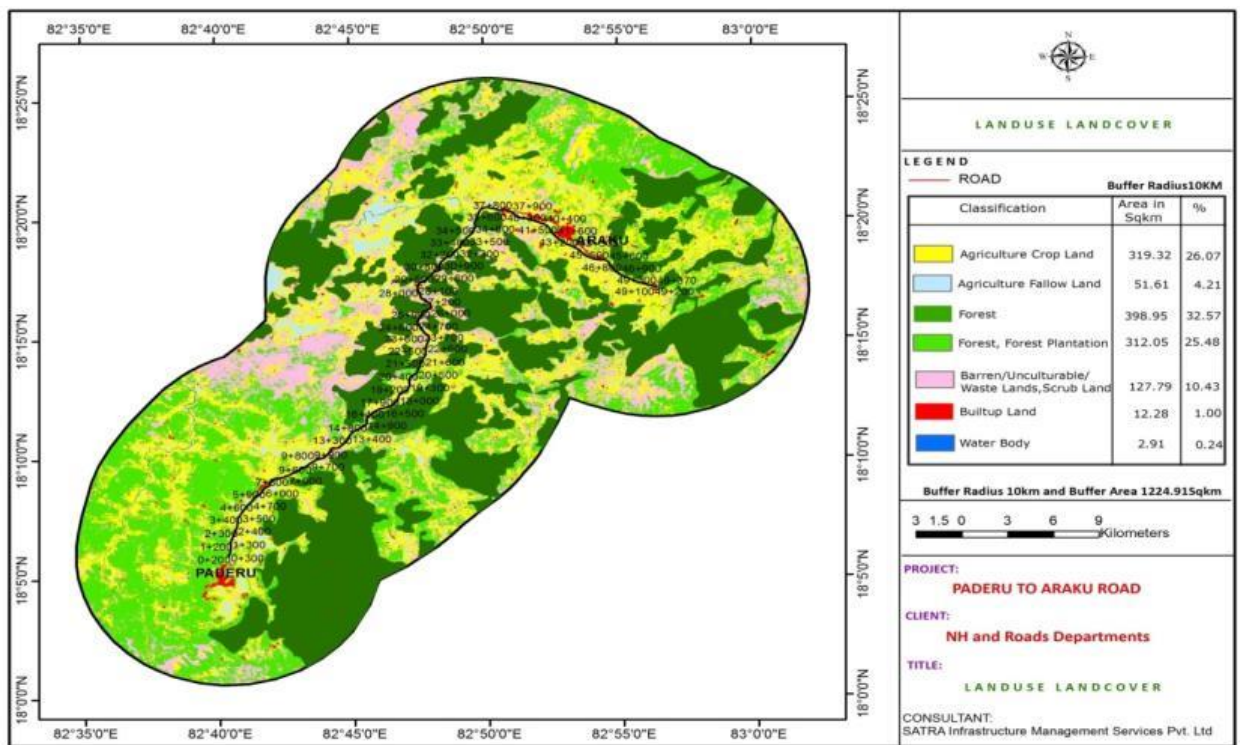


Figure 4.6: Land use land cover map of study area along the road

4.3.7 BIO-DIVERSITY

FLORA

The project road has a variety of trees. Trees like Palm, Coconut, mango, teak, subabul, badam, banyan, and tamarind are found along the project. Details of trees are given in table. A total of trees were found as per topographical data. During the baseline assessment, enumeration of trees number of trees within a 15m corridor on each side of the road was conducted. It is estimated that 1964 trees would be felled during the construction of the road as given in **Table 4.2**.

Table 4.2 : Numbers of Trees Along The Project Road

Tree Details			
Tree Name	Left	Right	Total
Tree_Eucalyptus	41	28	69
Trees	873	756	1629
Tree_mango	137	88	225
Tree_Coconut	8	5	13
Tree_tamarind	13	7	20
tree_palm	5	3	8
Total	1077	887	1964

Details of Trees species found along the Project Road are given Table 4.3.

Table 4.3 : List of Plant Species Recorded Along The Project Road

S.No	Botanical Name	Common name	Family	Status
1	<i>Acacia auriculiformis Benth.</i>	Australia thumma	Leguminosae	Common
2	<i>Acacia leucophloea (Roxb.)</i>	Tella thumma	Leguminosae	Dominant
3	<i>Acacia nilotica (L.) Delile</i>	Nalla thumma	Leguminosae	Dominant
4	<i>Aegle marmelos (L.) Corrêa</i>		Rutaceae	Rare
5	<i>Ailanthus excelsa Roxb</i>	Pedda manu	Simaroubaceae	Dominant
6	<i>Alangium salviifolium (L.f.) Wangerin</i>	Vuduga chettu	Cornaceae	Sparse
7	<i>Albizia amara (Roxb.) B.Boivin</i>	Konda sigara	Leguminosae	Sparse
8	<i>Albizia lebeck (L.) Benth.</i>		Leguminosae	Common

S.No	Botanical Name	Common name	Family	Status
9	<i>Alstonia scholaris</i> R.BR	Edakula pala	Apocynaceae	Dominant
10	<i>Annona squamosa</i> L.	Seethapalam	Annonaceae	Common
11*	<i>Anthocephalus cadamba</i> (Roxb.) Miq.	Kadambe	Rubiaceae	Common
12	<i>Azadirachta indica</i> A.Juss.	Vepa	Meliaceae	Dominant
13	<i>Balanitesa egyptiaca</i> (L.) Delile	Gara	Zygophyllaceae	Common
14	<i>Bauhinia purpurea</i> L.	Bodhanta	Leguminosae	Dominant
15	<i>Borassus flabellifer</i> L.	Thadi chettu	Arecaceae	Dominant
16	<i>Butea monosperma</i> (Lam.) Taub.	Modhuga	Leguminosae	Sparse
17	<i>Carica papaya</i> L.	Bopaya chettu	Caricaceae	Common
18	<i>Cassia fistula</i> L.	Rela	Leguminosae	Sparse
19	<i>Cassia siamea</i> Lam.	Seema thangedu	Leguminosae	Common
20	<i>Ceiba pentandra</i> (L.) Gaertn	Tella buruga	Malvaceae	Sparse
21	<i>Chukrasia tabularis</i>	Konda vepa	Meliaceae	Common
22	<i>Citrus limon</i> (L.) Burm. f.	Nimma	Rutaceae	Sparse
23	<i>Cocos nucifera</i> L.	Kobbari	Arecaceae	Dominant
24*	<i>Dalbergia latifolia</i> Roxb	Jiteegi	Leguminosae	Sparse
25	<i>Dalbergia sissoo</i> DC.	Sisu	Leguminosae	Dominant
26	<i>Decalepis hamiltonii</i>	Maredu kummulu	Periplocaceae	Sparse
27	<i>Delonix regia</i> (Hook.) Raf.	Chittikesaram	Leguminosae	Dominant
28	<i>Dendrocalamus strictus</i>	Sanna vedru	Graminae	Dominant
29	<i>Diospyros melanoxylon</i> , Roxb.		Ebenaceae	Sparse
30	<i>Dolichandron eatrovirens</i> (Roth) K.Schum.		Bignoniaceae	Sparse
31	<i>Eucalyptus globulus</i> Labill.	Neelagiri thylam	Myrtaceae	Common
32	<i>Ficus benghalensis</i> L.	Marri	Moraceae	Common

S.No	Botanical Name	Common name	Family	Status
33	<i>Ficus hispida L.f.</i>	Medipandu, Bemmedu akulu	Moraceae	Dominant
34	<i>Ficus microcape</i>		Moraceae	Sparse
35	<i>Ficus racemosa</i>	Medi	Moraceae	Common
36	<i>Ficus religiosa L.</i>	Ravi	Moraceae	Sparse
37	<i>Gmelina asiatica L.</i>		Lamiaceae	Rare
38	<i>Holoptelea integrifolia Planch.</i>	Nemali nara	Ulmaceae	Rare
39	<i>Lannea coromandelica (Houtt.) Merr.</i>	Gumpena	Anacardiaceae	Rare
40	<i>Leucaena leucocephala (Lam.) de Wit</i>	Jabarichettu	Leguminosae	Dominant
41*	<i>Limonia acidissima L.</i>	Velaga	Rutaceae	Common
42	<i>Madhuca indica, Gmel.</i>		Sapotaceae	Common
43	<i>Mangifera indica L.</i>	Mamidi	Anacardiaceae	Common
44	<i>Morinda tinctoria Roxb.</i>	Maddichettu	Rubiaceae	Sparse

FAUNA

The Visakhapatnam District has a livestock of about 14 lakhs out of which the cattle form 34% Buffaloes 31% sheep 13% and Goats 17% about wild fauna Boars and Bear are found in the forest area of the region and isolated instances of Cheetas and Tigers.

The prevailing and pre-dominant Fauna in the direct area of influence and in the study areas of the project road are Jungle Cat, Wild Dog, Indian Fox, Indian Hare, Hyena, Common Langur, Rhesus Macaque (Common Monkey), Indian cuckoo, Common House Rats, Indian Palm Squirrel, House Sparrow, Common Myna, Common kingfisher, Common Peafowl, Common Pigeon, Goose Greylag, House Crow, Indian Courser, Indian Pond Heron.

Throughout the study area, there are no direct evidence of wild animal species observed. From the secondary source (local people near villages), it is also revealed that presence of common snakes exists here. Common bird species such as Paddy egrets, Green bee eaters, Indian rollers, Parakeets, common babblers, Weaver birds, Mynas, Black drangos, Crows, Sparrows are sighted here.

From the present survey it appears that none of the terrestrial species are under endangered and threatened species, and not listed in the Schedule I of the Indian Wildlife (Protection) Act, 1972 as amended in 1991.

Also, there are no National Park, Wildlife Sanctuary, Biosphere Reserve and any other notified sensitive area within the 15 Km radius PIA considered for baseline assessment.

Details of wild fauna found along the project road are given in Table 4.4.

Table 4.4: Fauna Found in the Area along the Project Road

Scientific Name	Common Name
<i>Bendicota bengalensis</i>	Indian mole rat
<i>Bendicota indica</i>	Bandicoot rat
<i>Mus booduga</i>	Little Indian Field mouse
<i>Mus musculus</i>	House Mouse
<i>Rattus rattus</i>	House rat
<i>Suncus murinus</i>	Grey musk shrew
<i>Funambulus palmarum</i>	Three striped palm squirrel
<i>Herpestes edwardsii</i>	Grey Mongoose

Forest Details

The Forest of Andhra Pradesh is mostly moist and dry deciduous type in nature and its canopy density widely changes in different months. The State has 1,60,204 Sqm. geographical area having 22 percent forest cover. The district has 11, 16,100 hectares of geographical area and the notified forest comprises 4,70,800 hectares of forest which amounts to 42 per cent, the highest in the State.

The common species available are Guggilam, Tangedu, Sirimanu, Kamba, Yegisa, Nallamaddii, Gandra, Vepa etc. Bamboo shrubs are sparsely scarcely scattered. Major flora found along the project rod area: Innu maddi, Kondatangedu, pasupu-kadamba, Mango/Mamidi, Ippa Puwu, Imli, Manduka-Parnamu/ Indian trumpet flower, Bongu-Veduru, Dhaman, Teak, Guava, Amaltaas, Katira, Peepal tree, Chulta, East Indian ebony, Indian gooseberry, Bastard teak, Indian-almond, Neem, Banyan. The strip of the land along the coast and the interior called the plains division and hilly area of the Eastern Ghats flanking it on the North and West called the Agency Division.

The Agency Division consists of the hilly regions covered by the Eastern Ghats with an altitude of about 900 metres dotted by several peaks exceeding 1200 metres. Also, 1615 metres embraces the mandals of Paderu, G.Madugula, Hukumpeta, Chintapalli, G. K. Veedhi, Koyyuru, Pedabayalu, Munchingiput, Dumbriguda, Arakuvalley and Ananthagiri. There exists ITDA at Paderu. The basic profile of ITDA, Paderu is given in **Table 4.5**.

Table 4.3.7.5: ITDA, Paderu Details

Basic Profile of ITDA, Paderu	
Geographic area of Visakhapatnam District	11,167Sq. Kms
Area of the I.T.D.A.	6,293 Sq. Kms
% Agency area to the total district area	56.38%
District Population	42,90,589
Population of Paderu division	6,04,047
Population of Scheduled Tribes	5,47,951
Tribal Households	1,34,233
% of Agency Population to the Dist. Population	14.08%
Population Density in the District (per Sq. Km.)	384
Population Density in Agency Area (per Sq. Km.)	96
PTGs Tribes	Khond, Gadaba, Poorja
Non-PTGs Tribes	Bhagatha, Valmiki, Kondadora, Kotia, Kammara, Nookadora
No. of Schedule Mandals	10 (Full) + 2 (Partial)
Gram Panchayats	244
No. of revenue villages	2,312
Tribal habitations	3,574
No. of PTG Habitations	1,093
No. of Non-PTG habitations	2,481

Forest area details are given in **Table 4.6.**

Table 4.3.7.6: Forest Area details

S.No	Circle	Division	Range	Section	Beat	RF_Block	Compartment No.	From	To	Length (m)	Side	Area in Sqm	Area in Ha
1	Vizag	Paderu	Araku	Guntaseema	Arama	Arama	70	27+335	27+425	90	Left	1561.78	0.1562
2	Vizag	Paderu	Araku	Araku	Araku	Kuridi	62	34+980	35+288	308	Right	4857.77	0.4858
Total										398		6419.55	0.642

Nearest Wildlife Sanctuary or Protected Area

There are no National park or wildlife sanctuaries within 10 km of the project road. The project road does not pass through the forest area and wildlife/protected area network, and these don't exist within project influence area. However, the following table shows the presence of nearest Wild life/Sanctuary details to the project site. There is no impact on sanctuary due to the current project.

Wildlife/Bird Sanctuary Details Nearest to the Project is given in **Table 4.7.**

Table 4.3.7.7: Wildlife/Bird Sanctuary Details Nearest to the Project

Details of Wildlife Sanctuary/Bird Sanctuary/Wetlands from proposed alignment				
S.No	Name of the road project	Proposed Length (in Km)	Nearest Wildlife/Bird Sanctuary	Arial distance from Proposed Project Road alignment (Km)
1	Paderu to Araku Upto Bhallaguda	50	Kambalakonda Wildlife Sanctuary	70

WILDLIFE PROTECTED AREAS

The project road does not pass through any National park/Wildlife sanctuary or in the vicinity of 10 km radius. However, there is no presence of any NP/WL National park/Wildlife sanctuary along with in PIA. There are no National Park, Wildlife Sanctuary, Biosphere Reserve and any other notified sensitive area within the 15 Km radius.

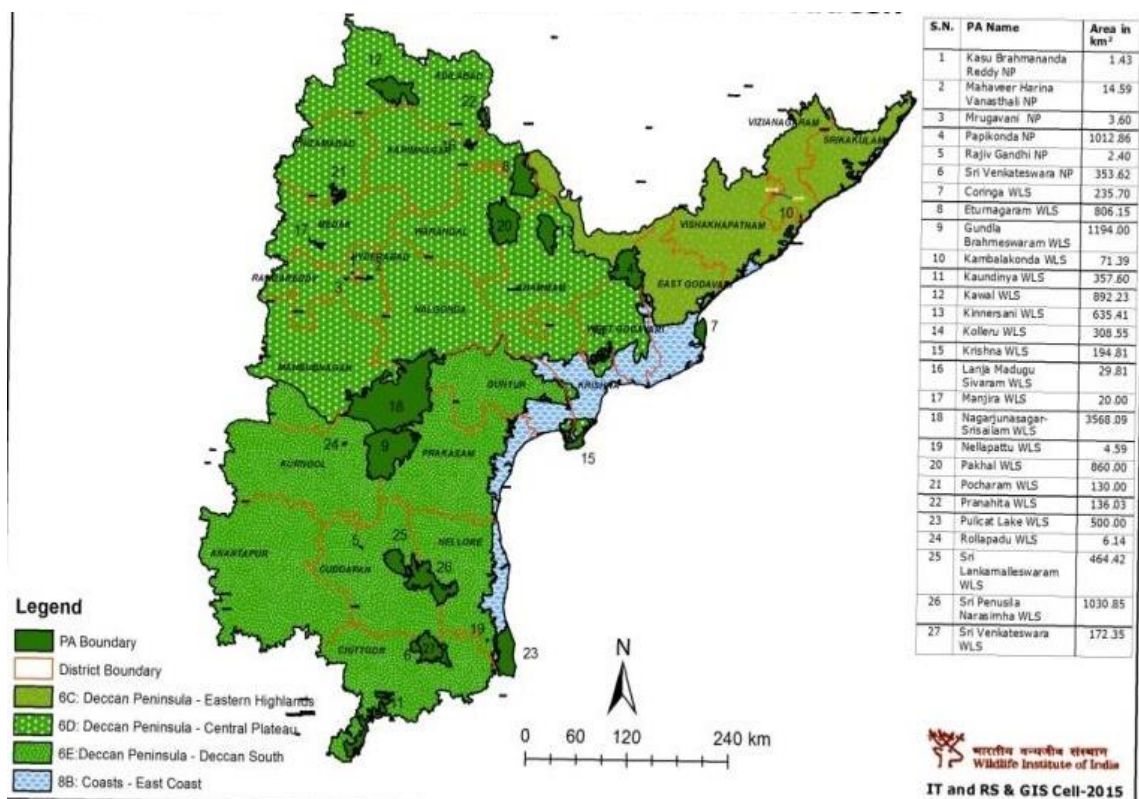


Figure 0.1: Andhra Pradesh Wildlife Protected Area Map

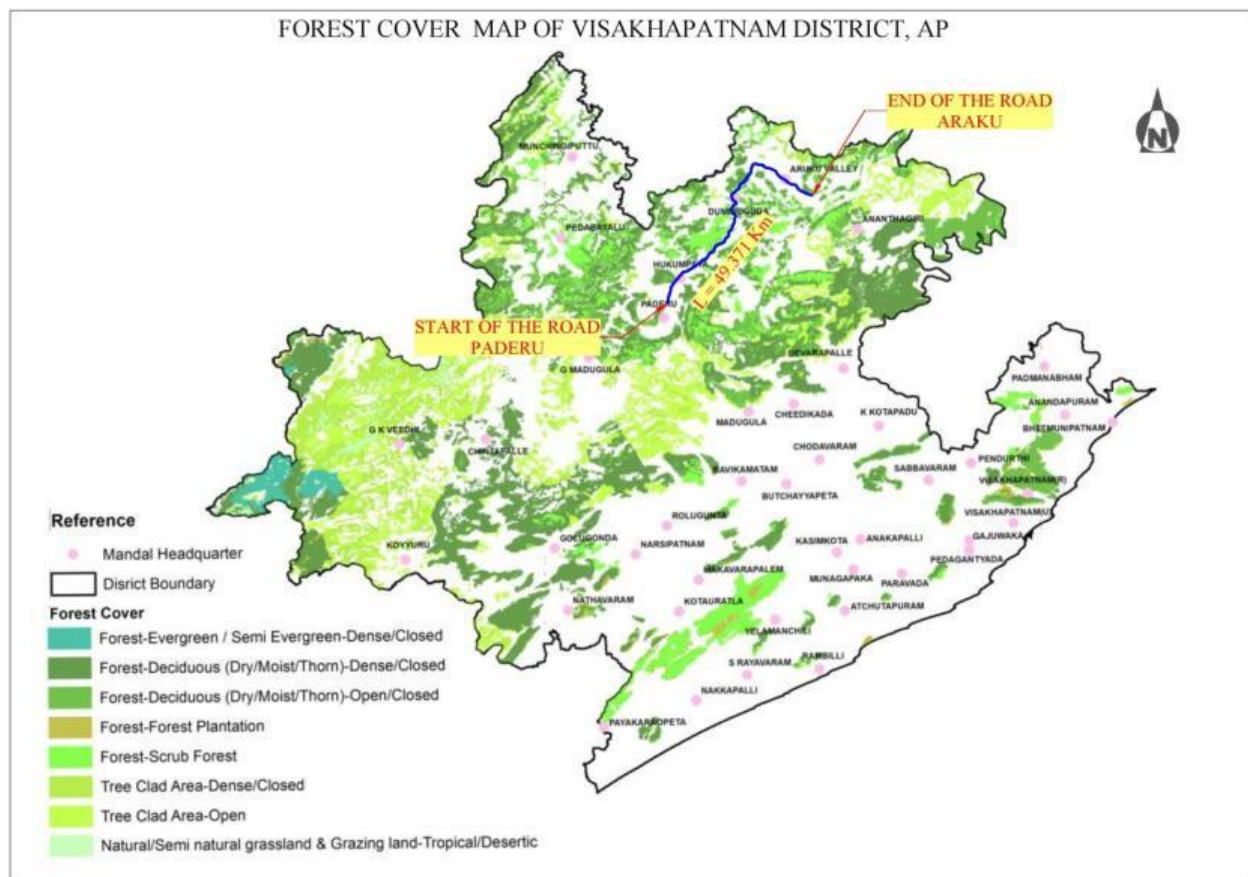


Figure 4.8: Forest Cover map of Vishakhapatnam District showing Project Road.

4.3.8 TOURIST

Along the project road, there exist many tourism spots. Various places like Araku, Borra caves, Lambasinghi exists near to the project vicinity. Due to this project, the tourism will be enhanced drastically by the attraction of many tourists in these places. Major important places near to project vicinity are:

Araku:

- **Ooty** of Andhra Pradesh
- Present in the **Eastern Ghats** inhabited by **Kodhu tribes**.
- Famous for Tribal Museum, Anantagiri water falls, Dumbriguda Water Fall.
- Famous for **Coffee Production** and export.
- A unique dance is performed by tribal called **Dhimsa** in this region.

Lambasinghi

- Located along **NH-516E**
- **Kashmir** of Andhra Pradesh

- Temperature of this place goes to **-2 °C**
- Only place in south India that receives **snowfall** during winters
- Adventurous spots like **trekking** and mountain biking to hiking and camping.

Borra Caves

- Located at **40kms from Araku** on the east coast of India in the Anantagiri hills
- Largest and deepest Caves in Country
- The Borra Caves, also called Borra Guhalu

According to AP Tourism, about **2500 Tourists** visit these spots every day. However, the number will increase at peak/holiday seasons. The Tourist map of is shown in **Figure 4.9.**



Figure 4.3.8.9: Tourist Map of Andhra Pradesh

Details of tourism spots in the vicinity of project road are shown in **Figure 4.10.**



Figure 4.3.8.10: Details of Tourism Spots in the vicinity of project Road

4.3.9 INDUSTRIES

There are no specific industries along the project road.

4.3.10 ARCHAEOLOGICAL AND HISTORICAL MONUMENTS

The project road doesn't have any notified/protected Archaeological or Historical monuments

4.4 ENVIRONMENTAL MONITORING

An Environmental monitoring along the project corridor was carried out. The schedule of monitoring locations and parameters analyzed is given in Table 4.8 and Table 4.9 respectively. Photographs taken during monitoring are given in Fig. The test results are given Map showing monitoring locations is given in Fig

Table 4.4-8: Locations for Environmental Monitoring

S.No	Location code	Location Name	Chainage	Criteria for selection
Ambient Air Quality				
1	AAQ1	Paderu	0+300	Represents Down wind & Residential area
2	AAQ2	Kinchumanda	22+200	Represents cross wind & Residential area
3	AAQ3	Araku	41+500	Represents Down wind & Residential area
Noise Level Survey				
1	N1	Paderu	0+300	Represents Habitation & commercial area
2	N2	Kinchumanda	22+200	Represents Habitation
3	N3	Araku	41+500	Represents Habitation
Ground Water				
1	GW1	Paderu	2+100	Bore well sample representing Residential area.
2	GW2	Kinchumanda	21+300	Bore well sample representing Residential area.
3	GW3	Araku	41+600	Bore well sample representing Residential area.
Surface Water				
1	SW1	Chaparai Stream	29+00	Stream sample collected
2	SW2	Araku seasonal nalla	37+100	Stream sample collected

Table 4.4.9: Environmental Monitoring Schedule & Methods

S.No.	Item	Monitoring Schedule	Method
1	Air Quality Monitoring	24 hourly samples monitoring twice a week for one month at each location (Total 8 samples at each location)	Respirable Sampler with arrangement for monitoring PM2.5
2	Water Quality Monitoring	Grab samples from identified locations	Grab sampling
3	Noise Level Monitoring	Hourly recording of noise levels for one full day (24 hours) at each location)	Integrated Noise monitor
4	Soil Testing & Analysis	Grab Sample from each identified location	Grab samples

4.4.1 Meteorology

Micro meteorological studies are simultaneously conducted with the air quality monitoring. Methodology plays a vital role in effecting the dispersion of pollutants, once discharged into the atmosphere, their transport, dispersion and diffusion into the environment. The meteorological data is very useful for interpretation of the baseline information and for model study of air quality impacts also.

Since meteorological data show wide fluctuations with time, meaningful interpretation can only be drawn from long term and reliable data. Such source of data is the India Meteorological Department (IMD) that maintains a network of meteorological stations at several important locations.

Meteorological Station at Paderu Site.

The station was installed in such a way that there are no obstructions facilitating free flow of wind. Wind speed, wind direction, humidity and temperature are recorded on hourly basis in the study period.

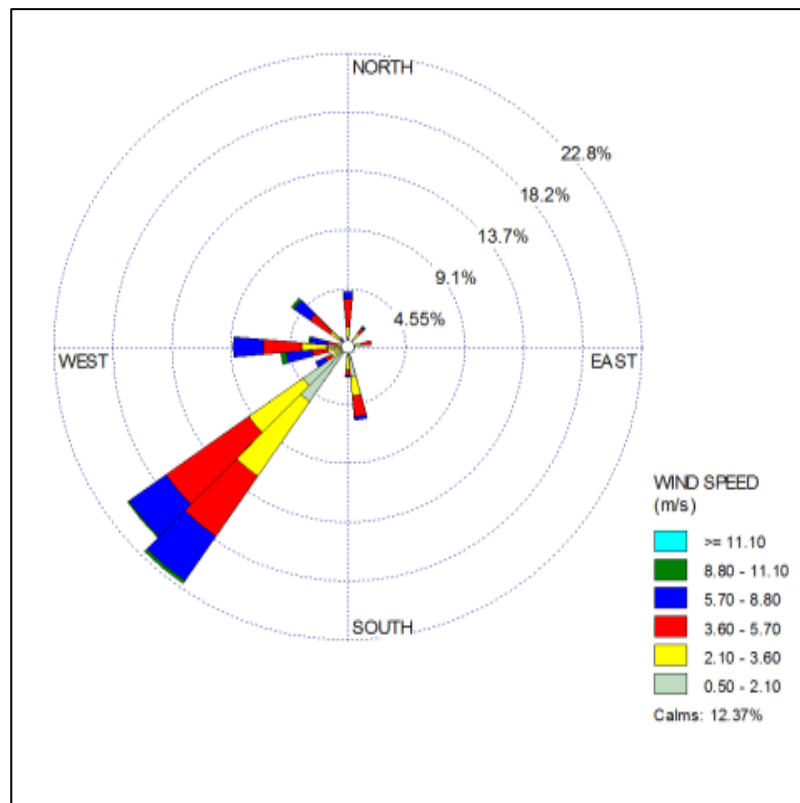


Figure 4.11: Wind rose-diagram for the study period March to May 2018 at Paderu

- Calm period is observed to be 12.37 % during the time of monitoring.
- The predominant wind is west direction.

4.4.2 Ambient Air Quality

Air pollution means the presence in the outdoor atmosphere of one or more contaminants or combinations thereof in such quantities and of such duration as are or may tend to be injurious to human, plant or animal life or property. Air pollutants include smoke, vapors, soot, fumes, gases, mist, odors, particulate matter, radioactive material or noxious chemicals. With upcoming industrial activity a range of different pollutants are released into the atmosphere that are dispersed and have a significant impact on neighbourhood air environment. Thus collection of base line data of air environment occupies a predominant role in the impact assessment

statement. The ambient air quality status across the study zone forms basis for prediction of the impacts due to the project.

The project is located at Paderu – Araku section 49.3 Km of Visakhapatnam (D), Andhra Pradesh state. The data required for assessing air quality impacts in and around neighborhood is achieved by designing such a network, which encompasses micro meteorological conditions, quantity and quality of emissions, locations, duration, resources/monitoring technology and operational criteria. The optimal scheme for air quality monitoring should consider all the above factors

Description of Sampling Locations

The location of ambient air quality stations is contingent on the meteorological status of the area. Hence the micro meteorological data was collected before initiating the ambient air quality monitoring. **Table 4.10** presents the ambient air quality locations and their distances and directions from the plant site.

Table 4.10: Ambient Air Quality Locations

S.No	Location code	Location Name	Chainage	Latitude	Longitude
1.	AAQ1	Paderu	0+300	18° 06'08.23"	82° 40' 23.67"
2.	AAQ2	Kinchumunda	22+200	18° 14'34.44"	82° 47' 44.15"
3.	AAQ3	Araku	41+500	18° 19'15.36"	82° 52' 44.45"

Ambient air quality monitoring location map is shown in **Figure 4.12**.

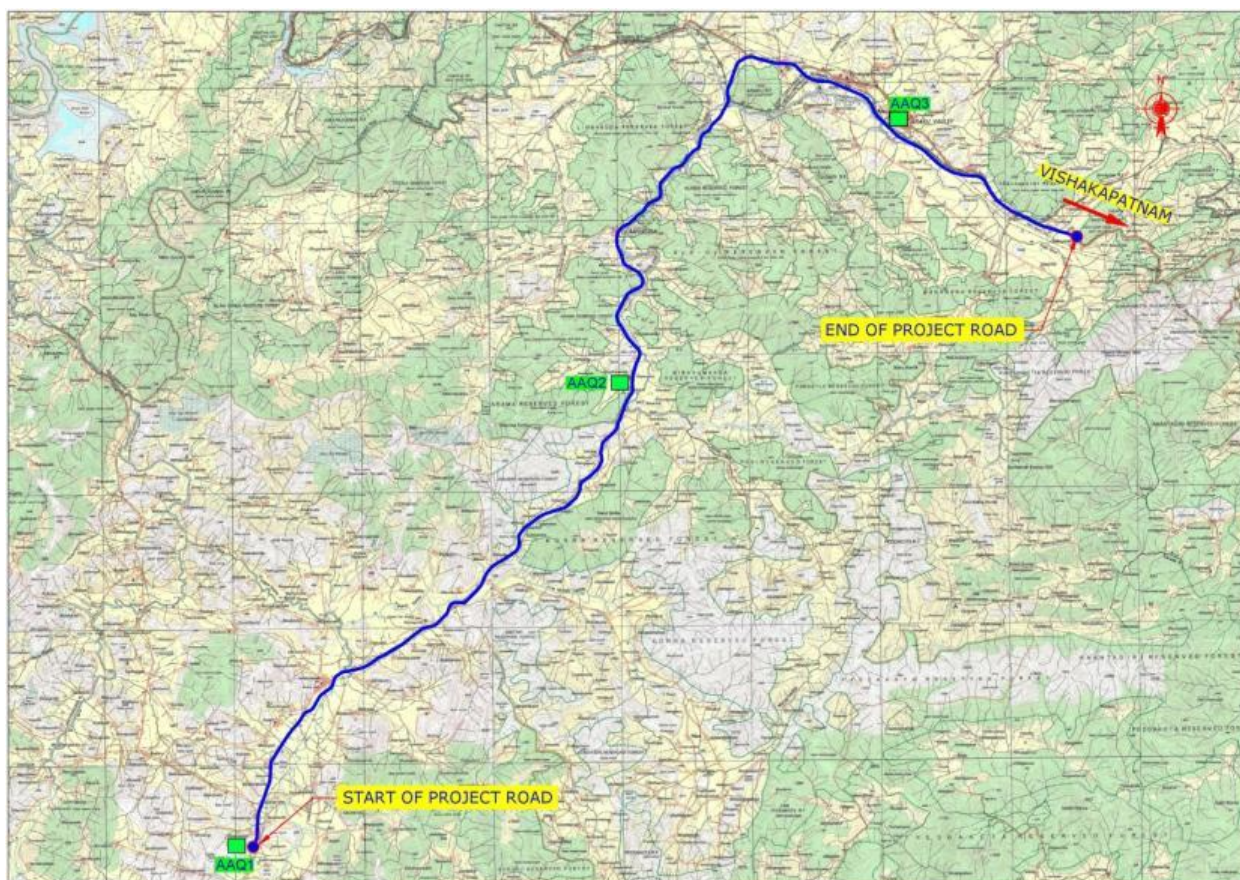


Figure 4.12: Ambient Air Quality Monitoring Location Map

Ambient Air Quality Results are shown in **Figure 4.11**.

Table 4.11: Ambient Air Quality Results

Max Values ($\mu\text{g}/\text{m}^3$)						
S.No	Location	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO
1	PADERU	65.23	23.60	14.20	30.15	0.63
2	KINCHUMUNDA	55.20	29.20	19.47	37.12	0.56
3	ARAKU	56.20	23.11	23.12	34.75	0.74
Min Values ($\mu\text{g}/\text{m}^3$)						
S.No	Location	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO
1	PADERU	58.20	19.50	13.60	29.20	0.44
2	KINCHUMUNDA	50.10	21.58	14.99	24.13	0.29
3	ARAKU	53.40	17.60	10.60	27.62	0.42

4.4.3 Noise Measurements

A preliminary reconnaissance survey was undertaken to identify the major noise generating sources along the project road. The noise at three locations (**Table 4.12**) considering all categories like commercial, residential and silence zone has been carried out. Lutron Make Noise Level Meter instrument was used to ascertain noise status at monitoring sites along the project road.

Table 4.12: Ambient Air Quality Locations

S.No	Location code	Location Name	Chainage	Latitude	Longitude
1	N1	Paderu	0+300	18° 06'08.23"	82° 40' 23.67"
2	N2	Kinchumunda	22+200	18° 14'34.44"	82° 47' 44.15"
3	N3	Araku	41+500	18° 19'15.36"	82° 52' 44.45"

Hourly measurements have been carried out in day and night time at three locations during the study period. Locations of noise level sampling are given in **Figure 4.13**.

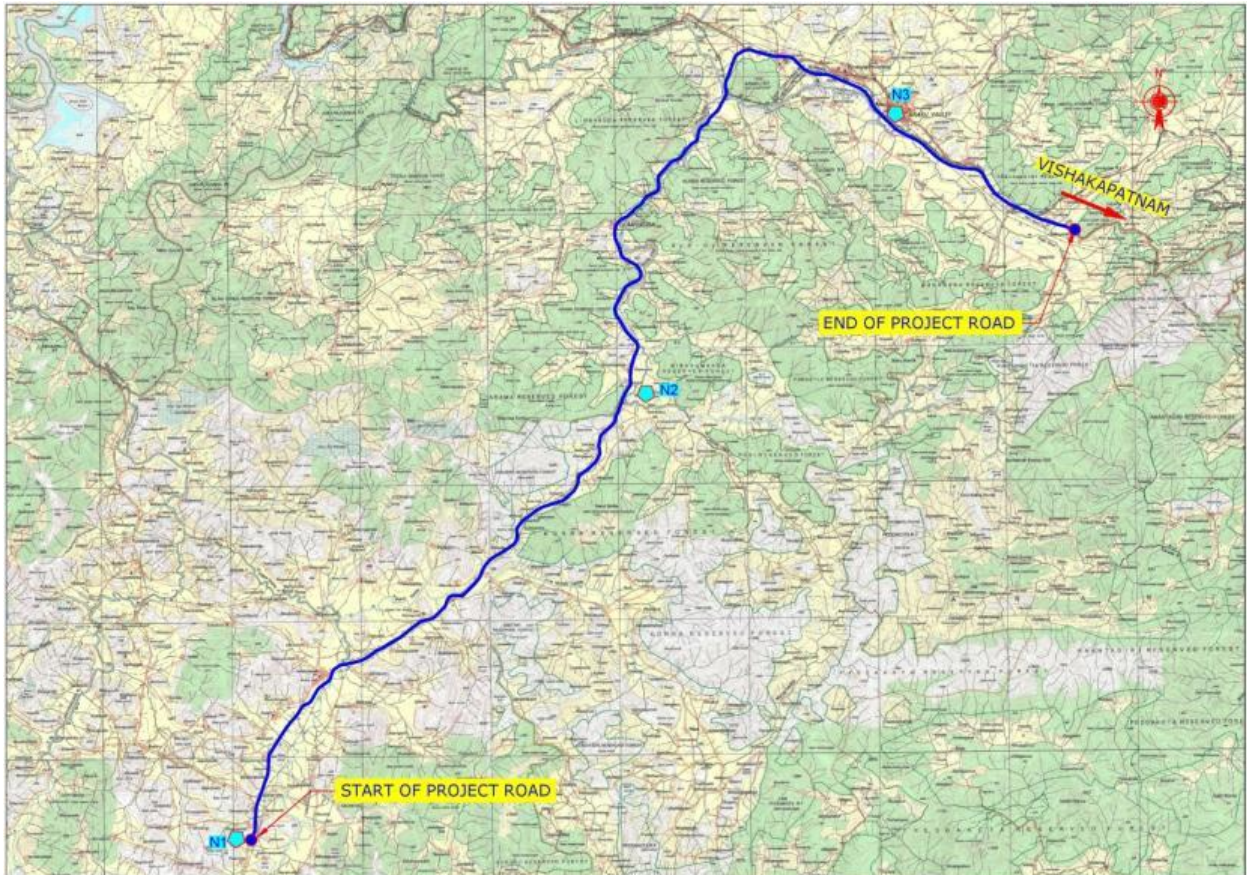


Figure 4.13: Ambient Noise levels Location Map

Day and night-time Leq have been calculated from hourly Leq values and compared with the stipulated standards (Table 4.13). Day and night time noise level at all monitored site was noted under permissible limit of CPCB. Day time noise level at Sheohar slightly exceeded from standard. This exceeded limit during day hours was due to unnecessary vehicles horn and various advertisers through amplifier.

Table 4.4.13 : Day and Night Leq in the Area

Location	Distance / Direction	Leq Day dB(A) Max	Leq Day dB(A) Min	Leq Night dB(A) Max	Leq Night dB(A) Min
Paderu	150 mts /North	66	39	36	26
Kinchumanda	120 mts /West	65	38	40	30
Araku	150 mts /South	70	48	36	52
Noise standards for Commercial Areas		65		55	

4.4.4 Soil

Soil Type in the Area

The Soil characteristics include both physical and chemical parameters. M/s. Savanth Envirotech (P) Limited field team carried out soil survey to assess the soil characteristics of the study area.

Soil Type in the Area

Soil found in the area are Red soils, sandy Loams and Sandy Clay and they constitute 96% of the total area. The soils in the along the road are predominantly loamy with medium fertility. There are mostly red loamy soils, as far as dry lands are concerned and clay loamy in case of wet lands. The soils at some places are as thick as 4 Metres. It is likely that the thick soil cover might represent alluvium along the valleys. Soil along the project area is fertile and used for paddy cultivation.

For studying the soil characteristics of the area along the project road, two samples were collected to assess the baseline soil conditions along the project road. The physical, chemical, nutrient characteristics of soil samples were determined. The samples were collected by ramming a core-cutter into the soil up to a depth of 15 cm.

Soil sampling location details are given in **Table 4.14**.

Table 4.14 : Soil Sampling Location Details

S.No	Location code	Location Name	Chainage	Latitude	Longitude
1.	S1	Paderu	0+00	N 18 ⁰ 06'01.14"	E 82 ⁰ 40'24.00"
2.	S2	Araku	39+700	N 18 ⁰ 19'55.42"	E 82 ⁰ 51'43.15"

Soil sampling locations map is shown in **Figure 4.14**.

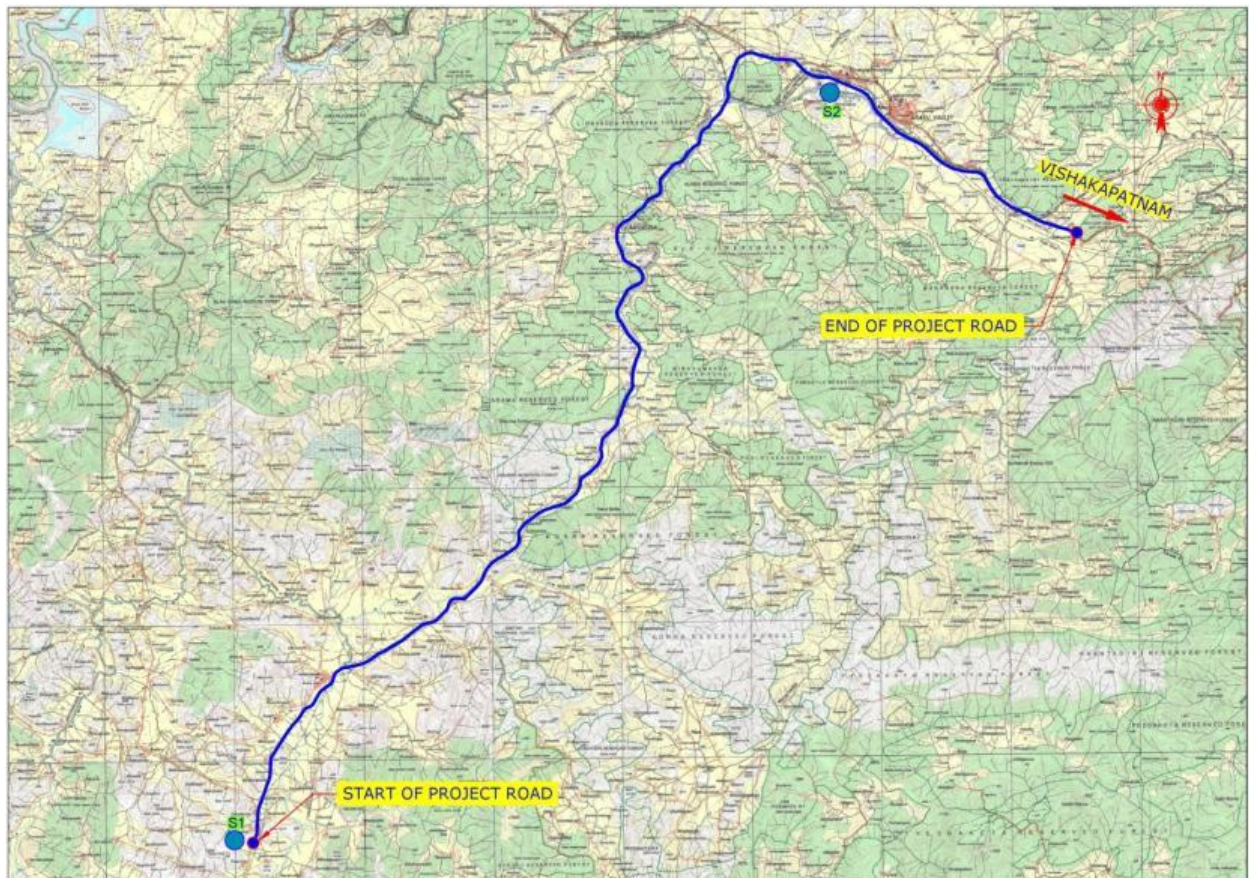


Figure 4.14 Soil Sampling Locations Map

Soil analysis results are presented in **Table 4.15** and described below:

Moisture: Moisture content of soil of the area ranges from 3.2 to 3.95 %.

Total Organic Carbon: the total organic carbon of soil the area ranges from 0.8%

Bulk Density: Bulk density of soil samples of the area ranges from 1.1 to 3.65 g/cc. Generally soils with low bulk density have favourable physical condition whereas those with high bulk densities exhibit poor physical conditions.

pH: The pH of soil of the area ranges from 7.1 to 7.45. The soil are, therefore, neutral in nature.

Electrical Conductivity: The Electrical conductivity of soil of the study area ranges from 18404 to 185 umho/cm.

Calcium: Calcium content in soil sample ranges from 21.6 to 162.4.mg/kg.

Magnesium: Magnesium content in soil sample ranges from 76 to 150 mg/kg.

Table 4.15: Soil Analysis Results

S.No	Parameters	Units	Paderu	Araku
1	pH	--	7.45	7.1
2	Electrical Conductivity	μ mhos	185	184.4
				1.12
3	Bulk Density	g/cc	1.1	3.65
4	Moisture Content	%	3.2	3.95
5	Nitrates as N	mg/kg	2	19.2
6	Phosphorous as P	mg/kg	18.2	10.5
7	Potassium as K	mg/kg	28.5	20.56
8	Sodium as Na	mg/kg	10.2	78.2
9	Calcium as Ca	mg/ kg	162.4	21.6
10	Magnesium as Mg	mg/ kg	150	0.76
11	Total Organic Carbon	%	0.8	Medium Loam
12	Type of Soil	--	Silt Loam	40
	a) Sand (%)	--	25	33
	b) Silt (%)	--	45	27
	c) Clay (%)	--	30	8.5
13	Copper as Cu	mg/ kg	10.15	12.4
14	Chromium as Cr	mg/ kg	15.45	<0.5
15	Cadmium as Cd	mg/ kg	<0.5	9.8
16	Zinc as Zn	mg/ kg	8.2	9.9
17	Lead as Pb	mg/ kg	10.25	5.1
18	Nickel as Ni	mg/ kg	6.8	25.5
19	Sulphates as SO ₄	mg/ kg	32.5	-

4.4.5 WATER QUALITY

The water quality parameters as per IS: 10500 for water resource within study area have been used for describing the water environment and assessing the impacts on it.

Based on the water sample in the study area three ground water and two surface samples were collected from the study area during the study period. These samples were taken as grab samples and were analyzed for various parameters compared with the standards for drinking water as per IS: 10500.

Samples were collected in polyethylene carboys for chemical analysis. Samples collected for metal content were acidified with 1 ml of HNO₃. Selected physico-chemical characteristics have been analyzed for projecting the existing water quality status in the study area. Parameters like temperature, Dissolved Oxygen (DO), and pH were analyzed at the time of sample collection.

The samples were collected and analyzed as per the procedures specified in "Standard Methods for the Examination of Water and Wastewater" published by American Public Health Association (APHA).

Ground water quality map of Vishakhapatnam District showing project road is presented in **Figure 4.15**.

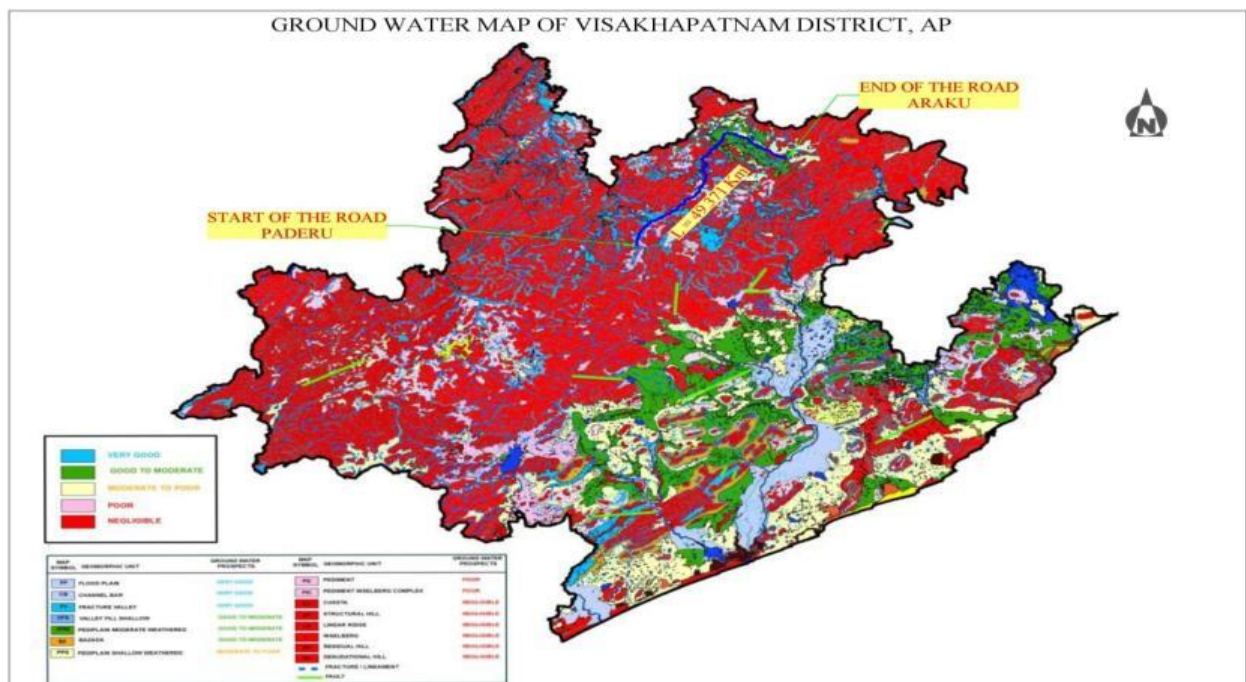


Figure 4.15. Ground Water Quality Map of the Area

Ground water monitoring locations map is shown **Figure 4.16**.

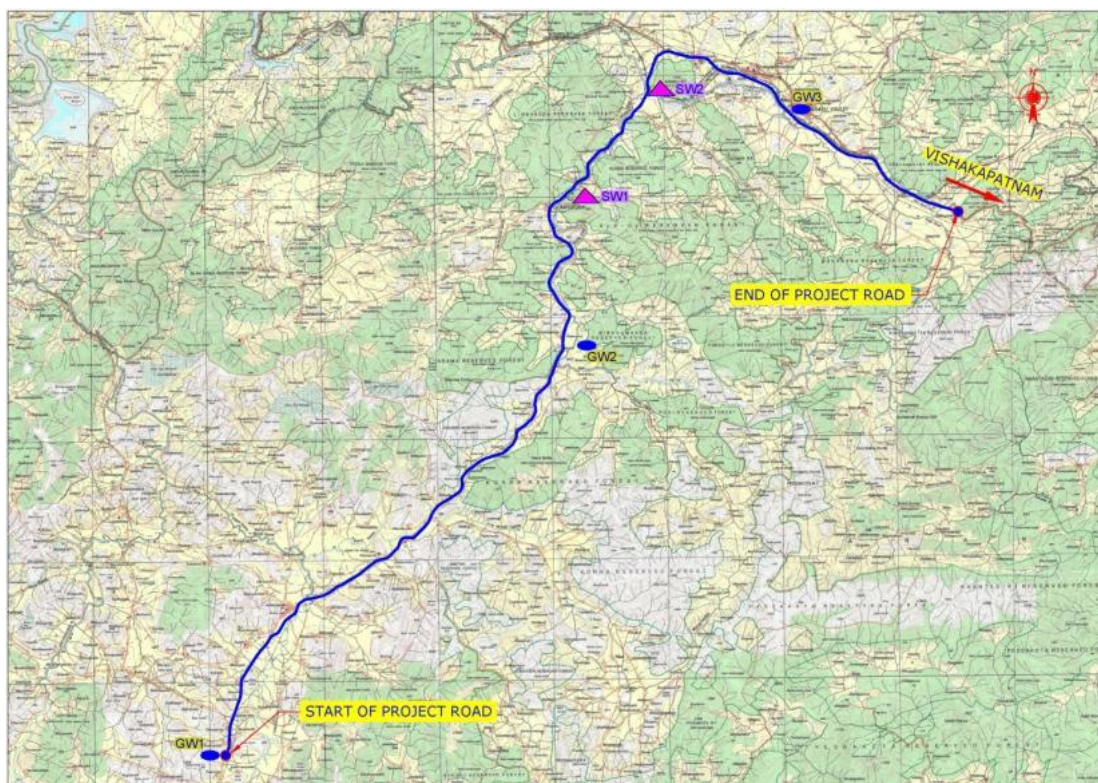


Figure 4.16. Ground water monitoring locations map

Ground and surface water sampling location details are given in **Table 4.16**.

Table 4.16 Ground and Surface Water Sampling Location Details

S.No	Location code	Location Name	Chainage	Latitude	Longitude
Ground Water					
1.	GW1	Paderu	0+000	18° 06'02.71"	82° 40' 21.75"
2.	GW2	KInchumunda	22+300	18° 14'37.96"	82° 47' 47.89"
3.	GW3	Araku	41+600	18° 19'16.43"	82° 52' 45.27"
Surface Water					
1.	SW1	Chaparai Stream	29+000	18° 17'30.98"	82° 47' 52.35"

S.No	Location code	Location Name	Chainage	Latitude	Longitude
2.	SW2	Araku Sream	3+700	18° 19'54.30"	82° 49' 32.88"

Ground Water Analysis Results are presented in **Table 4.17**.

Surface Water Analysis Results are presented in **Table 4.18**.

Table 4.17: Ground Water Analysis Results

Ground Water monitoring Details				Paderu (GW1)	Kinchumanda (GW2)	Araku (GW3)	IS 10500 Limits	
S.No.	Parameter	Method	Unit	Result	Result	Result	Acceptable	Permissible
1	pH	APHA 22nd Edition 4500	--	7.39	6.35	6.32	6.5-8.5	No Relaxation
2	Color	APHA 22nd	CU	< 1.0	< 1.0	< 1.0	5	15
3	Total Dissolved Solids	APHA 22nd Edition 2540 C	mg/l	164.5	227	514.5	200	2000
4	Total Alkalinity (as CaCO ₃)	APHA 22nd Edition 2320 B	mg/l	90	225	250	200	600
5	Total Hardness (as CaCO ₃)	APHA 22nd Edition 2340 C	mg/l	150	250	275	200	600
6	Calcium (as Ca)	APHA 22nd Edition 3500 Ca B	mg/l	36.02	60.12	68.13	75	200
7	Magnesium (as Mg)	APHA 22nd Edition 3500-Mg B	mg/l	14.58	24.3	25.51	30	100
8	Sulphate (as SO ₄)	APHA 22nd Edition 4500 SO ₄ E	mg/l	6.89	38.56	92	200	400
9	Chloride (as Cl)	APHA 22nd Edition 4500 Cl- B	mg/l	29.3	114.9	184.6	250	1000

Table 4.17: Ground Water Analysis Results

Ground Water monitoring Details				Paderu (GW1)	Kinchumanda (GW2)	Araku (GW3)	IS 10500 Limits	
S.No.	Parameter	Method	Unit	Result	Result	Result	Acceptable	Permissible
10	Lead as Pb	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
11	Cadmium as Cd	APHA 22nd Edition 3111B	mg/l	< 0.001	< 0.001	< 0.001	0.003	No Relaxation
12	Total Chromium as Cr	APHA 22nd Edition 3111B	mg/l	< 0.05	< 0.05	< 0.05	0.05	No Relaxation
13	Copper as Cu	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01	< 0.01	0.05	1.5
14	Zinc as Zn	APHA 22nd Edition 3111B	mg/l	< 0.5	< 0.5	< 0.5	5	15
15	Nickel as Ni	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
16	Fluorides as F	APHA 22nd Edition 4500 F- D	mg/l	<0.5	<0.5	<0.5	1	1.5
17	Aluminum as Al	APHA 22nd Edition 3500 Al B	mg/l	< 0.03	< 0.03	< 0.03	0.03	0.2

Table 4.17: Ground Water Analysis Results

Ground Water monitoring Details				Paderu (GW1)	Kinchumanda (GW2)	Araku (GW3)	IS 10500 Limits	
S.No.	Parameter	Method	Unit	Result	Result	Result	Acceptable	Permissible
18	Boran as B	APHA 22nd Edition 4500 B B	mg/l	< 1.0	< 1.0	< 0.2	0.2	1
19	Manganese as Mn	APHA 22nd Edition 3111B	mg/l	<0.02	<0.02	<0.02	0.1	0.3
20	Iron as Fe	APHA 22nd Edition 3500 Fe B	mg/l	0.14	0.12	0.13	0.3	No Relaxation
21	Nitrate Nitrogen	APHA 22nd Edition 4500 NO3 B	mg/l	8.1	10.1	9.5	45	No Relaxation
22	Sodium as Na	APHA 22nd Edition 3500 Na B	mg/l	20	98	125	--	--
23	Potassium as K	APHA 22nd Edition 3500 K B	mg/l	1.3	3.2	2.8	--	--
24	Odour	APHA 22nd Edition 2150 B	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
25	Electrical Conductivity	APHA 22nd Edition 2510 B	µMho/cm	265	570	957	--	--

Table 4.17: Ground Water Analysis Results

Ground Water monitoring Details				Paderu (GW1)	Kinchumanda (GW2)	Araku (GW3)	IS 10500 Limits	
S.No.	Parameter	Method	Unit	Result	Result	Result	Acceptable	Permissible
26	Phosphorus as P	APHA 22nd Edition 4500 P C	mg/l	0.2	0.28	0.26	--	--

Table 4.18: Surface Water Monitoring Results

S.No	Parameter	Method	Chaparai Stream (SW1)		Araku Stream (SW2)
			Unit	Result	Result
1	pH	APHA 22nd	--	7.76	7.45
2	Color	APHA 22nd	CU	< 1.0	< 1.0
3	Turbidity	APHA 22nd	NTU	1	1
3	Total Dissolved Solids	APHA 22nd Edition 2540 C	mg/l	145	63.8
4	Total Alkalinity (as CaCO ₃)	APHA 22nd Edition 2320 B	mg/l	455	65
5	Total Hardness (as CaCO ₃)	APHA 22nd Edition 2340 C	mg/l	115	60
6	Calcium (as Ca)	APHA 22nd Edition 3500 Ca B	mg/l	28.05	14.02
7	Magnesium (as Mg)	APHA 22nd Edition 3500-Mg B	mg/l	10.9	6.07
8	Sulphate (as SO ₄)	APHA 22nd Edition 4500 SO ₄ E	mg/l	1.12	1.45
9	Chloride (as Cl)	APHA 22nd Edition 4500 Cl- B	mg/l	19.5	7.4
10	Lead as Pb	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01
11	Cadmium as Cd	APHA 22nd Edition 3111B	mg/l	< 0.001	< 0.001
12	Total Chromium as Cr	APHA 22nd Edition 3111B	mg/l	< 0.05	< 0.05
13	Copper as Cu	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01
14	Zinc as Zn	APHA 22nd Edition 3111B	mg/l	< 0.5	< 0.5

S.No	Parameter	Method	Chaparai Stream (SW1)		Araku Stream (SW2)
			Unit	Result	Result
15	Nickel as Ni	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01
16	Fluorides as F	APHA 22nd Edition 4500 F- D	mg/l	<0.5	<0.5
17	Aluminum as Al	APHA 22nd Edition 3500 Al B	mg/l	< 0.03	< 0.03
18	Boran as B	APHA 22nd Edition 4500 B B	mg/l	< 1.0	< 1.0
19	Manganese as Mn	APHA 22nd Edition 3111B	mg/l	<0.02	<0.02
20	Iron as Fe	APHA 22nd Edition 3500 Fe B	mg/l	0.18	0.21
21	Nitrate Nitrogen	APHA 22nd Edition 4500 NO3 B	mg/l	18.2	21.2
22	Chemical Oxygen Demand	APHA 22nd Edition 5200 B	mg/l	12	20
23	BOD	IS3025(Part-44)2009	mg/l	<2.0	7.2
24	Sodium as Na	APHA 22nd Edition 3500 Na B	mg/l	10.5	2.48
25	Potassium as K	APHA 22nd Edition 3500 K B	mg/l	2.2	1
26	Total Suspended solids	APHA 22nd Edition 2540D	mg/l	9.2	9.8
27	Dissolved Oxygen	APHA 22nd Edition 4500 O C	mg/l	5.4	5.1
28	Oil & Grease	APHA 22nd Edition 5520 OB	mg/l	<1.0	<1.0
28	Electrical Conductivity	APHA 22nd Edition 2510 B	µMho/cm	203	97

S.No	Parameter	Method	Chaparai Stream (SW1)		Araku Stream (SW2)
			Unit	Result	Result
29	Phosphorus as P	APHA 22nd Edition 4500 P C	mg/l	0.21	0.11
31	Total Coliforms	IS1622	MPN/100ml	60	52
32	E-Coli	IS1622	MPN/100ml	4	5

4.4.6 HAZARD AND VULNERABILITY PROFILE

The Hazard and Vulnerability profile of the project region which includes wind hazards, earth quake hazards, flood hazards. Hazards are summarized hereunder.

WIND HAZARD

As per wind hazard map of Andhra Pradesh, the project road traverses in high damage risk zone for 80% of length and remaining 20% length in moderate zone. The wind hazard map along the project road is shown in Error! Reference source not found..

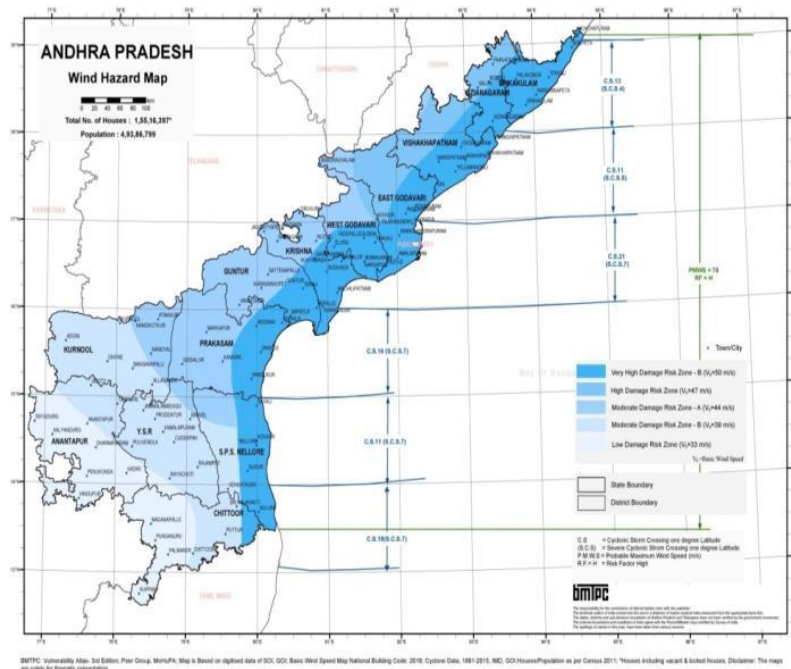


Figure 4.4.6.17: Wind Hazard Map

FLOOD ZONES

Flood Zone map of Andhra Pradesh is shown in Figure 4.18.

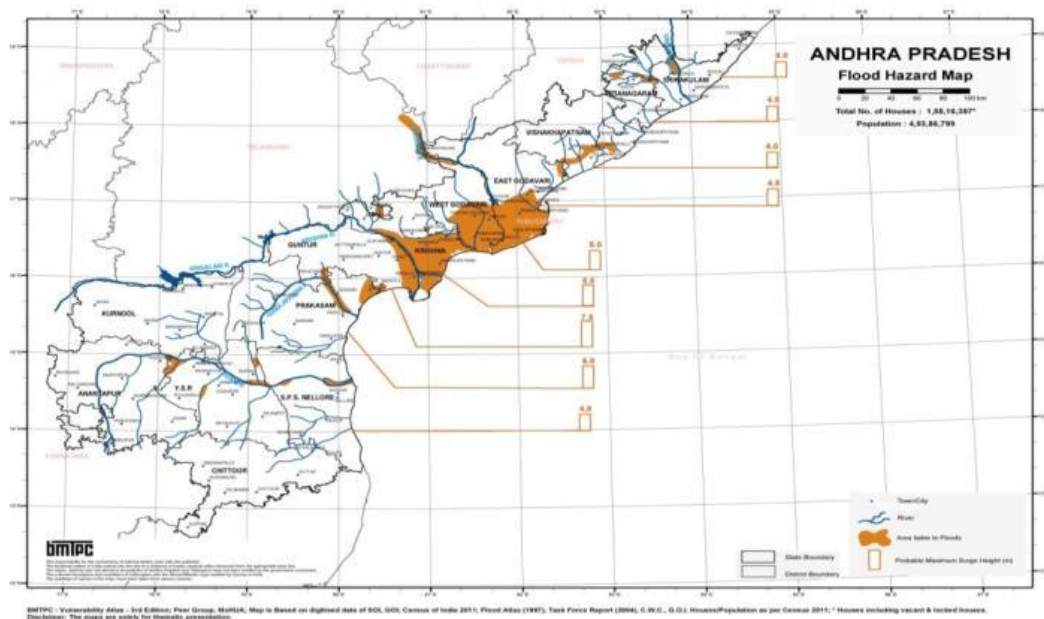


Figure 4.4.6.1 Flood Hazard Map

EARTHQUAKE ZONES

In general, India is divided into 4 seismic zones (II, III, IV, V); Zone -II being the least active seismic zone, whereas Zone-V is the highest seismic zone as given in **Table 4.4.6** The project road falls under Zone - IV, which is at High risk and warrant earthquake resistant designs for structures. The earthquake hazard map along the project road is shown in Figure 4.4.6..

Table 4.4.6.19: Earthquake Zones of India

Zone	Intensity
Zone - V	Very High risk - Intensity IX
Zone -IV	High risk - Intensity VIII
Zone - III	Moderate risk - Intensity VII
Zone - II	Low Damage Risk - Intensity VI
Zone - I	Not in Use

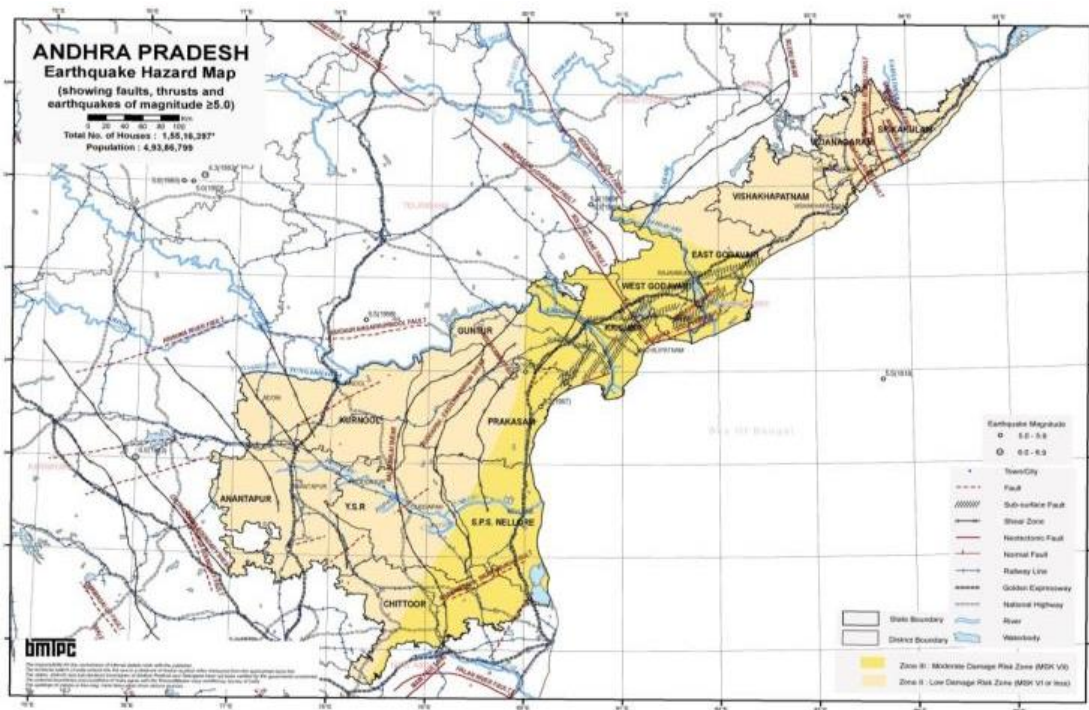


Figure 4.4.6.19: Earthquake Hazard Map

VULNERABILITY STATUS OF PROJECT

The Overall vulnerability of the project road can be stated as moderate. List of various hazards and Vulnerability status along the project road are given in

Table 4.4.6-.

Table 4.4.6-20: Over all Vulnerability of Project road

S.No	Name of Road	District	Hazards		
			Earthquake	Flood	Vulnerability
1	Paderu-Araku	Visakhapatnam	Zone-II	-	High

4.5 SOCIO-ECONOMIC ENVIRONMENT

With the geographical area of 1, 62,760 Sq km Andhra Pradesh ranks as the 8th largest State in the country. Situated in a tropical region, the state has the 2nd longest coastline in the country with a length of 974 km. The State has a forest area of 34,572 Sq km as per the forest records, which accounts for 21.58% the total geographical area. Andhra Pradesh is the tenth largest state in the Country, in terms of population. As per 2011 Census, the State accounts for 4.10% of the total population of the country. The demographic profile of Visakhapatnam district is summarized in Table and **Table 4.21:**

Table 4.21: Geographical Area and Population of Project District

Sl. No.	District	Area in sq.	Population	No. of HHs
1	Visakhapatna	1116	4290589	1097042
Andhra Pradesh		1,62,760	84580777	21022588

Source: Final Population Tables, Census of India, 2011.

4.5.1 Demographic Features of the Project District – Visakhapatnam

Demographic Profile

Demographic profile has an important bearing on the development process. According to the 2011 Demographic profile has an important bearing on the development process. According to the 2011 census, the total population of Visakhapatnam district is around 42.90 lakhs. The proportion of urban population is 47.45% in Visakhapatnam district. The number of households in Visakhapatnam district is 1097042 of which around 52.82 percent are in Rural area and the remaining 47.18 percent are in Urban areas. The average household size is 3.91 in Visakhapatnam district. The Sex ratio is 1006 in total. The proportion of SC population is around 7.68 percent. The ST population in Visakhapatnam district is around 14.42 percent. The basic demographic details are presented in below Table 4.22.

Table 4.22: Demographic profile of Visakhapatnam District of Andhra Pradesh

Descriptio	Total	Rural	Urban
No. of Households	1097042	579417	517625
Population	Persons	4290589	2035922
	Males	2138910	1025676
	Female	2151679	1010246
Sex ratio (Females per 1000)	1006	1025	985
Proportion of SC Population (%)	7.68	6.74	8.72
Proportion of ST Population (%)	14.42	25.72	1.89

Source: Primary Census Abstract, Census of India, 2011

Table 4.23: Demographic profile of settlements along the Project Road

S.NO	Name	TRU	No_HH	TOT_P	TOT_M	TOT_F	P_SC	P_ST
Paderu Mandal Visakhapatnam District of A.P								
1	Burmanguda	Rural	57	190	89	101	0	174
2	Hukumpeta	Rural	470	2408	1212	1196	36	1722
3	Chatraiputtu	Rural	92	352	152	200	0	341
4	Kinchumanda	Rural	400	2141	1293	848	3	2016
5	Kusumavalasa	Rural	58	241	109	132	0	240
6	Dumbriguda	Rural	280	1795	812	983	17	1692
7	Antriguda	Rural	45	187	88	99	0	185
8	Araku	Rural	574	2279	1086	1193	6	1682
9	Kantabamsuguda	Urban	1433	6714	3921	2793	180	4313

Source: Census 2011

Literacy

The literacy rate of Visakhapatnam district as per 2011 census is around 59.86 percent. It is observed that the literacy rate of male in both Rural and urban areas are higher as compared to female literacy rate in the district. A variation across the rural and urban areas and the gender gap in literacy for the project district is presented in the following **Table 4.24**

Table 4.24 : Gender wise Literacy Rate in Visakhapatnam District of Andhra Pradesh

Literacy Rate %	Tota	Rura	Urban
Persons	59.8	47.5	73.48
Males	66.5	55.5	78.43
Females	53.2	39.7	68.46
Gender gap in literacy	13.2	15.8	9.98

Source: Primary Census Abstract, Census of India, 2011

4.5.2 Work Participation

The occupational classification as per 2011 Census shows that the percent total workers in Visakhapatnam district account for 44.05 percent of total population of the district. The proportion of main workers to total population in Visakhapatnam district is around 34.52 percent. Out of the total main workers, male main workers accounted for 49.08 percent and female main workers are around 20.05 percent. Of the remaining total population, around 9.53 percent are marginal workers. It can be seen from the below table that, in the project district that nearly 55.95 percent of the total population are non-workers. The details across gender are presented in the following **Table 4.25**.

Table 4.25 : Percentage of Workers and Non-Workers in Visakhapatnam District

Description	Total	Mal	Female
Work Participation Rate	44.05	57.9	30.25
Proportion of Main Workers	24.52	40.0	20.05
Proportion of Marginal Workers	0.5	0.0	10.20
Proportion of Non Workers	55.95	42.0	69.75

Source: Primary Census Abstract, Census of India, 2011

4.5.3 Occupation Profile

The occupation classification in Visakhapatnam district shows that, out of the total main workers, cultivators comprising (19.23 Percent), Agricultural Labourers (25.42 percent), Household Industries workers (2.55 percent) and other workers (52.80 percent). **Table 4.26** below gives the details of the occupation across gender.

Table 4.26 : Occupation profile of Visakhapatnam District

Occupation	Total	Mal	Female
Cultivators	19.2	17.3	23.84
Agricultural labourers	25.4	20.1	38.36
Household Industries	2.5	2.2	3.2
Other workers	52.8	60.2	34.60

Source: Primary Census Abstract, Census of India, 2011

4.5.4 COMMON PROPERTIES/SENSITIVE RECEPTORS ALONG THE ROAD

As per Environmental point of view, there exists some sensitive receptor like temples, schools, tombs, tanks, wells etc., The following are the common properties that are affected along the project road. Apart from these there exist 5 ponds in the proposed right of way of the project road. Common Property Resources are given in **Table 4.27**.

Table 4.27: Common Property Resources

Common Property Resources				
S.No	Item	Left	Right	Total
1	Temple	4	2	6
2	Well	4	4	8
3	Bore well	6	1	7
4	Toilet	7	12	19
5	Water Tap	5	13	18
6	Tank	1	3	4
7	Tomb	6	4	10
Total		33	39	72

4.5.5 UTILITY SHIFTING

Different types of existing utility services like Optical Fibre Cables (OFC), Electric poles, Transformers, Telephone poles are existing which shall be affected during implementation stage and may require shifting for construction of proposed carriageway. The summary of existing utilities is in the **Table 4.28**.

Table 4.5.5.28: Summary of Existing utilities along the existing alignment

S.No	Description	Unit	Quantity
1	Shifting of Hand pump	Nos.	8
2	Shifting of Transformer	Nos.	7
3	Shifting of Telephone Pole	Nos.	17
4	Shifting of Electric Pole	Nos.	220
5	Optical Fibre Cable	Running mt	70

CHAPTER 5

ANTICIPATED ENVIRONMENTAL IMPACTS

5.1. Environmental Impacts & Issues

This section presents identification and evaluate of anticipated impacts during pre-construction, construction and operation phases of the two lane upgradation with paved shoulders of Paderu- Araku (up to Bhalluguda) Section of NH-516E in Andhra Pradesh. The planning of the proposed project intervention points towards the impacts in the pre-construction, the construction stages and the operation stages. The subsequent sections deal with the prediction of impacts due to the project on the physical, biological and socio & cultural environment **Tables 5.1** and **5.2** below presents the general environmental impacts expected due to the proposed up-gradation of the project road. Environmental impacts have been assessed based on the information collected from the project activities as per DPR, screening & scoping of environmental attributes, and baseline data collected during the EIA study. The quantum of anticipated impacts on physical, biological and socio-economic environment has been discussed in details in subsequent paragraphs.

5.2 Impacts on Topography, Physiography and Geology

Construction Phase

The two lane upgradation with paved shoulders of Paderu- Araku (up to Bhalluguda) Section of NH-516E is traversing mostly through plain territory. Therefore, no significant cutting and filling activity will be involved in existing alignment of the project road.

The proposed up-gradation of the project road will be confined along the existing alignment except two bypasses (Hukumpet Bypass and Araku Bypass) and 12 realignments in the length of 15772 m. The design has not suggested any substantial change in the height of the embankments of the existing alignment. However, for construction of two bypasses (Hukumpet Bypass and Araku Bypass) and 12 realignments at Paderu- Araku (up to Bhalluguda) Section of NH-516E, earth filling will be required for embankment for new road construction. The overall topography of the area is not going to alter due to minor changes in geometry & profile and two realignments construction.

Table 5.1 : Anticipated Impacts on Physical & Biological Environment

Project Activity	Planning and Design Phase	Pre-construction Phase		Construction Phase					Road Operation
		Removal of Old Structures	Removal of trees and vegetation	Earth works including and borrow area	Laying of pavement	Vehicle & Equipment operation & maintenance	Asphalt & crusher plants	Sanitation & Waste (labour campus)	Vehicle operation
Air		Dust generation during dismantling	Reduced buffering of air pollution, Hotter, drier microclimate along the road	Dust generation	Asphalt odour and emissions	Dust, Pollution	Soot, Odour, gaseous Dust, Pollution	Odour / Smoke from Cooking of food	dust, vehicular emissions
Land	Impact on productive land if land acquisition required	Generation of debris	Erosion and loss of top soil	Erosion and loss of top soil	Land contamination due to improper disposal of bitumen waste/ solid wastes	Contamination by fuel and lubricants and compaction	Contamination and compaction of soil at camp & Plants	Contamination from Wastes and sewage	--
Water	Impact on Water Sources	Siltation due to loose earth	Siltation due to loose earth	Alteration of drainage, Break in continuity of ditches Siltation,	Reduction of ground water recharge area	Contamination by fuel and lubricants	Contamination by asphalt leakage or fuel	Contamination from wastes and untreated	Spill Contamination by fuel, lubricants and washing of vehicles

Project Activity	Planning and Design Phase	Pre-construction Phase		Construction Phase					Road Operation
				Stagnant water pools in quarries and borrow area.				sewage disposal	
Noise		Noise Pollution	High Noise due to machinery	Noise Pollution	Noise pollution	Noise pollution	Noise Pollution	--	Noise from traffic movement
Flora	Tree cutting		Loss of Biomass and vegetation cover due to Removal of vegetation	Lowered productivity loss of ground for vegetation	--		Lower productivity Use as fuel wood	Felling trees for fuel	Compensatory plantation and road side plantation

Table 5.2: Anticipated Impact on Social and Cultural Environment

Project Activity	Planning and Design Phase	Pre Construction Phase			Construction Phase					Operation	
		Land acquisition	Removal of Structures	Removal of trees & vegetation	Earth works including quarrying	Laying of Pavement	Vehicle & machine operation & maintenance	Asphalt and crusher plants	Labour Camps	Vehicle operation	Indirect Induced development
Env. Component Affected	Design decisions & Implementation policies	Land acquisition	Removal of Structures	Removal of trees & vegetation	Earth works including quarrying	Laying of Pavement	Vehicle & machine operation & maintenance	Asphalt and crusher plants	Labour Camps	Vehicle operation	-
Agricultural land	-	Change in land prices	Change in land economic value	Loss of standing crops	Loss of productive land	-	-	Dust on agricultural land reduce n productivity	-	-	Conversion of Agricultural Land
Buildings and built structures in ROW	-	-	Loss of structures, Debris generation, Noise and Air pollution	-	Dust Deposition on structures	-	Noise, vibration may cause damage to structures near to road	Dust accumulation on building and structure	-	Vibration and noise	Change in building use and characteristics
People and Community	Impact on near by community structure,	-	Impact on people and loss of livelihood	Loss of shade & community tree.	Health hazard to people	Odour and dust	Noise and Air pollution and discomfort	Air and noise pollution and discomfort	Community clashes with migrant labour	Risk of accident due to increase in speed on smooth carriageway	Induced pollution and increase in accident rate

Project Activity	Planning and Design Phase	Pre Construction Phase			Construction Phase					Operation	
										Direct	Indirect Induced development
Cultural Assets	-	Impact on access to cultural structure	Displacement loss of structure from RoW	--	--	-	--	Dust accumulation	-	Damage from vibration & air pollution	-
Utilities and Amenities	-	-	Interruption in supply	-	-	-	Damage to utility and amenities	Dust accumulation on water bodies	Pressure on existing amenities		-
Labour's Health & Safety	-	-	-	-	Stagnation of water and disease	Asphalt odour and dust	Accident and injuries to labour/public	Impact on health due to inhale of dust	Health hazard from raw sewage disposal/wastes	Road safety issues	-

During construction of the project, following environmental impacts are anticipated on topography and physiography:

- minor changes are anticipated in existing profile of the land due to borrow pits and construction of re-alignments and improvement of sharp curb.
- disturbance on geological setting due to quarrying.
- uncontrolled digging of borrow pits resulting in water accumulation & breeding of vector disease.
- construction of embankments for realignments,
- debris disposal,
- construction of diversions roads for construction of bridge and culverts.

Physiographic impacts could be due to the construction of the embankments of two bypasses (Hukumpet Bypass and Araku Bypass) and 12 realignments at Paderu- Araku (up to Bhalluguda) Section of NH-516E and improvement of sharp curbs. The height and width of the embankment will be altered, when the road is widened and rehabilitated as per the new design for the project road.

In most of the stretch along the project road, project will stick to the existing ROW without any noticeable changes.

Borrow earth will be required in the project road for filling and will be obtained from several borrow areas to be opened in the nearby areas or from the existing approved borrowing areas. Except the construction of embankments, there would not be any other impacts to geomorphology of the area during construction stage.

Most of the excavated materials from existing roads will be left reused as construction materials. If not used, contractor may dispose of this in the nearby areas causing untidiness near disposal areas. Therefore, this is seen as a potential impact. It may increase soil erosion and could generate considerable impacts on natural drainage courses, and siltation to runoff during rains.

Likely impact on the geological resources will occur from the extraction of construction materials like borrow of earth, granular sub-base and aggregates for base courses, culverts and bridges.

Operational Phase

Upgradation and widening of the project road will not cause any topographic, physiographic and geological changes during operational stage.

5.3 Impact on Seismological Characteristics

The project road is located in seismic zone II as per BIS classification with low seismic risk. All cross-drainage structures and bridges on the project roads need to consider the seismic coefficients with regards to the seismic energy propagation along the fragile geological/lithological strata.

The construction and operation phase of the project road are not expected to add the seismicity issues due to the project road.

5.4 Impact on Soil

Construction Phase

Soil Erosion: Erosion of top-soil can be considered a moderate, direct and long-term negative impact resulting from the construction of existing road and two bypasses (Hukumpet Bypass and Araku Bypass) and 12 realignments at Paderu- Araku (up to Bhalluguda) Section of NH-516E. The potential for soil erosion is pervasive during the construction stage, especially in realignment and earth work on the existing alignment. Starting with clearing and grubbing, vegetation will be stripped away, exposing raw soil. Earth works and embankment will also prone to erosion during rains.

Road Slopes and Spoils: Erosion problems may occur on newly constructed slopes and earth fills in realignments depending on soil type, angle of slope, height of slope and climatic factors like wind (direction, speed and frequency) and rain (intensity and duration). Soil erosion will add siltation to the runoff during the monsoon season.

Construction of New Bridges and Culverts: Along the project road reconstruction/widening of bridges and culverts is planned. Major bridge at four locations and minor bridge at 18 locations, while 128 box culverts are proposed to be constructed in the proposed project. Construction of bridges involves

excavation of natural water channels bed and banks for the construction of the foundation and piers. If the residual spoil is not properly disposed of, increased sedimentation in downstream of the bridge may take place during the monsoon. Also, the bridge-end fills require armouring to ensure minimum gullying and slumping.

During the construction period, some amount of drainage alteration and downstream erosion/siltation is anticipated. Some of these alterations may be because of construction of temporary traffic detours/diversion. Except for these temporary works, in almost all cases there should be an improvement in the drainage characteristics of the surrounding area due to improved design and added culvert/ditch capacity. Changes in the drainage pattern due to the raising of the road profile has not been discussed in specific cases, as the likely impact will not adverse and does not warrant mitigation as the road design itself takes care of cross drainage.

Quarries and Borrow Areas: The excavation of quarries and borrow pits used for obtaining aggregate materials and soil for road construction can cause direct, and indirect long-term major adverse impacts on the environment. While loss of productive soil is the most direct negative impact from borrow areas, other significant indirect negative impacts can also occur. Since most of the construction materials would be available from existing quarries nearby, relatively few new borrow areas may be required. One of the long-term residual adverse impacts of borrow pits not reclaimed, is the spread of mosquitos. Mosquitoes breeding and multiplying in stagnant water that collects in these pits can affect human health in villages in close vicinity.

Generation of Debris: The major source of debris generation is dismantling of existing cross drainage structures, scarifying of bitumen from carriageway and removal of existing road for upgradation.

Contamination of Soil: In this project, contamination of the soil may take place, from the following activities at the construction zones, construction labor camps, construction plant sites and other auxiliary facilities required for the construction. Details of the activities from which the contamination can occur are presented below:

- Scarified bitumen wastes,
- Debris generation due to dismantling of structures,

- Runoff from muck disposal area,
- Maintenance of the machinery and operation of the diesel generator sets on site,
- Oil spill from the operation of the construction machineries, maintenance and diesel storage and diesel generator sets,
- Spillage bitumen from operation of hot mix plant,
- Wastes from the residential facilities for the labour and officers at camp site, and
- Storage and stock yards of bitumen

Operation Phase

No significant impact is anticipated on soil along the road during operational phase.

5.3. Water Environment

5.3.1 Water Resource - Impacts

A. Surface Water -Impacts

The project roads are crossing natural streams at 25 locations, which remain dry in non-rainy days. There is no perennial river crossed by the project roads. No potential impact is anticipated on surface water bodies during the pre-construction phase.

Construction Phase

Estimated water requirement will be 30 to 40 kl per day per kilometre. Depending on the source of water there could be minor depletion of water sources due to the construction water requirements.

Operation Phase

During operation phase, no impact is anticipated on surface water resources.

B. Ground Water - Impacts

Construction Phase

Along the project road, ground water resources are available and ground water will be exploited through mostly from tube wells, where surface water sources are not available. Therefore, the eventual impact of the proposed upgradation of the project road will be negated to a considerable extent.

Operation Phase

During the operation phase, ground water resource will not be affected significantly. Therefore, no significant impact is anticipated during operation phase. However, rainwater harvesting will be provided along the project road in unpopulated areas.

5.3.2 Water Quality - Impacts

A. Impact on Surface Water Quality

Degradation of surface water quality due to sediment transport with runoff through erosion of soil and earth may occur from activities like removal of trees, clearing and grubbing, removal of grass cover, excavation, stock piling of materials as part of the pre-construction and construction activities. The soil type present along the project corridor consists of the loamy/silty soil, which are prone to erosion. The impacts due to increased sediment laden run-off will make the water more turbid. This is a significant negative impact on the water bodies/flowing streams. Heavier sediment may smother the algae growing in the lower strata and could completely alter the nature of the watercourse. Excessive sediment loads may also mean disruption to areas of fish breeding/aquatic life.

Contamination of Surface Water - The degradation of the surface to a much less extent ground water quality can occur from pavement construction works, bridges construction works, construction plants, machinery and accommodations of workers. The sources of water pollution from the construction activities are as follows:

- Water flow from scarified bitumen materials,
- Rain-water flow from muck disposal area,
- From the foundation works of the bridges and culverts such as piling and excavation for open/well foundations,
- Oil spills from the maintenance of the machinery and operation of the diesel generator sets on site,
- Oil spill from diesel storage and parking places,
- Operation of the emulsion sprayer and laying of hot mix,
- Discharge of sewage and waste from labour and plants,
- Storage and stock yards of bitumen and emulsion.

Degradation of water quality is also possible due to accidental discharges into water-courses from drainage of workers camps and from spillages from vehicle parking and/or fuel and lubricant storage areas.

Operation Phase

During normal operation phase, no impact is anticipated on the surface water quality.

B. Impact on Groundwater Quality

No impact is anticipated on ground water during pre-construction phase.

Construction Phase

- During construction phase, ground water quality can be affected due to following reason:
- Spillage of diesel, lube oil and used oil could lead to ground water pollution in long term and can affect ground water quality.
- Leached water from scarified bituminous waste materials entering into ground.
- Disposal of solid wastes, used POL wastes, oil contained cotton wastes in non-environmentally sound manner and leaching to ground water.

Operational Stage

During the normal operation phase, no impact is anticipated on the ground water quality of the area.

C. Floods Related Impacts

Pre construction phase impacts

The natural drainage channels are located at 25 locations, and at 128 culvert locations. Pre-construction activities such as tree removal and clearing and grubbing will not lead to any flood related impacts.

Construction Phase

During construction phase, the project activities are unlikely to create localized flood related issues. Nevertheless, various construction activities could temporarily worsen the flooding problem due to improper drainage conditions on account of the contractor's poor engineering practices and negligence. If the high intensity rainfall continues for many days a number of sections along the project road could develop flooding situation.

Operation Phase

During operation phase, flood related impacts would not be appeared as culverts and cross drainage structures will be reconstructed/ constructed and widened to maintain proper drainage. Therefore, no flood related impact is anticipated during operation phase.

5.4 Impact on Air Environment

Construction Phase

During construction phase, there will be two main sources of air emissions *i.e.* mobile sources and fixed sources. Mobile sources are mostly vehicles involve in construction activities while emissions from fixed sources include diesel generator set, construction equipment and excavation/grading activities those produce dust and gaseous emissions.

Certain amount of dust and gaseous emissions will be generated during the construction phase from excavation machines and road construction machines. Pollutants of primary concern include Particulate Matter (PM_{2.5}) and Particulate Matter (PM₁₀). However, suspended dust particles may be coarse and will be

settled within a short distance from construction area. Therefore, anticipated impact on ambient air quality will be temporary and restricted within the closed vicinity of the construction activities along the project road only.

Considerable amount of emissions of carbon monoxide (CO), unburned hydrocarbon, sulfur di-oxide, particulate matters, nitrogen di-oxide (NO₂), etc, will be generated from the hot mix plant and may cause air pollution problem in nearby areas.

Summarily, generation of dust is likely due to:

- Site clearance and use of construction vehicles and machinery, etc.
- Transport of raw materials, borrow and quarry materials to construction sites,
- Earthworks,
- Stone crushing operations at the crushers,
- Handling and storage of aggregates at the asphalt plants,
- Concrete batching plants, and
- Asphalt mixing plants due to mixing of aggregates with bitumen.

Generation of dust is a critical issue and is likely to have adverse impact on health of workers and vegetation in surrounding areas. Generation of exhaust gases is likely due to movement of heavy machinery for clearance of the RoW for construction. High concentration of HC and NO_x are likely from hot mix plant operations. Toxic gases are released through the heating process during bitumen production. Although the impact will be much localized, it can be dispersed downwind depending on the wind speeds.

Air Pollution Modelling for Construction Phase

During the construction phase, the activities related to earthwork/rock excavation, borrow area operations, transport of material, storage and handling of construction material, quarrying and/or stone crushing operations, movement of construction vehicles on unpaved roads, Hot-mix plant, handling of cement in batching plants, among others would contribute to the increased dust levels in terms of PM 10, PM 2.5, and other air pollutants like SO_x, and NO_x, and carbon monoxide levels.

The maximum concentration of PM10 predicted is 4.21 µg/m³. PM10 values are varying between 0.4 to 4.21 µg/m³ in the surrounding areas of the proposed road project stretch. When compared with the National Ambient Air Quality Standard (NAAQS) of 100 µg/m³ for 24 hour, predicted values are well below the prescribed standard limit at all of the places near the road project stretch.

The maximum concentration of PM2.5 predicted is 6.98 µg/m³. PM2.5 values are varying between 0.6 to 6.98 µg/m³ in the surrounding areas of the road project stretch. When compared with the National Ambient Air Quality Standard (NAAQS) of 60 µg/m³ for 24 hour, predicted values are well below the prescribed standard limit at all of the places near the road project stretch. The predicted 1st high 8 Hour values of CO are varying from place to place in Paderu –Araku road project road stretch. The maximum concentration of CO predicted is 582 µg/m³. CO values are varying between 300 µg/m³ to 582 µg/m³ in the surrounding areas of proposed road stretch. When compared with the National Ambient Air Quality Standard (NAAQS) of 4 mg/m³ (4000 µg/m³) for 8 hour, predicted values are well below the prescribed standard limit near the project corridor.

The predicted concentrations of PM10, PM2.5 and CO are found to be well below the NAAQ standards at all of the places. It is already suggested in EMP to go for avenue plantation on either side of the proposed project road and median plantation. This will further reduce the concentration of PM & CO.

In the existing scenario, due to lesser width and higher roughness, the average vehicle speed is low, which results in more exhaust gas emissions. In the post-project scenario, improved road conditions and congestion free traffic movement will reduce emissions.

Furthermore, lower growth of traffic and better road conditions with improved average speed, which constitutes about 95% of the total project road length, will not have any significant increase in concentration of PM and CO even after 20 years of operation, subject to regular maintenance of the road condition and maintaining the average speed of traffic.

However, in Paderu – Araku road project, the emissions will increase significantly due to increase in traffic density. The Isopleths of PM10, PM2.5 and CO concentration along the project stretch are given below in Figures.

The Isoleths of PM₁₀, PM_{2.5} and CO concentration along the project stretch are given below in **Figures 5.1, 5.2** and **5.3**.

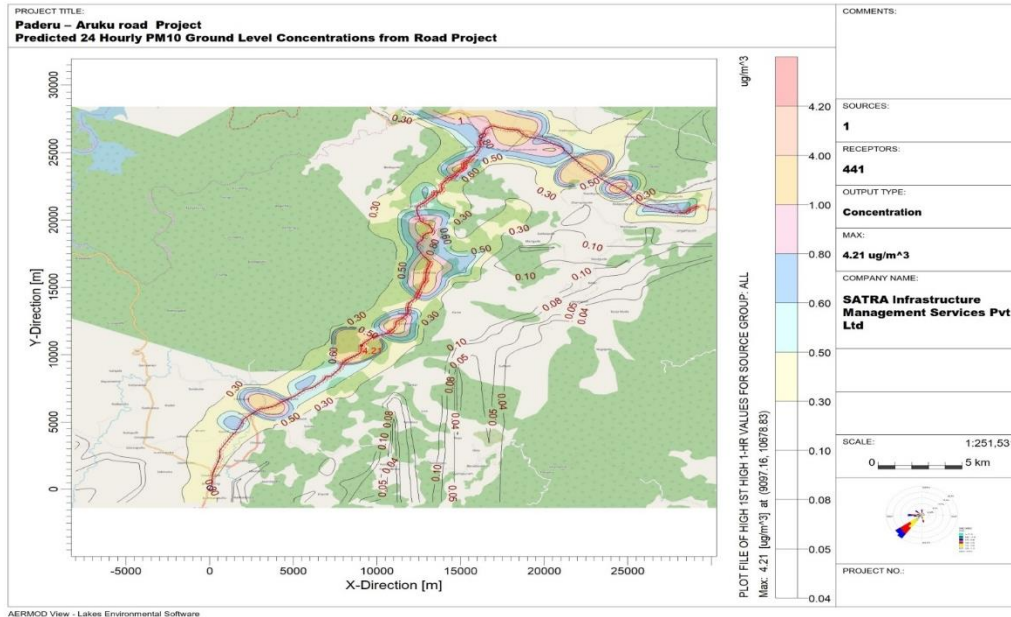


Figure 5.1: Isoleths Showing 24 Hourly GLC's for PM₁₀

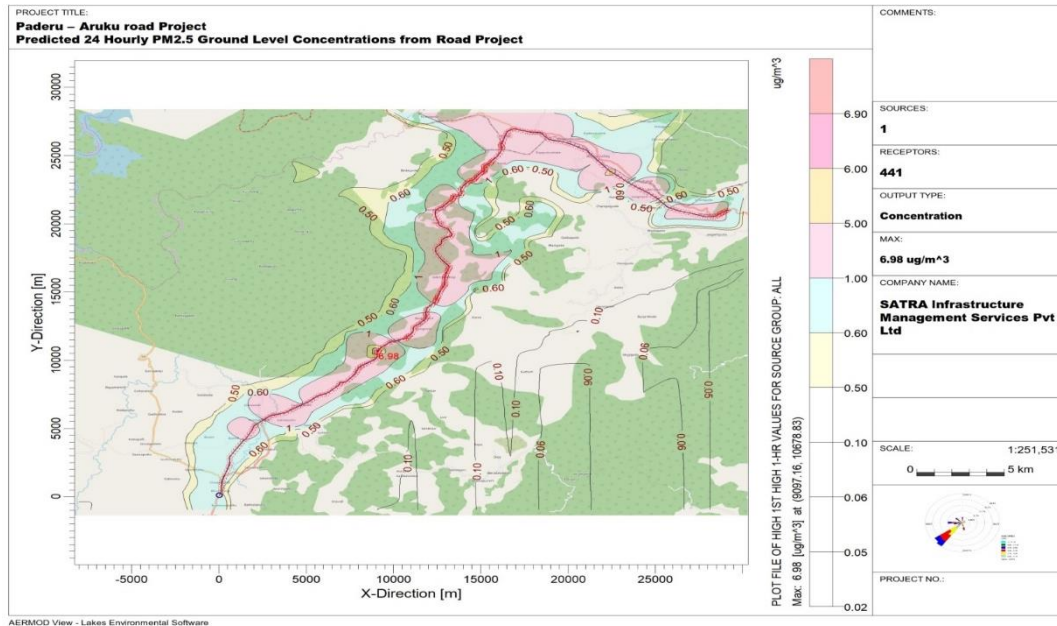


Figure 5.2: Isoleths Showing 24 Hourly GLC's for PM_{2.5}

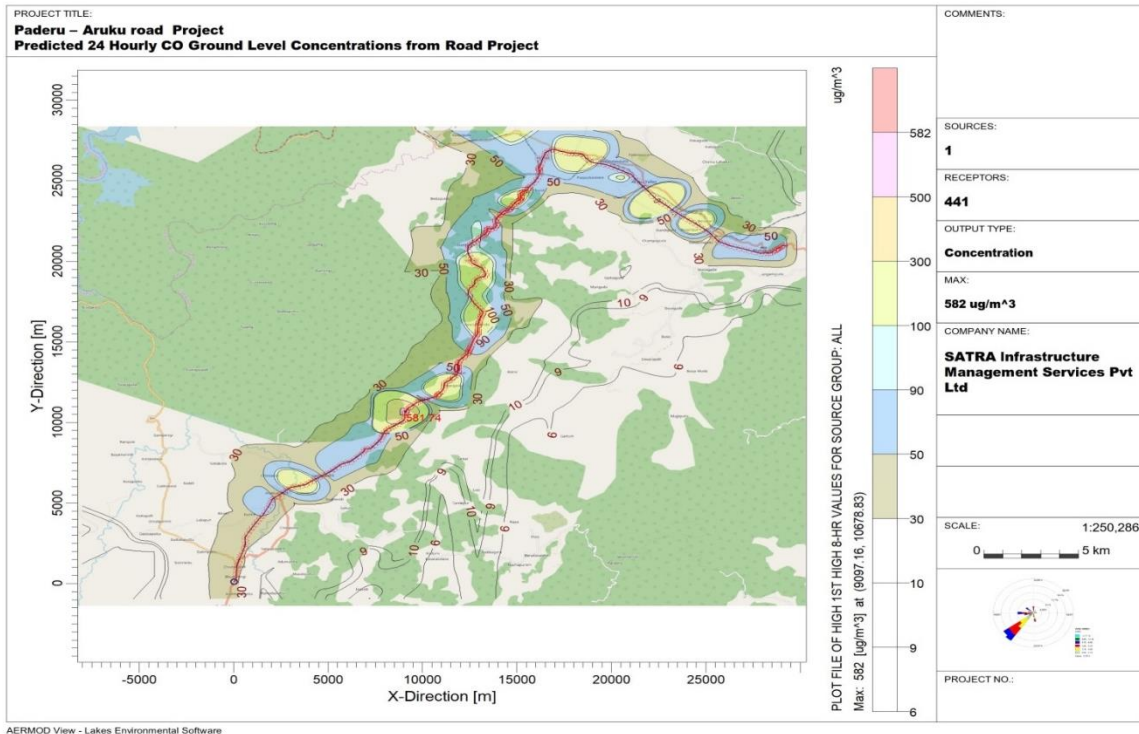


Figure 5.3: Isopleths Showing 24 Hourly GLC's for CO

Operational Phase

During operational phase, the congestion will be relieved to an optimum level on the project road. Widening and improvement along the project road could result in improved surface condition and traffic capacity. During the operation phase, vehicular emission will be emitted from vehicular movement on the roads.

5.5 Impact on Noise Environment

Construction Phase

Highway traffic noise, is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency as well as type of vehicles on the road. The impacts of noise due to the project roads will be of temporary significance locally in the construction phase. Table below present

the source of noise pollution and the impact categorization.

Sn.	Phase	Source of Noise pollution	Impact categorization
1.	Pre-construction	<ul style="list-style-type: none"> • Man, material & machinery movements • establishment of labor camps, onsite offices, stock yards and construction plants 	<ul style="list-style-type: none"> • all activities will last for a short duration and also shall be localized in nature
2.	Construction Phase	<ul style="list-style-type: none"> • Plant Site <ul style="list-style-type: none"> - stone crushing, asphalt production plant and batching plants, diesel generators etc • Work zones <ul style="list-style-type: none"> - Community residing near to the work zones 	<ul style="list-style-type: none"> • Plant Site: Impact will be significant within 250m. • Work zones: Such impacts again will be of temporary nature as the construction site will go on changing with the progress of the works.

Construction - Related Noise

With regards to noise related impacts, construction phase is a difficult stage. During this period noise impacts will be high due to operation of construction machineries and the conflict with the regular traffic requiring more honking of vehicle horns and more stop and go (acceleration and deceleration process).

All temporary noise related impacts in the immediate vicinity of the project roads will occur during the construction activities. This will be occurred along the construction zones as well as construction camps, hot mix plants, WMM plants, crusher and quarry sites (if required).

Typical noise levels associated with highway construction is given in **Table 5.3**. The magnitude of impact will depend upon the specific types of equipment to be used, the construction methods employed and the scheduling of the work.

Table 5.3 : Typical Noise Levels Associated with Road Construction

Sn.	Activity Noise Levels	(d(B)A)
1.	Grading & Clearing	84
2.	Excavation	89
3.	Foundations	88
4.	Finishing of Road	84

Project Road Noise modelling

Dhwani-pro noise model is developed to undertake construction, industrial and traffic noise propagation studies for noise assessment. The model is used to predict the impact of noise on receptors from the noise generation source. It is also used to predict impact due to group noise sources in the industrial complex (multiple sound sources) and traffic.

A noise propagation modeling study has been conducted to find out the impact from the noise generated because of the estimated total traffic flow as well as the significance of these impacts. The noise modeling has been done taking into account the design speed at various stretches and the stretches with restricted speeds have also been considered.

Noise modeling for the project road is given in **Table 5.4**.

Table 5.4: Noise level predictions for the locations

S.No	Name of Locations	Noise Level dB(A)
1	Paderu	49
2	Kinchumunda	50
3	Araku	54

The predicted noise levels during both day and night time are below the stipulated limits at road project stretch for all the land uses *i.e.*, commercial, residential/rural and sensitive.

The contour map showing noise levels due to traffic at the project stretch has been shown in **Figure 5.4**.

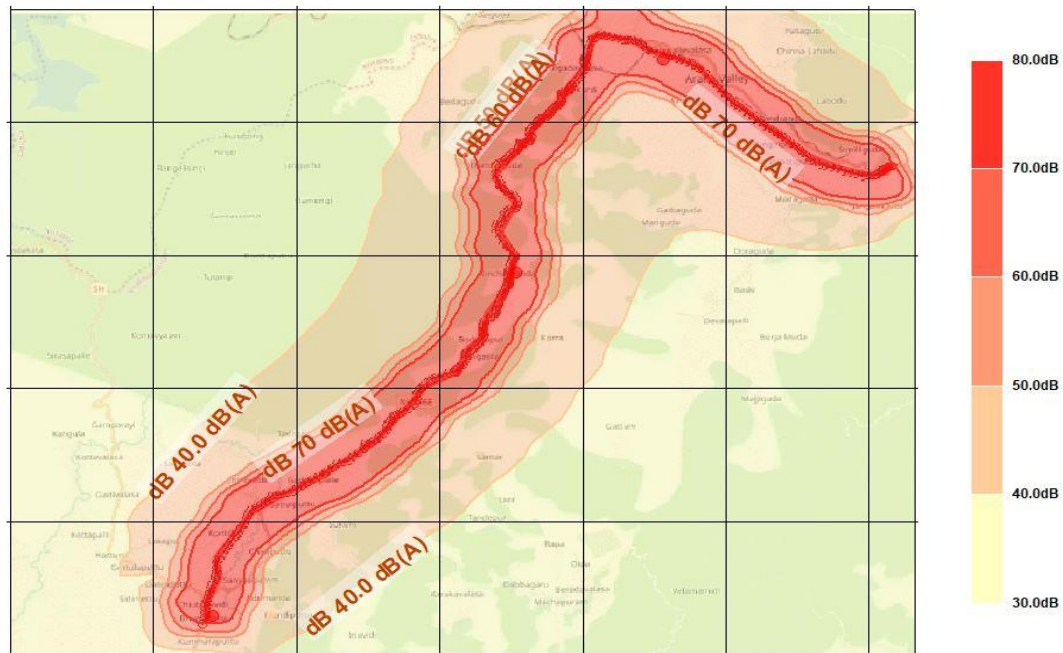


Figure 5.4: Contour Map Showing Noise Levels Due to Traffic at the Project Stretch

Operational Noise

During operation phase, noise levels will be reduced due to smooth flow of traffic on reconstructed/upgraded road. However, traffic will be increased on the road in due course of time and subsequently noise levels are expected to increase.

5.6 Impact on Biological Environment

5.6.1 Anticipated Impacts

The proposed up-gradation of the project road doesn't involve forest areas. Hence, anticipated impact on Forest area is not envisaged. Existing road side vegetation and trees were recorded during the field survey. Crops fields and open land are observed on both sides of the project road. Some of the indigenous of trees are likely to be cut down due to the upgradation.

Depending on the final design for upgradation/widening of road, the tree cutting and resultant pressure on flora and fauna (mainly avifauna) could be the potential impact during preconstruction/construction.

The major impact in this project on flora involves the removal of trees to permit construction and to provide clear zone for safety of the road users. **Table 5.5** below presents the major adverse impacts on the flora & fauna and the indicators chosen to assess the impacts for this study.

Table 5.5: Impacts Due To Construction and Indicators

Impacts Due To Construction	Indicators
Tree felling	No. of trees to be felled
Vegetation	Area of vegetation loss

Forest Area

There is no forest along the project road. Therefore, impact related to forest will not be appeared in the project.

Wildlife

There is no wildlife sanctuary, national park or bioreserve along the project roads. Therefore, no impact is anticipated on wildlife due to up-gradation of the project road.

Tree Cutting

Approximately 1964 trees are likely to felled for upgradation of the project. Trees growing within the proposed toe line (bottom of formation) will need to be removed for upgradation of the project road. Roadside trees with strong and rigid stems can pose safety hazards. Some trees obstruct clear sight distances. Others have a propensity to overturn when old and are potential safety hazards depending upon age and decay condition. All such trees that are safety hazards need to be cleared. All efforts will be made to minimizing cutting of trees.

There will be a significant, direct impact due to cutting of the roadside trees, it includes:

- The loss of shade.
- Loss of tree products.
- Loss of birds nesting place.
- Removal of roadside trees will also reduce comfort levels for slow moving traffic and pedestrians.
- The removal of trees would lead to erosion and contributes to the loss of the micro-ecosystems developed on the roadside.
- Besides these trees act as noise barrier, dust absorption, pollutant sequester, etc.

Removal of Vegetation

Clearing and grubbing is the foremost requirement to start the construction activities of the project roads. The impact due to removal of vegetation includes:

- Dust generation during windy atmosphere.
- Loss of productive top soil.

- Soil erosion during rainy season, may lead to water contamination.

Measures have been taken in reducing and curtailing the clearing and grubbing of excess land.

Impact of Dust on the Vegetation Growth

During the construction activities, dust will be emitted and deposited on the leaves of vegetation/crops along the project roads. Dust deposition on the leaves will affect the photosynthesis process and subsequently hamper the growth of the plants.

5.7 Impact on Socio-Economic Environment

Construction and operation phases of the project road will have some beneficial impact on social environment. Some increase in income of local people is expected as some local unskilled, semiskilled and skilled persons will gain direct or indirect employment during construction phase. Since the immigration of work force during construction phase is likely to be very small, the social impacts on literacy, health care, transport facilities and cultural aspect are expected to be insignificant.

The impacts of the construction of the project road on the socio-economic environment are systematically discussed under the following categories:

- Influx of construction workers,
- Economic impacts,
- Relocation of community structures within the proposed ROW.

Influx of Construction Workers

Although the construction contractors are likely to use un-skilled labour drawn from local communities, use of specialized road construction equipment will require trained personnel not likely to be found locally. Sudden and relatively short-lived influxes of construction workers to communities along the project will have the potential to 'skew' certain demographic variables and the traditional social coherence.

It is anticipated that the construction labour inputs for the construction of the project road will be in the order of about 100 to 150 persons per day. However, this number will fluctuate and the number in any particular activities will be lower.

Economic Impacts

The relatively short-lived economic impacts of the construction phase are likely to be experienced in local communities for the duration of construction, as workers will make everyday purchases from local traders. This is likely to give a short-lived stimulus to these traders that will disappear as soon as the construction is complete. Wider, flow-on economic impacts will be experienced in other sectors of economy as a result of purchase of construction materials and the payment of wages and salaries.

Impact on Religious Structures and Cultural Properties

Few religious structures are located along the project road. Some of these religious structures may be partially or fully affected during up-gradation of the project road. Shifting of religious structures is sensitive issue, therefore, local community and followers of religious structures should be taken in to confident.

Common Property Resources

Along the project road, few community structures are located, which are used by local communities. The partial or total impact on these common property resources is anticipated due to up-gradation of the project road. These should be properly relocated and rehabilitate before start the construction or proper access to such common properties should be provided.

Adverse socio-economic impacts include all disruptions on the social and economic interactions of communities due to the road project. This involves effect on both the adjacent communities (mostly direct) as well as the nearby communities (mostly indirect).

5.8 Impacts Relating To Human Health & Safety

Poor sanitation arrangement and improper methods used for collection and disposal of solid wastes and effluent, accommodation without ventilation, unhygienic food, electrical safety, risk from mosquito and reptile etc at the construction workers camp will impact human health and safety.

5.9 Road Safety Aspects

Increase of incidence of accidents is anticipated due to disruptions of traffics movements on the in construction work zones on the project road.

5.10 Safety and Health Related Issues

Safety and health related issues for the project road are given below:

- Occupational health and safety risks to workers due to inadequate housekeeping and unsafe work practices at work sites.
- Health problems to workers due to inadequate sanitation and unhealthy environment at labour camps/plant sites.

CHAPTER 6

ANALYSIS OF ALTERNATIVES

6.1 INTRODUCTION

This chapter discusses the analysis of alternatives that have been considered for the proposed widening/upgradation. It also includes a discussion on the “With” and “Without” project scenario. Further, the evaluation and selection of alternative bypass alignments to Hukumpet and Araku Village are based on engineering, economic, environmental and social considerations. The minimization of environmental impacts by considering design alternatives determines the extent of mainstreaming of the environmental component. An evaluation of the various alignment options has been done for arriving at the most promising alignment for the bypass.

6.2 NO PROJECT SCENARIO

The entire stretch of Paderu – Araku road upto Bhalluguda has both engineering and physical constraints which results in congestion in habitation areas coupled with roadside commercial activities. In absence of the project the situation would be aggravated. Thus, to address these physical obstructions which pose problems for smooth passage of through traffic and at the same time address the issue of traffic congestion, road users’ safety, travel time, vehicle operating cost, exposure of residents to vehicular emission etc. improvement of the road in terms of upgradation and widening is required.

The population growth, increase in traffic volumes and the economic development along the corridor would continue to occur and will worsen the already critical situation. The existing unsafe conditions and the adverse environmental consequences in terms of the environmental quality along the highway would continue to worsen in the absence of the proposed improvements. Moreover, if it is decided not to proceed with the project, then the attendant reduced socio-economic development of this remote, relatively poorly connected area cannot be justified. Therefore, the no-project alternative is neither a reasonable nor a prudent course of action for the proposed project, as it would amount to failure to initiate any further improvements and impede economic development.

6.3 WITH PROJECT SCENARIO

To avoid the acquisition of land and properties, the project envisages the development within the minimum RoW as much as possible. However, need for land acquisition has been envisaged for Bypass, Realignment and curve improvement sections.

In spite of the various development benefits likely to accrue due to the project, as is the case of every road development project, the project would be accompanied by certain impacts on the natural, social and environmental components. The potential impacts on the various environmental components can be avoided through good environmental practices. Wherever avoidance of negative impact has not been possible, appropriate mitigation and enhancement actions will be worked out to effectively offset the environmental damages inflicted due to the project.

The comparative assessments of the "with and without" project scenarios are presented in the following Table.

Table 0-1: "With and Without" Project Scenarios - A Comparative Assessment

Component	"With" Project Scenario	'Without" Project Scenario
Highway Geometrics	2-lane carriageway with paved with geometric improvements	Existing single carriageway with poor geometrics
Design Speed	Design speed 80-100 Kmph	40 – 60 kmph
Congestion in Settlements	Free flow of traffic due to widened carriageway and improved geometry	Congestion in urban areas and rural areas
Felling of road side trees	Felling of trees located near the road edge as these trees shall become a road hazard. Double the number of new young and healthy trees to be planted in compensation.	No felling of trees. The old trees may become a safety hazard to the road users with passage of time.
Pedestrian safety	Bypasses, realignment are proposed for safety of pedestrian. Along the settlement stretches with significant pedestrian traffic, provision of	Pedestrian safety an issue of major concern especially along the settlements and congested sections.

Component	"With" Project Scenario	'Without" Project Scenario
	pedestrian (zebra) crossings and footpath has been kept in urban sections.	
Road Safety Measures	Provision of proper road markings, zebra crossings and improvement of geometry to reduce accidents.	Accident incidents shall rise with an increased traffic volume.
Environmental Quality	The widening of existing 2 lane and the proposed bypasses will improve environmental quality due to lowered pollution levels by relieving of congestion. Short term increase in dust and noise levels during construction activities.	Poor due to congestion and slow movement of traffic. A further deterioration is expected due to increase in traffic volumes and further congestion within the towns.
Drainage	Will be improved due to further widening of culverts / bridges with adequate hydraulics.	These issues remain unaddressed without the project
Better Transportation Facilities	Reduction in time and fuel consumption for easy and fast movement through the major towns and villages. Better Access to markets	Increased vehicle operating costs due to reduced speeds
Economic Development	There will be increased access to markets. Local people will be employed during construction of the project road. Better transport facilities will lead to access to new employment centres.	The economy will remain static.
Loss of Property and livelihood	Some people will lose their property and livelihood due to land acquisition for bypasses and widening of existing road where RoW is not sufficient to accommodate the road design	Project may provide job / livelihood opportunities to people through commercial establishment in area due to good connectivity with other cities and towns.
Loss of	Vegetative cover will be	No such impact

Component	"With" Project Scenario	'Without" Project Scenario
vegetative cover	removed within corridor of Impact. Compensatory plantation will enhance vegetative cover of area after 3-4 years.	
Access to basic facilities such as Markets, schools, Hospitals etc.	Easy access to basic facilities due to fine road	Difficulty in accessing the basic facilities due to heavy traffic.
Development	Higher potential for development due to improvement in access and consequent increase in connectivity	Development activities will be greatly hampered by the gross inadequacy of infrastructure.

By looking at the above table, "with" project scenario, with its minor adverse impacts is more acceptable than the "without" project scenario which would mean an aggravation of the existing problems. The potential benefits of the proposed road improvements are substantial and far-reaching both in terms of the geographical spread and time. Hence, it is clear that the implementation of the project will have definite advantage to area in development of its economy and progress for its people.

The potential benefits of the proposed road improvements are substantial and far reaching both in terms of the geographical spread and time. The project will have significant benefits as under:

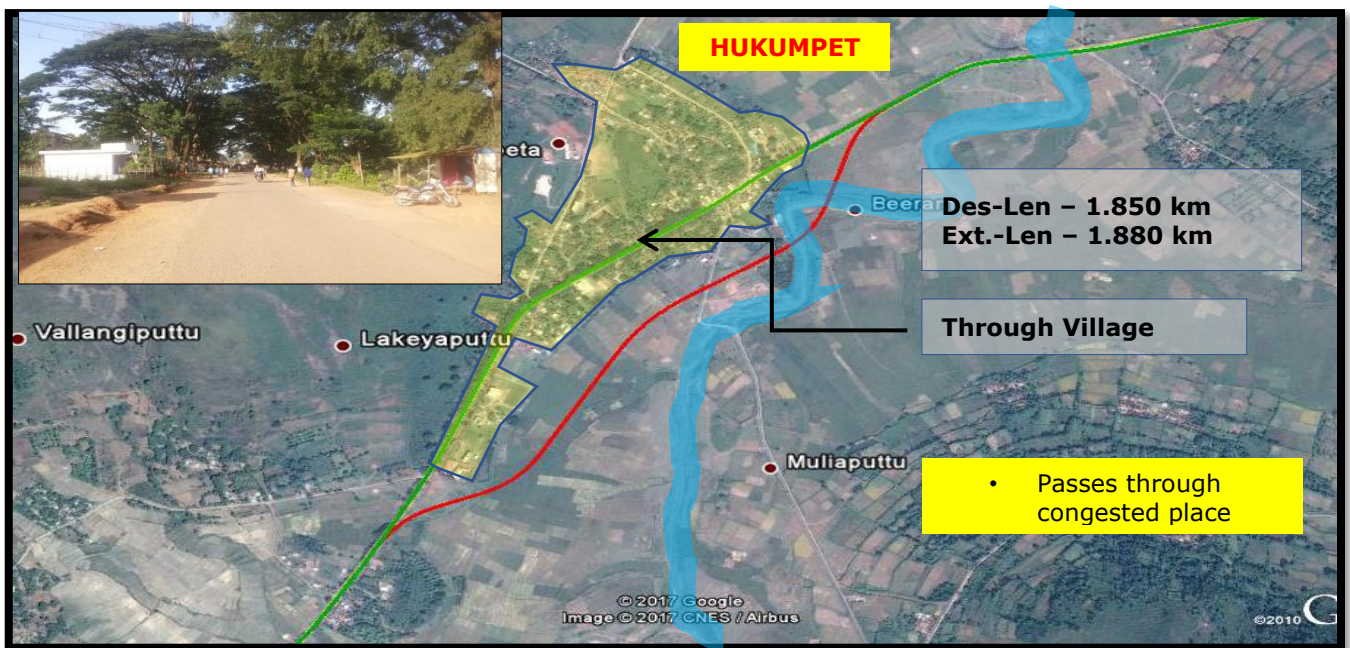
- It will reduce the travel time substantially.
- Fast and safe connectivity resulting in savings in fuel, and total transportation cost.
- Increased employment opportunities for the locals.
- Development of local industries and agriculture.
- Transporting processing and marketing of agricultural products.
- Reduction in accidents.
- Reduction in pollution
- Opening up of opportunities for new occupations.
- Better approach to Medical & Educational services
- Improved quality of life for people and so on.

Hence, it is clear that the implementation of the project will be a definite advantage to the Local of Paderu-Araku Villagers in particular and the State of Andhra Pradesh in general to achieve all-round development of its economy and progress for its people.

6.4 ALTERNATIVE ALIGNMENT FOR BYPASS AND RELAINMENT

The need for bypass around the congested towns along the project road was identified and also considering the quantum of development within the towns. Accordingly, Hukumpet and Araku were identified for bypass provision as the proposed improvement and widening in the town is very difficult on account of significant Resettlement & Rehabilitation problem.

HUKUMPET BYPASS



6.5 RE-ALIGNMENTS

In the entire Stretch of Paderu-Araku Road, in order to improve existing poor road geometry, sixteen re-alignments have been proposed as presented in the Table below.

Table 0.2: Realignment Proposed for Paderu-Araku Road

Realignments Summary					
S.No	Road Name	Proposed Chainage		Length (m)	Remarks
		From	To		
1	Hukumpet	7300	9200	1900	Realignment
2	Tadigiri	13550	13780	230	Curve Improvement
3	-	25300	25700	400	Curve Improvement
4	-	27480	27900	420	Realignment
5	-	28200	28850	650	Curve Improvement
6	-	31900	32700	800	Curve Improvement

Realignments Summary					
S.No	Road Name	Proposed Chainage		Length (m)	Remarks
		From	To		
7	-	35900	36900	1000	Curve Improvement
8	-	41780	48200	6420	Bypass
9	Bhaluguda	50700	51895	1195	Realignment

6.6 ALTERNATIVE MATERIALS AND TECHNOLOGIES

Increasing demand for natural material for other construction activities e.g. building construction, urban development projects has put pressure on the existing natural resources e.g. aggregates, sand, soil. Procuring natural construction material for the road construction has thus not only become difficult due to increased competition from other sectors but also escalated both time and money required for procuring them. Increased regulatory compliance requirements have also made availability difficult. Added to this is the increase lead distance because at times these materials have to be procured from quarries away from the construction site thus not only increasing cartage cost but also increasing the carbon-footprint of the project.

The use of alternate materials for construction focuses on the management and reuse of alternate material including waste materials locally available in the project area or generated by the project itself.

6.6.1 Use of Alternate Recycled Material or Waste in Road Construction

Use of Fly ash in Construction

In tandem with the IRC Guidelines for promoting the use of fly ash in road embankments (IRC: SP:58-2001), MoEF&CC issued an amendment to their fly ash notification which make it mandatory for road construction within a radius of hundred kilometers of thermal power plant to undertake construction or approve design for construction of roads or flyover embankment with fly ash as mentioned in the IRC specification No. SP: 58.

- Alternatives for minimization of road side hill cutting.
- Alternatives for minimization of cutting of trees and forest land diversion.
- Alternatives for minimization of use of water in construction activities.
- Use of alternative construction materials to minimize use of aggregate, bitumen, borrow earths.
- Alternatives for saving existing community structures, etc.

- Alternatives considered for protection of slopes.

CHAPTER 7

GREEN INITIATIVES

Green Initiatives describes green highway, green initiatives, GHG emissions reductions and climate resilient initiatives adopted in the project and estimated GHG emissions reduction.

7.1 CARBON FOOT PRINT

Carbon footprint is a commonly used term to describe the total amount of carbon dioxide (CO₂) and other greenhouse gas (GHG) emissions for which an individual or organization is responsible.

It is usually defined as the total amount of CO₂ and other GHGs emitted over the full life cycle of a product or service. It measures the total GHG emissions caused directly by a person, organization, event or product.

Carbon sources or carbon emission sources are formed in the pavement structure within the boundary of the pavement system, including a series of intermediate products and the unit process of collection. Bitumen pavement construction was divided into two parts, namely, Bitumen mixture production and Bitumen mixture construction. Bitumen mixture production includes aggregate stacking, aggregate supply, bitumen heating, aggregate heating, and mixture mixing. The construction of Bitumen mixture was divided into Bitumen mixture transportation, Bitumen mixture paving, and compaction of Bitumen mixture.

In concrete pavements the stages of carbon emission includes the raw materials production, concrete manufactures and concrete pavement construction. The boundary of carbon emission comprises four stages: material manufacture, transportation, construction, and disposal.

The challenge of global climate change has motivated transportation agencies involved in the construction and maintenance of transportation infrastructure to investigate strategies that reduce the life cycle greenhouse gas (GHG) emissions associated with the construction and rehabilitation of highway infrastructure.

Environmental consciousness is on the rise and many transportation officials are striving to make their practices and policies greener or more sustainable.

To analyze carbon footprint, one must look at the greenhouse gas (GHG) emissions associated with the construction and maintenance of a road.

Greenhouse gases include carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) etc.

7.2 CO₂ Equivalent (CO₂e)

It is used as a metric measure used to compare the emissions from various GHGs based upon their global warming potential (GWP).

CO₂ is taken as a reference for calculation of overall emissions because almost all of the materials contain the basic element as carbon, which on oxidation produces CO₂; and it is also the most prevalent GHG present in the atmosphere.

Although CO₂ and CO₂e are interrelated, they are distinct measures for calculating the global emissions. The carbon dioxide equivalent for a gas is derived by multiplying the Tonnes of the gas by the associated GWP [4]: kgCO₂e = (Amount of a gas in kg) * (GWP of the gas) In line with the definition given above, the carbon footprint of the road sector can be defined as the total amount of CO₂ and other GHGs (direct and indirect) emitted over the full life cycle of a road.

7.3 CALCULATIONS

Greenhouse gas emissions are typically measured in terms of carbon dioxide equivalents (CO₂).

Over the last several years, calculations of carbon footprints have gained more importance due to the fact that the environmental norms and conditions specify a particular amount of CO₂ emissions for various activities.

The total GHG emissions caused directly and indirectly by an individual, organization or product is expressed as a CO₂e.

$$CE (S) = CE (S1) + CE (S2) + CE (S3)$$

Where, CE (S1): Carbon emissions at the material manufacture stage; CE (S2): Carbon emissions at the material transportation stage; CE (S3): Carbon emissions at the construction stage.

Table Error! No text of specified style in document..1: Carbon foot print data

Carbon Foot print					
S.No	Component	Value	Unit	Project Value	Total GHG in kg/Co₂
At Materials Manufacturing Stage					
1	Aggregates	0.0028	kg/co ₂ /kg	723963850	2027099
2	Bitumen	0.43	kg/co ₂ /kg	388715	1655926

Carbon Foot print					
S.No	Component	Value	Unit	Project Value	Total GHG in kg/Co ₂
				0	
3	Cement	0.82	kg/co ₂ /kg	250	205
4	Steel	4.67	kg/co ₂ /kg	184813	863077
At Transportation Stage					
5	Truck Transport (14 T capacity)	1.10	kg/co ₂ /(Veh* km)	324	356
At Construction Stage					
6	Clearance for road Construction	6.56	kg/co ₂ /Ha	0.642	4
8	Excavation for Excavator	0.539	kg/co ₂ /m ³	121151	65300
9	Rolling of layers	0.102	kg/co ₂ /m ²	100000 0	102000
10	Prime Coat	0.020 5	kg/co ₂ /m ²	523486	10731
11	Tack Coat	0.020 5	kg/co ₂ /m ²	520165	10663
12	Paving of asphalt layers for one layer	0.096 5	kg/co ₂ /m ²	500000	48250
Traffic					
13	LMV (Goods)	0.914	kg/co ₂ /km	50	46
14	LMV (Passengers)	0.46	kg/co ₂ /km	50	23
Total GHG emissions					4783680

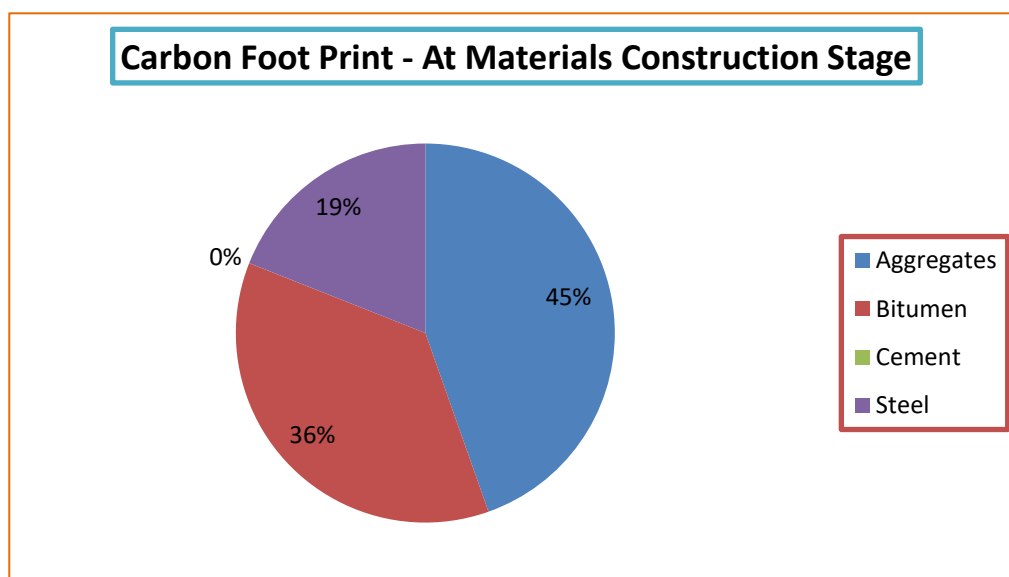


Figure Error! No text of specified style in document..1: Carbon Foot print (Materials)

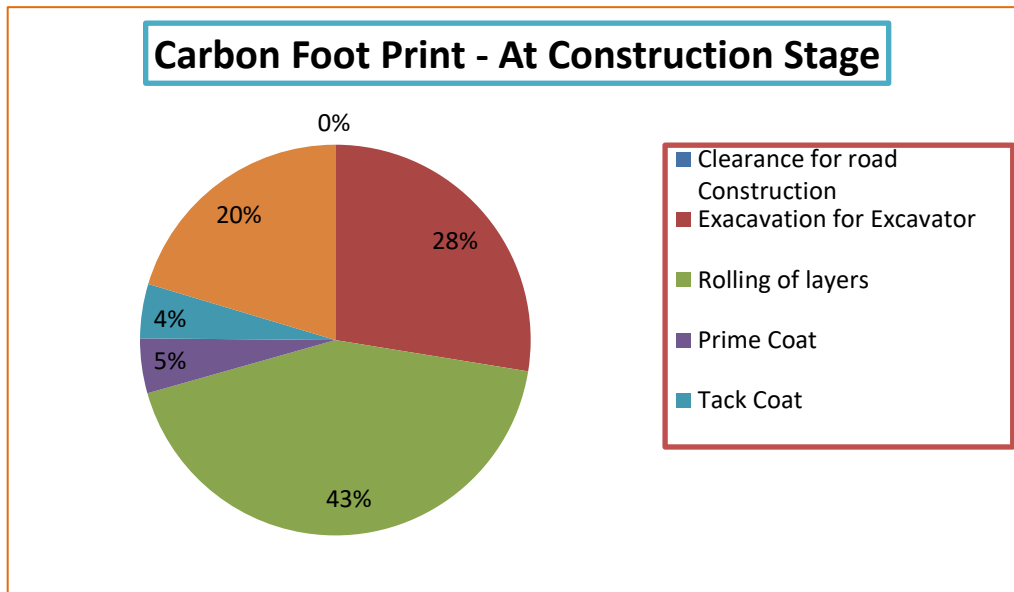


Figure Error! No text of specified style in document..2: Carbon Foot print (At Construction Stage)

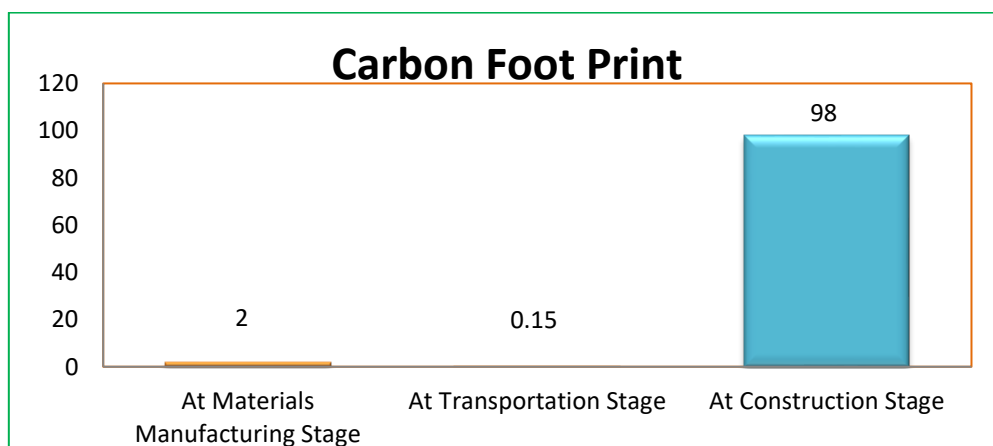


Figure Error! No text of specified style in document..3: Carbon Foot print (Overall Project)

7.4 WATER DEMAND OF THE PROJECT

Here, the details of water requirement for construction stage are provided in Table 7.2.

Table 7.2 : Details of Water Requirement for Construction Stage

Project Details			Water requirement, KLD for Construction stage				
S.No	Name of the road project	Proposed Length (in Km)	Dust suppression /Allied activity of Construction (Wetmix etc.,)	Domestic Purpose (KLD)	Trees to be planted	Green Belt/ Plantation (KLD)	Total in KLD
1	Paderu to Araku	50	3	332	1964	1768	2103

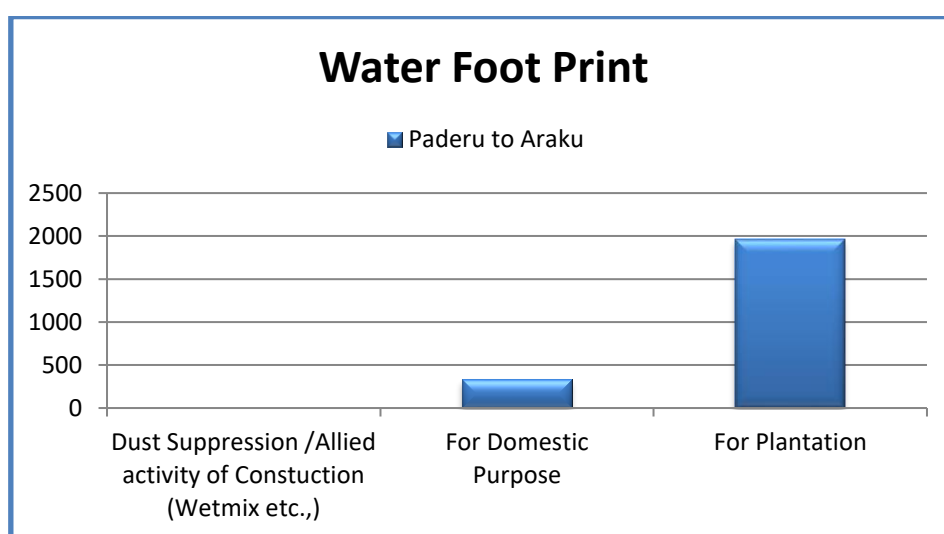


Figure Error! No text of specified style in document..4: Water Foot print (at construction Phase)

7.5 UTILIZATION OF COCO FIBRE IN ROAD CONSTRUCTION

Coconut shell is one of the main polluter that contributes to the nation's pollution problem. It is a solid waste in form of shell with approximately 3.18 million tonnes produced annually.

The common waste materials that used to improve the quality of pavement construction are ash, scrap tire, iron and steel slag, fly ash and plastic waste.

Coconut shell (CS) and coconut fiber (CF) as shown in Figure are known as new waste materials that used in highway industry. This is because coconut shell has good weather resistant thus it is suitable to use as construction materials. Besides, it has no economic value and its dispose process is costly and will cause environmental problem.



Figure Error! No text of specified style in document..5: Coconut shell (left) and coconut fiber (right)

The chemical compositions of CS contains is 33.61% cellulose, 36.51% lignin, 29.27% pentosanes and 0.61% ash. CS has low ash content but high volatile matter, While CF has the lowest cellulose content, but with twice amount of lignin (41-45%) compared to jute and sisal which makes it has greater resistance and hardness. CF will act as stabilizing additives when added into the asphalt mix around 180°C.

CF generates many advantages when react with asphalt mixture as it can reduce bleeding of the binder and advancing the macrottexture of the coating. Besides, it can help to reform the mechanical characteristics and improve surface drainage pavement of tyres.

CF enables the use of discontinuous of grain size, which can increase the content of binder, hence the aggregates will coat with thicker film. This can reduce the oxidation of asphalt mixtures, moisture penetration and separation.

On the other hand, all asphalt applications has one problem, it will become brittle at low temperatures and soft at high temperatures. CF can increase the range of temperature of porous asphalt thus help to resist degradation. This function can reduce the drying and cracking that occur in conventional asphalt pavement when faces various climate. At high mixing and compaction temperatures, CF also helps in reduce the flow of asphalt hence it can help to prevent bleeding and make sure the air void content is not clogged by asphalt binder.

CF has outstanding moisture absorption because the irregular of crack in the cross section surface provides unique structure. The unique structure also results in better air permeability and moisture conductivity. In addition, the unique structure of the CF will improve the moisture susceptibility, viscoelasticity and rutting resistance as well as ameliorate low temperature anti-cracking

properties, durability, material toughness, fatigue life and lowering reflective cracking of asphalt concrete mixtures and pavements.

Detailed investigated should be done on the CS and CF like reinforcing mechanisms as well as optimum fiber and shell content. The various properties of CS and CF like fiber and shell content, fiber length, shell's size, shell's shape and orientation of fibers should be focus in the asphalt pavement in the future research. In addition, field performance of shell and fiber modified asphalt pavement should be determine the boundary effects on the test results. New research field can be conducting such as investigate modeling of mechanical properties of CS and CF modified asphalt pavement by using composite science principles.

7.6 GABION WALLS FOR SLOPE PROTECTION

Gabion baskets were used for landslide mitigation. It is easily and quickly assembled and provided the advantage of being sustainable, resilient and flexible in nature.



Figure Error! No text of specified style in document..6: Gabion Walls for Slope Protection

Gabion retaining wall is flexible, free draining, permeable, environmentally friendly, quick and easy to assemble and cost-effective. A gabion wall of approximately 9m height was constructed, with a coir mat provided to stabilize the surcharge slope.

7.7 BIOENGINEERING TO STABILIZE LANDSLIDE-PRONE HILLSIDES

One of the major challenges in building hill roads is stabilizing hill slopes with appropriate and cost effective interventions.

Bioengineering techniques that used the abundantly available local bamboo to stabilize the hill slopes at a fraction of the cost of conventional methods that use concrete structures for the purpose.

Bioengineering is the use of vegetation, mostly shrubs and grasses, either alone or in conjunction with stone and concrete protection works such as retaining walls etc. to enhance the stability of slopes.

It benefits both road building agencies and users alike as it not only provides one of the best, and cheapest, ways to protect the road and its users from landslides, but also retains the hillside's productivity, unlike stone and cement works on which no vegetation can grow.

A slope treated with bioengineering measures can therefore retain its forests, water bodies, farmlands and orchards while also covering up any unsightly scars that result from road widening activities. These environment friendly measures also reduce the carbon footprint of roads.

7.8 Disposing of debris

Cutting the hillside to widen a road invariably generates debris. Disposing of this debris in the hilly areas is a challenging task as loose debris can potentially cause landslides, lead to unsightly scarring and cause the hill slopes where it is dumped to lose their productivity.

Bamboo terracing, bamboo crib walls and bamboo knitting were developed to suit the requirements of each slope as well as for debris disposal sites.

CHAPTER 8

CONSULTATION WITH KEY STAKEHOLDERS

8.1 GENERAL

Stakeholder's consultations and participation have been viewed as a continuous two way process, involving, promoting of public understanding of the processes and mechanisms through which developmental problems and needs are investigated and solved. The stakeholder consultation, as an integral part of environmental impact process throughout the project preparation stage not only minimizes the risks and unwanted political propaganda against the project but also abridges the gap between the community and the project formulators, which leads to timely completion of the project and making the project people friendly.

8.2 DEFINITION OF STAKEHOLDER

Stakeholder consultation involves the interaction of various stakeholders and the project proponent. It is highly desirable for all key stakeholders to arrive at a consensus on sensitive features, impacts and remedial actions. Stakeholder identification was done by examining the potential impacts of the project in terms of:

- Who may be affected directly (project affected people);
- Which agencies might have responsibility for the impact management;
- Which other organizations might have an interest in monitoring proponent activities or have local knowledge to contribute; and
- Which private/ non-government sector entities might face financial and social hardships if the predicted impacts occur?

8.3 TYPES/CATEGORIES OF STAKEHOLDERS CONSULTED

For the project road, following major groups of stakeholders have been identified for consultations:

- Primary Stakeholder as local people that include project affected people, local residents, shopkeepers, farmers, etc.
- Institutional stakeholders such as concerned govt. agencies, etc.
-

8.3.1 Primary Stakeholder

The enactment of the participation and consultations with the primary stakeholders was done at local or village level in areas where problems were noted.

During survey, one to one meetings are generally held with informed people. Informed people are those sections of the village community whose general awareness is very high. Such category of people include but not limited to, school teachers, retired senior level government officials such as military officials, post masters, forest officers, etc. In other words, informed people are those members of the local communities who in their past had a thorough experience and has geographic, political and general knowledge about the area and requirements of the communities.

These consultations sometimes focus on one or more specific issues for example road safety in a given section of the project road. Wherever possible such type of consultations is generally held with informed people.

Focus group meetings are usually conducted with a sample section of the community usually with a good representation from the affected communities. Such meetings usually provided substantial information about the community concerns.

During consultation, efforts were made for one to one meeting, however, local people did not attend the meetings due to hesitation. After that strategy were changed and stakeholder consultation were carried out in the form of focused group discussions with project affected people, shopkeeper, farmers, etc, along the project road,

8.3.2 Institutional Stake Holders

The general cooperation was received from the Govt. Department. This section has been provided to encourage the dialogue between the different departments.

8.4 OBJECTIVE OF THE CONSULTATION

The main objectives of the consultation program were to minimize the negative impact of the project corridors and to make people aware of the road rehabilitation project. During the process efforts were made to ascertain the views and preferences of the people. The aims of community consultation were:

- To understand views of the people affected w.r.t to the impacts of the road
- To identify and assess all major economic and sociological characteristics of the village to enable effective planning and implementation and;
 - To resolve the issues relating to the impacts on community property.

Stakeholder consultation was carried out with the objective of finding out the views and opinions of the stakeholders, mainly the community in and around, on issues relating to the project, its operations and also on peripheral development.

Through public participation, stakeholder’s key social issues were identified and strategy was formulated. It included socio analysis and design of social strategy, institutional analysis and specifically addressed the issue of how poor and vulnerable groups may benefit from the project. The consultation process established during preparation stage of the project used different types of consultation such as in-depth interviews with key informants, focus group discussions, and meetings. The consultation program included the following:

- Heads of households likely to be impacted;
- Household members including women;
- Villagers in the Project Influence area;
- Village panchayats; and
- Government Agencies and Departments

Stakeholders	Consultation Method
Executing Agency, Implementing Agency	Individual interview, discussion, joint field visit
Line Departments/Agencies	Individual meeting/interview, discussion
Local Communities	Meeting a group of People at the affected Villages along the road.

8.5 Methodology Adopted including information dissemination for Consultation with Stakeholders

Consultations and discussions were held along the project with the affected families and other stakeholders. Displaced persons were consulted through project census survey. Consultation meetings were organized to get wider public input from both the primary and secondary stakeholders.

An appointment has been fixed prior to the meeting with the stake holders. Prior intimation of at least 15 days before the planned consultation meeting was given to Village office /Sarpanch /Villagers, so that the villagers were aware of date and location of meeting before hand for active participation. Summary of public consultations are given in **Table 8.1.**

Table 8.1: Summary /Feedback of Public Consultation/Gram Sabha conducted during the EIA Process on 03.10.2018

No of Participants	Issues/Suggestions	Included in Design or not
At Paderu @ 3-10-2018		
1	The villagers were rarely using the existing road but due to bad condition it was not preferred often. They were happy to seek employment locally during construction of the road.	Provided Bus stops wherever possible
	They asked for market area for selling of their produce along with all the required facilities like drinking water, power supply and shelter, during market traffic jam is high and chances for accidents are boosted up.	
	Required some place for animals to be stocked as they are roaming on the roads which leads to accidents.	
	Villagers asked for bus stop with shelter	
At Chintalaveedi @ 3-10-2018		
2	The Spl. Officer/Panchayat secretary and other villagers were eager to get a good condition road which has been overused.	Road is improved based on design standards
At Hukumpet @ 3-10-2018		
3	All the villagers are in the favour of road improvement	Road is improved based on design standards
At Araku Valley @ 3-10-2018		

No of Participants	Issues/Suggestions	Included in Design or not
4	All the villagers are in favour of the road but need to clarify the project effected persons in the by-pass area which can be done only after the publish of 3(A)	Road is improved based on design standards

8.5 Key findings of the local level consultations

The key findings of the local level consultations are as follows:-

- The size of participants in each consultation ranges between 30-50.
- The participants were aware of the fact that road will be widened, but they didn't know the details of the project.
- The participants, in general were in favour of road widening and improvement; however, they had apprehensions regarding safety.

Various details like minutes of meetings, photographs, and permission letters from concerned departments are included here.

Various Public Consultations along the Project road



Dumbriguda



Hukumpeta



Paderu



Araku



Public Consultations/Gram Sabha at Hukumpet on 03.10.2018



Public Consultations/Gram Sabha at Araku Valley on 03.10.2018



Public Consultations/Gram Sabha at Paderu on 03.10.2018



Public Consultations/Gram Sabha with women group at Chintalaveedi on 03.10.2018

Attendance Sheet for Consultations along the Project road

List Of Participants attended for Public Consultation Consultancy Package No. NH/AP (R&B)-10 (Paderu - Araku Section)

District Name: VISAKHA PATNAM

Mandal Name: ARAKU VALLEY

Village Name : ARAKU VALLEY (P)

Date : 03/10/2018

Sl.No	Name	Occupation/ Designation	Contact No	Signature /LTI
	<i>[Signature]</i>	PS.	9441058563	<i>[Signature]</i>
3	B. Ramana	Grade	9441486494	<i>[Signature]</i>
	<i>[Signature]</i>	Subgrader	8985587091	<i>[Signature]</i>
	A. Kameswari	Subgrader	949234340	<i>[Signature]</i>
	M. Devi Prasad	Ramalgudi	944016672	<i>[Signature]</i>
	M.R.R	SUS KIRAN	9441466294	<i>[Signature]</i>
	B. Daba Ratu	IS. Srinivas Reddy	9441605769	<i>[Signature]</i>
	CH. SRINIVAS RAO	PARSONS	9490188558	<i>[Signature]</i>
	P.V. A. Suresh	Hotel Manager	9440179246	<i>[Signature]</i>
	<i>[Signature]</i>		9490823673	<i>[Signature]</i>

List Of Participants attended for Public Consultation Consultancy Package No. NH/AP (R&B)-10 (Paderu - Araku Section)

District Name: VISAKHAPATNAM

Mandal Name: PADERU

Village Name : PADERU (Bibulwalgate EE)

Date : 04/10/18

Sl.No	Name	Occupation/ Designation	Contact No	Signature /LTI
1	P. Anudeep	DCS/TL Paderu	8331943901	<i>[Signature]</i> 4/10/18
2	G. Sankesh Kumar	Asst. Engineer Highways	9573056646	<i>[Signature]</i>
3	Mohammad.C. Gilani	Asst Engineer Highways	9493011267	<i>[Signature]</i>
4				

EIA Report for Two Lane Upgradation with Paved Shoulders of Paderu- Araku (up to Bhalluguda) Section of NH-516E in Andhra Pradesh under Green National Highway Corridor Project (GNHCP)

List Of Participants attended for Public Consultation Consultancy Package No. NH/AP (R&B)-10 (Paderu - Araku Section)

District Name: VISAKHAPATNAM Mandal Name: HUKUMPETA
 Village Name : HUKUMPETA (531077) Date : 03/10/2018

Sl.No	Name	Occupation/ Designation	Contact No	Signature /LTI
2	H. Uthappa	OPR&D.	9440279329	H. Uthappa
3	G. Kameswara Rao	Farmer	8500941742	G. Kameswara Rao
4	M. Srinivasulu	Worker	8500766494	M. Srinivasulu
5	L. Nagaraj Rao	Self-employed	9492824683	L. Nagaraj Rao
6	A. Srinivasulu	Self-employed	94440155078	A. Srinivasulu
7	B. Viswanatham	Self-employed	9941023795	B. Viswanatham
8	K. Krishna Kumar	(A.W.)HKP2	8500506169	K. Krishna Kumar
9	J. Annapurnaamma	Self-employed	919490598870	J. Annapurnaamma
10	J. Hemalatha	NO 'A' Nalguda	9493764473	J. Hemalatha
11	G. Srinivasulu A.W.W I	i.c.d.s.	8331961432	G. Srinivasulu
12	K. Ganeshwar	A.B. Rep-NA	9490087675	K. Ganeshwar

List Of Participants attended for Public Consultation Consultancy Package No. NH/AP (R&B)-10 (Paderu - Araku Section)

District Name: VISAKHAPATNAM Mandal Name: PADERU
 Village Name : Chintalaveddi (Grama Panchayat) Date : 03/10/2018.

Sl.No	Name	Occupation/ Designation	Contact No	Signature /LTI
37	K. Bulamma	Housewife	-	-
38	S. Kalavathi	Housewife	9490337922	S. Kalavathi
39	G. Eshwaramma	Housewife	-	G. Eshwaramma
40	P. Bhavani	-do-	-	P. Bhavani
41	O. Sureshanna	-do-	-	O. Sureshanna
42	O. Satyavathi	-do-	-	O. Satyavathi
43	G. Revathi	-do-	-	G. Revathi
44	S. Suresh	P. Secretary	9703308457	S. Suresh Panchayat secretary Grama Panchayat CHINTHALAVEEDI Paderu Mandal

EIA Report for Two Lane Upgradation with Paved Shoulders of Paderu- Araku (up to Bhalluguda) Section of NH-516E in Andhra Pradesh under Green National Highway Corridor Project (GNHCP)

List Of Participants attended for Public Consultation Consultancy Package No. NH/AP (R&B)-10 (Paderu - Araku Section)

District Name: Vishakhapatnam Mandal Name: Paduru

Village Name : Paderu Date : 03.10.2018

Sl.No	Name	Occupation/ Designation	Contact No	Signature /LTI
1	B. Chankora Rao	Spaid officer	8985824118	B. Chankora Rao
2	S. Raja Sekharaiah	pastry & Security	9490937260	S. Raja Sekharaiah
3	Sakti Rama Krishna	Pesa Art	9494109950	S. Rama Krishna
4	K. Nageswara Rao	Biggness	9490423231	K. Nageswara Rao
5	M. Chinna Rao	Barber	-	
6	SK. Meera Saibh	Other	-	
7	B. Vasa Lakshmi	Other	-	
8	E. Paidithallamma	Other	-	
9	D. M. Laxmi	PHN	9494665661	D. M. Laxmi 8/10/18
10	V. Parvathi	Other	-	
	Y. S. S. S. S. S.	Housewife	9441333954	Y. S. S. S. S.

Sri L.V. Subrahmanyam, B.Tech.,
Executive Engineer,
R&B NH-Division,
Vishakapatnam-18.

The Extension officer,
Paderu Mandal,
Visakhapatnam District.

Lr.No.NIL/ATO/NH-Division/2018 dated: 29-9-2018.

Dear Sir,

Sub: Consultancy Services for Project Management including preparation of Detailed Project Report of selected stretches/ corridors of National Highways/State Roads (Approved "In Principle" for declaration as National Highways) in the state of Andhra Pradesh for upgradation to Two/Four Lane with paved shoulder configuration, of Consultancy Package No. NH/AP (R&B)-10 ((i) Paderu-Araku Road Section (ii) Srungavarapukota - Vizianagaram on NH-26 Road Section) – Public Consultation –Requested –Regarding.

Ref: (i) Contract Agreement No. 11/2-16-17,dated: 28.07.2016.
(ii) Alignment is approved under No. RW/NH-12011/56/2016-AP/P-7, dated 28th November, 2017.

With reference to subject matter cited above, the alignment from Paderu to Araku (up to Bhalluguda) Road (50Km) and Bowdara to Vizianagaram Road (32Km) was approved on 28th November, 2017. The Consultancy Service for above work has been entrusted to M/s. SATRA Infrastructure Management Services Pvt. Ltd. Secunderabad, Telangana.

As a part of DPR Study, It is mandatory for DPR consultants to conduct public consultations and Gram Sabha with the project affected persons along with R&B,

Hence, I request you to accord official person on **Date 3rd October 2018**, time **11:00 AM**, venue at **Grampanchayat officeto** conduct Gramsabha and Public consultations and requested to cooperative with the representative of M/s SATRA Infrastructure Management Services Pvt. Ltd. Secunderabad, Telangana

Yours Sincerely,



Executive Engineer (R&B)I/C
NH-Division, Visakhapatnam.

Copy to:

1. M/s. SATRA Infrastructure Management Services Pvt. Ltd. Secunderabad, Telangana-500003.

Sri L.V. Subrahmanyam, B.Tech.,
Executive Engineer,
R&B NH-Division,
Vishakapatnam-18.

The Extension officer,
Paderu Mandal,
Visakhapatnam District.

Lr.No.NIL/ATO/NH-Division/2018 dated: 29-9-2018.

Dear Sir,

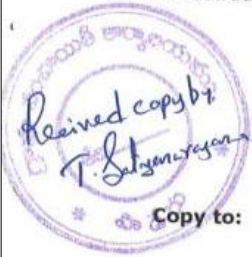
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Yours Sincerely,


Executive Engineer (R&B)I/C
NH-Division, Visakhapatnam.

- Copy to:**
1. M/s. SATRA Infrastructure Management Services Pvt. Ltd. Secunderabad, Telangana-500003.

From
Sri L.V. Subrahmanyam, B.Tech.,
Executive Engineer,
R&B NH-Division,
Vishakapatnam-18.

To
The Extension officer,
Hukumpeta Mandal,
Visakhapatnam District.

Lr.No.NIL/ATO/NH-Division/2018 dated:29-9-2018.

Dear Sir,

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Hence, I request you to accord official person on **Date 3rd October 2018, time 11:00 AM**, venue at **Grampanchayat office** to conduct Gram sabha and public consultations and requested to cooperative with the representative of M/s SATRA Infrastructure Management Services Pvt. Ltd. Secunderabad, Telangana.

Yours Sincerely,


Executive Engineer (R&B)I/C
NH-Division, Visakhapatnam.

Copy to:

1. M/s. SATRA Infrastructure Management Services Pvt. Ltd. Secunderabad, Telangana-500003.

Received Copy
ch. Jotsna
2/10/18
Panchayat secretary
HUKUMPETA (GP)
Hukumpeta (Md)

From
Sri L.V. Subrahmanyam, B.Tech.,
Executive Engineer,
R&B NH-Division,
Vishakapatnam-18.

To
The Extension officer,
Araku Valley Mandal,
Visakhapatnam District.

Lr.No.NIL/ATO/NH-Division/2018 dated: 29-9-2018.

Dear Sir,

Sub: Consultancy Services for Project Management including preparation of Detailed Project Report of selected stretches/ corridors of National Highways/State Roads (Approved "In Principle" for declaration as National Highways) in the state of Andhra Pradesh for upgradation to Two/Four Lane with paved shoulder configuration, of Consultancy Package No. NH/AP (R&B)-10 ((i) Paderu-Araku Road Section (ii) Srungavarapukota - Vizianagaram on NH-26 Road Section) - Public Consultation -Requested -Regarding.

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As a part of DPR Study, It is mandatory for DPR consultants to conduct public consultations with the project affected persons along with R&B, Revenue, Tourism and Forest Officials.

Hence, I request you to accord official person on **Date 3rd October 2018, time 11:00 AM**, venue at **Grampanchayat officeto** conduct Gramsabha and Public consultations and requested to cooperative with the representative of M/s SATRA Infrastructure Management Services Pvt. Ltd. Secunderabad, Telangana.

Yours Sincerely,


Executive Engineer (R&B)I/C
NH-Division, Visakhapatnam.

Copy to:

1. M/s. SATRA Infrastructure Management Services Pvt. Ltd. Secunderabad, Telangana-500003.

From

To

CHAPTER 9

ENVIRONMENTAL MANAGEMENT PLAN

9.1 Introduction

Environmental Management Plan has been prepared which mainly centered on the understanding of the interactions between the environmental setting and the project activities and the assessment of the anticipated impacts. Mitigation measures for anticipated environmental impacts have been elaborated as specific actions which would have to be implemented during the project implementation. The EMP would help the contractors/PIU to implement the project in an environmentally sustainable manner and where contractors, understand the potential environmental impacts arising from the project road and take appropriate actions/mitigation measures to properly mitigate/manage such environmental impacts. EMP can thus be considered to be an overview document for contractors that will guide environment management of all anticipated impacts in proposed two lane upgradation with paved shoulders of Paderu- Araku (up to Bhalluguda) Section of NH 516 E. This EMP may also be considered as flexible and will be further developed by the Contractor in the Contractor's Environment Management Plan.

9.2 Outline of EMP and its Implementation Strategy

The EMP is a guiding tool which discusses the potential environmental impacts and specific mitigation/management measures for the proposed two lane upgradation with paved shoulders of Paderu- Araku (up to Bhalluguda) Section of NH 516 E. It refers to the responsibilities ensuring commitment for implementation and means of verifying/supervision whether the same has been implemented properly. The timing and frequency of monitoring along with the supervision responsibility and reporting requirements are also provided in the Environmental Management Plan. As a part of the EMP, the contractors will commit to identification of the environmental and social impacts at the project road. In case of any future changes in the project road design, the EMP will need to be updated to reflect the new scope of the activities. such revisions will be finalized in consultation with the World Bank.

The PIU will be responsible to ensure implementation of EMP by the contractors with the overall accountability resting with the GNHCP-PMU. Whereas, the PIU/ Independent Engineer will ensure periodic quality audit/ guidance to the PIU and by imparting regular training, monitoring and ensuring that all EMP provisions and requirements are translated into 'contract documents and that these requirements are implemented to their full intent and extent.

Overall responsibility will be of Contractor for effective implementation of EMP and adherence to all the mitigation measures as outlined in this EMP associated with their respective activities. The Contractor will be required to comply with the provisions of the EMP.

9.3 Environmental Management Plan

The Environmental Management Plan (EMP) will guide the environmentally-sound construction of the project road and ensure efficient lines of communication/co-ordination between the PIU, Contractor, GNHCP-PMU. The EMP has been prepared for three stages of project road construction activities as: (i) Pre-construction Stage; (ii) Construction Stage; and (iii) Demobilization Stage. EMP for above project road have been prepared and presented in **Table 9.1**. Various guidelines, checklists and reporting formats for implementation of EMP are given as Annexures at the end of EIA Report.

The purpose of the EMP is to ensure that the activities are undertaken in a responsible non-detrimental manner with the objectives of: (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impacts of the project road; and (iv) ensure that safety recommendations are complied with.

Budgetary provisions for implementation of EMP shall be integrated with the bid/construction contract in the form of technical specifications and environmental performance requirements. The costs to be incurred on implementation of EMP shall be incidental to the civil works and therefore, no separate environment budget/cost will be provided to the contractor for implementation of EMP. The contractor will ensure effective implementation of EMP during pre-construction, construction and demobilization stages. EMP for operation stage will be implemented by PIU/PMU.

The Contractor is deemed not to have complied with the EMP if; i), within the boundaries of the project site/ ancillary sites, site extensions and haul/ access roads, (ii) there is evidence of contravention of clauses, (iii) if environmental damage ensues due to negligence, (iv) the contractor fails to comply with corrective action measures or other instructions issued by the PIU) / GNHCP-PMU within a specified timeframe and (v) the Contractor fails to respond adequately to complaints from the public.

Table 9.1: Environmental Mitigation Measures and Management Plan

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
A.	Pre-Construction Stage			
	Pre-construction Activities By the PIU			
A.1	Tree Cutting Permission	<ul style="list-style-type: none"> Approximately 3596 trees are likely to be felled for upgradation of the project. All efforts will be made to minimise cutting of trees. Prior permission will be obtained for cutting trees. 	PIU	PMU
A.2	Preservation of Trees	<ul style="list-style-type: none"> All efforts will be made to preserve trees including evaluation of minor design adjustments/alternatives (as applicable) to save trees. In the event of design changes, additional assessments including the possibility to save trees shall be made. Stacking, transport and storage of the wood will be done as per the relevant norms Systematic corridor level documentation for the trees cut and those saved will be maintained by the PIU. 	PIU	PMU
A.3	Utility Shifting	Prior permission will be taken from line department offices of Electricity (PDD), Telecommunications (for OFC underground cables etc), water Pipeline (PHE) etc. Utility shifting required to be undertaken by PIU.	PIU	PMU
	Orientation of Implementing Agencies	The PIU shall organize orientation sessions for contractor. This shall include on-site training (general as well as specific to the context of this project road. In training session PIU officers, project staff, contractors, consultants etc will be involved.	PIU	PMU
	Pre-construction Activities By the Contractor			
A.4	Appointment and Mobilization of Environment & Safety Officer	<ul style="list-style-type: none"> The contractor will appoint qualified and experienced Environment & Safety Officer (ESO), who will dedicatedly work and ensure implementation of EMP including Occupational, Health and Safety measures. Contractor to inform the PIU for the appointment and mobilization each ESO 	Contractor	Independent Engineer /PIU
A-5	Regulatory Approvals	<ul style="list-style-type: none"> Prior permission will be obtained from concerned Department for any works related to culverts, embankment construction, protective works etc. along or near natural streams. Labour license from Department of Labour. If contractors open new stone quarry or borrow areas, prior Environmental Clearance will be obtained from SEIAA/DEIAA. For setting-up of Stone Crusher Plant, HMM Plants, Batching Plant, D.G Sets- Consent to Establish and Consent to Operate will be 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		obtained from Andhra Pradesh Pollution Control Board (APPCB) or if contractor intend to procure construction materials from local authorized third party agencies then contractor will collect and submit necessary clearance/approval from authorized third party agencies.		
A-6	Common Property Resources (CPR's)	<ul style="list-style-type: none"> All common property resources shall be relocated and restored before the commencement of the road improvement activities. Before commencement of works, a joint field Monitoring will be conducted by the Contactor and PIU to map out the alignments, to check if any CPR is being impacted due to construction works. While relocating these utilities and facilities all concerned agencies including PIU shall take necessary precautions and shall provide barricades/delineation of such sites to prevent accidental fall of pedestrian and other road users into pits, drains both during demolition and construction/ relocation of sum facilities. 	Contractor	Independent Engineer /PIU
A.7	Procurement of Machinery, Crushers, Batching Plants etc	<ul style="list-style-type: none"> Specifications of Machinery, crushers, and batching plants shall comply with the requirements of the relevant environmental legislations. Crusher, Batching plants and hot mix plant shall be located 250m away from settlements/ commercial establishments, preferably in the downwind direction. No plants should be set-up within 250m from the residential/ settlement locations. The Contractor shall submit a detailed layout plan for such sites and seek prior approval of PIU before entering into formal agreement with a land owner for setting-up such sites. Actions by PIU/PMU against any non-compliance shall be borne by the Contractor at his own cost. Arrangements to minimize dust pollution through provision of water spray shall have to be provided at such sites. 	Contractor	Independent Engineer /PIU
A.8	Construction Camp Locations - Selection, Design & Lay-out	<ul style="list-style-type: none"> If contractor decides to establish labour camp, siting of the camp will be as per the guidelines given in Annexures- and layout of camp will be approved by PIU. Labour camp will not be established within 250 m from the nearest settlement to avoid conflicts and stress with the local community. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
A.9	Arrangements for Temporary Land for Camp	The Contractor will obtain consent from land owners in writing for temporary use of land for labour camp, etc..	Contractor	Independent Engineer /PIU
A.10	Construction Vehicles, Equipment and Machinery	<ul style="list-style-type: none"> All vehicles and equipment to be procured for the proposed up-gradation works of project road will conform to the relevant Bureau of Indian Standard (BIS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 and Motor Vehicles Act, 2019 will be strictly adhered to. The silent/quiet equipment like DG set as per regulations will be used at the construction site or labour camp. The contractor will maintain records of Pollution Under Control (PUC) certificates for all vehicles used during the contract period, which will be produced to PIU for Monitoring and whenever required. 	Contractor	Independent Engineer /PIU
A.11	Arrangement for Construction Water	<ul style="list-style-type: none"> The contractor shall source construction water preferentially from surface water bodies in the project area. Boring of any tube wells shall be drilled only after obtaining necessary permission from Central Ground Water Authority. To avoid disruption/disturbance to other water users, the contractor shall extract water from fixed locations. The contractor shall consult the local people before finalization the locations. Contractor can extract ground water only in case surface water sources are not available and that too only after proper permission from Central Ground Water Authority. 	Contractor	Independent Engineer /PIU
A.12	Sand (all river beds used directly or indirectly for the project)	If the supplier of sand is another (third) party, the authentic copy of lease agreement that has been executed between the local Tehsildar and the supplier has to be submitted to PIU/PMU of the project, before any procurement is made from such a site. Environmental clearance for stone quarry and borrow area will be obtained from DEIAA/SEIAA.	Contractor	Independent Engineer /PIU
A.14	Labour Requirement	<ul style="list-style-type: none"> The contractor preferably will use unskilled/semiskilled labour from local areas to give the maximum benefit to the local community to avoid any additional stress on the existing facilities. On an average 150 labours/ day will be required during construction stage depending upon extent of construction work. All applicable labour regulation will be complied by the contractor. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> Necessary facilities will be provided to workers as per The Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 		
A.15	Traffic Management Plan- Planning for Traffic Diversions and Detours	<ul style="list-style-type: none"> Detailed traffic control plan shall be prepared by the contractor and same shall be submitted to the PIU for approval. The traffic control plans shall contain details of temporary diversions, traffic safety arrangements including night time safety measures, details of traffic arrangement after cessation of work each day, safety measures undertaken for transport of hazardous materials and arrangement of flagmen etc to regulate traffic congestion. The contractor shall provide specific measures for safety of pedestrians and workers as a part of traffic control plans. The contractor shall ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. The Contractor shall also inform local community about diversion in traffic routes and pedestrian access arrangements with assistance from PIU. 	Contractor	Independent Engineer /PIU
A-17	Stockyard/ Storage of Construction Material and Establishing Equipment Lay-down Area	<ul style="list-style-type: none"> Contractor in consultation with PIU shall identify the site for temporary use of land storage of construction materials including pipes etc. These sites shall not cause an inconvenience to local population / traffic movement. These locations shall be approved by the PIU. Selection of location for materials storage and equipment lay-down areas must take into account prevailing winds, distances to adjacent land uses, general on – site topography and water erosion potential of the soil. Impervious surfaces must be provided wherever necessary. Protect material stockpiles from storm water (e.g. by excavating a cut-off ditch around stockpiles to keep away storm water). Enclosed storage for fuel with non- permeable flooring. Contractor shall cover material stockpiles with tarpaulin or other materials. Avoid stockpiling material near natural streams. Proper cover and stacking of loose construction material will be ensured during construction of outfall structures at construction site to prevent surface runoff and contamination of receiving water body. Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures. The 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances like bitumen, diesel, used oil and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training. Necessary training and awareness program shall be carried out to make aware the contractor and its staff aware about hazardous nature of substances.		
A-18	Information Dissemination and Communication Activities	<ul style="list-style-type: none"> • Prior to construction activity, information dissemination will be undertaken by contractor at the project site. The wider dissemination of information to public will be undertaken through the disclosure of EA / EMP reports on the website of MORTH. • Project information Board showing the name of work, project cost, duration, date of commencement, date of completion, executing agency and contact details (including telephone numbers) shall be displayed both sides of the both roads in both English and in Vernacular. • Information boards will also be setup at the sites of construction camps and labour camps, plants and stockyard site. • Details of nodal officer with telephone numbers will be displayed for registering compliant/grievances by stakeholder/general public. 	PMU Contractor	PMU Independent Engineer /PIU
B.	Construction Stage			
B.1	Site Clearance (Clearing and Grubbing)			
B.1.1	Clearing, grubbing and Levelling	<ul style="list-style-type: none"> • If required vegetation will be removed from the construction zone only. • All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval of PIU. • The Contractor, under any circumstances will not cut or damage trees. • Trees identified under the project will be cut only after receiving necessary permissions. Vegetation with girth size of over 30 cm will be considered as trees and shall be compensated. 	Contractor	Independent Engineer /PIU
B.1.2	Dismantling of Culverts	Reconstruction of 38 culverts is proposed in the project road. All necessary measures shall be taken especially while working close to cross drainage channels to prevent earthwork, stonework, materials and appendage as well as the method of operation from impeding	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		cross-drainage at streams, water canals, existing irrigation and drainage systems. Demolition wastes will be collected and disposed as per the provision of Construction & Demolition Rule 2016.		
B.1.3	Generation & disposal of Debris	<ul style="list-style-type: none"> Debris generated due to the dismantling of the existing road shall be suitably reused in the proposed construction. Scarified asphalts and the other construction wastes shall be appropriately re-used in road construction with the permission of PIU. The dismantled road and scarified bitumen waste shall be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes, parking areas along the roads or in any other manner approved by the PIU. The Contractor will suitably dispose off unutilized debris and waste materials either through filling up of borrows areas located in wasteland or at pre-designated disposal locations, subject to the approval of the Environmental Expert of PIU. At locations identified for disposal of residual bituminous wastes, the disposal will be carried out over a 60 mm thick layer of rammed clay so as to eliminate the possibility of leaching of wastes into the ground water. The Contractor will ensure that the surface area of such disposal pits is covered with a layer of soil. All arrangements for transportation during construction including 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 PIU. The pre-designed disposal locations will be a part of Solid Waste Management Plan to be prepared by Contractor in consultation and with approval of Environmental Expert of PIU. 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. 		
B.1.4	Stripping, stocking and	The topsoil from 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 use will be earmarked for	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
	preservation of top soil	<p>storing topsoil. The locations for stock piling will be pre-identified in consultation and with approval of Environmental Specialist of PIU. 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 a case where there are to be rehabilitation • Dressing of slopes of road embankment • Agricultural fields of farmers acquired temporarily land. 		
B 1.5	Accessibility	The Contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property accesses connecting the project road, providing temporary connecting road. The Contractor will also ensure that the existing accesses will not be undertaken without providing adequate provisions. The Contractor will take care that the cross roads are constructed in such a sequence that construction work on the adjacent cross roads are taken up one after one so that traffic movement in any given area not get affected much.	Contractor	Independent Engineer /PIU
B 1.6	Planning for Traffic Diversions And Detours	Temporary diversions will be constructed with the approval of the Environmental Specialist of PIU. Detailed Traffic Control Plans will be prepared by the Contractor and approved by Environmental Specialist, seven days prior to commencement of works on any section of road. The traffic control plans shall contain details of temporary diversions, traffic safety arrangements for construction under traffic, details of	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<p>traffic arrangement after cessation of work each day, safety measures for night time traffic and precaution for transportation of hazardous materials and arrangement of flagmen.</p> <p>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. 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>		
B.2	Procurement of Construction Materials			
B.2.1	Procurement for Aggregate and other construction materials	<ul style="list-style-type: none"> No borrow area will be opened without permission of the Environmental Specialist and without obtaining necessary regulatory permission. The location, shape and size of the designated borrow areas will be as approved by the Environmental Specialist and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 36: 2010). The borrowing operations will be carried out as specified in the guidelines for siting and operation of borrow areas. The unpaved surfaces used for the haulage of borrow materials, if passing through the settlement areas or habitations; will be maintained dust free by the Contractor. Sprinkling of water will be carried out twice a day to control dust along such roads during their period of use. During dry seasons (winter and summer) frequency of water sprinkling will be increased in the settlement areas and Environmental Specialist of PIU will decide the sprinkling time depending on the local requirements. Contractor will rehabilitate the borrow areas as soon as borrowing of soil is over from a 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		particular borrow area in accordance with the approved borrow area Redevelopment Plan.		
B.2.2	Quarry Operations & Crushers	The Contractor shall obtain materials for approved quarries. The crushers will be operated after obtaining consent to establish and consent to operate from APPCB.	Contractor	Independent Engineer /PIU
B.2.3	Transporting Construction Materials	<ul style="list-style-type: none"> Contractor will maintain all roads, which are used for transporting construction materials, equipment and machineries. All vehicles delivering fine materials like aggregate, cement, earth, sand, etc, to the site will be covered by Tarpaulin to avoid spillage of materials and wind blown dust from the top of vehicles. Existing road used by vehicles of the contractor or any of his subcontractor or suppliers of materials will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. The contractor will make effort to transport materials to the site in non-peak hours 	Contractor	Independent Engineer /PIU
B.3	Construction Work			
B.3.1	Labour Camp Site	<ul style="list-style-type: none"> Project information board will be displayed at the labour camp site. Electrical cables and wires will be properly arranged with proper electrical safety. Loose electrical connections will not be allowed at the labour camp. Red danger sign with bone & skull will be displayed as per The Electrical Rules at three phase motors, electrical panels and electrical machines, DG sets, etc. Housekeeping at labour camp will be maintained properly. Daily sweeping and cleaning will be done at the labour camp. HIV Aid awareness posters will be displayed at the camp site. Solid waste generated at the camp site will be collected in covered waste bins. Then, it will be segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored in empty cement bags and to be sent for recycling through scrap dealer. Biodegradable (food waste, paper, etc) solid waste will be disposed in compost pit. Non-biodegradable inert wastes will be sent to nearest land fill site. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> • Proper drinking water, well ventilated accommodation, sanitation, canteen facilities will be provided to workers at the labour camp. • Suitable signages will be displayed at labour camps. 		
B.3.2	Drainage and Flood control	<ul style="list-style-type: none"> • Major bridge at four locations and minor bridge at 18 locations, while 128 box culverts are proposed to be constructed in the proposed project: • The Contractor shall ensure that no construction materials/debris shall block the water flow or create water lodging at the work site. The Contractor shall take remedies to remove accumulated water (if any) from the construction sites, camp sites, storage yard, excavated areas etc. • Construction works should plan well in advance prior to on-set of monsoon to avoid water- pool besides providing temporary cross drainage systems. The contractor shall take all adequate precautions to ensure that construction materials and excavated materials are enclosed in such a manner that erosion or run off of sediments is controlled. • Silt fencing shall be installed prior to the onset of the monsoon at all the required locations, as directed by PIU/PMU. Prior to monsoon, the contractor shall provide either permanent or temporary drains to prevent water accumulation in surrounding residential, commercial and agricultural areas. 	Contractor	Independent Engineer /PIU
B.3.3	Siltation of Water Bodies and Degradation of Water Quality	<ul style="list-style-type: none"> • The project roads are crossing natural streams at 25 locations, which remain dry in non-rainy days. • The Contractor will not excavate beds of any stream/canals/ any other water body for borrowing earth for embankment construction. • Contractor will construct silt fencing at the base of the embankment construction for the entire perimeter of any water body (including wells) adjacent to the project road and around the stockpiles at the construction sites including ancillary 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. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> • 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. • On completion of construction of culverts and bridges, drainage channels will be cleared by collecting debris and disposed suitably. Detours/diversions constructed for construction of culverts and bridges will be also be cleared before onset of monsoon. 		
B.3.4	Slope Protection and Control of Soil Erosion	<ul style="list-style-type: none"> • For construction of two bypasses (Hukumpet Bypass and Araku Bypass) and 12 realignments at Paderu- Araku (up to Bhalluguda) Section, earth filling will be required for embankment for new road construction, which will require slope protection and control of soil erosion. • The Contractor will construct slope protection works as per design, or as directed by PIU to control soil erosion and sedimentation through use of Breast walls, Retaining Walls, gabion wall, dykes, sedimentation chambers, basins, fibber mats, mulches, grasses, slope, drains and other devices. • 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 no separate payment will be made for them. Contractor will ensure the following aspects: <ul style="list-style-type: none"> • After construction of road embankment, the side slopes will be covered with grass and shrubs as per design specifications. • Turfing works will be taken up as soon as possible provided the season is favourable 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, pitching as per design specification will protect slopes. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
B.3.6	Pedestrian and Vehicular Traffic Movement Management	<ul style="list-style-type: none"> Detailed traffic control plans will be prepared and submitted to the PIU for approval one week prior to commencement of works. The traffic control plans shall contain details of temporary diversion, details of arrangements for construction (road stretches, timing and phases). Provide the construction itinerary in advance so that the road users can use alternative routes. Erect warning and safety signs of ongoing works. Suitable retro reflective warning signs should be placed at near construction locations and should be visible at night. Alternative access ways should be communicated to the community by way of announcement appropriately for the public information. The contractor shall take all necessary measures for the safety of traffic during construction and shall provide, erect and maintain such barricades, including signs, markings, flagmen as proposed and approved by PIU. The contractor shall ensure that all signs, barricades, pavement markings are provided as per applicable IRC code and guidelines. <p>Install signage, barricading, fencing as required and include safety measures for transport of materials/ equipment's, which shall be limited to certain times, and arrangements for flagmen at intersection.</p>	Contractor	Independent Engineer /PIU
B.3.7	Excavation works for longitudinal drains along road corridor	<ul style="list-style-type: none"> As per DPR, proper drainage arrangement of earthen drain length of 46400 m and RCC drain length of 7400m (both sides) at built up locations are proposed along the project road. At the excavation site, warning sign boards will be displayed in vernacular language and English. Entry of general public/unauthorized person will be restricted. During excavation for laying of concrete (RCC) cover drains necessary safety measures will be taken by the contractor. Excavation of 1.5 meters deep or greater requires a sides protection (Close Timbering and step cutting) unless the excavation is made entirely in stable rock. Contractor to follow strict protocol during construction/ excavation for longitudinal drainage especially along the sensitive receptors like schools, mosque, community centers, religious places, shrines, grave yard etc. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> Excavated earth will be collected and disposed in pre-identified site with the approval of PIU. Excavated earth shall not be dump on the carriageway or shoulders. Casted drain block and drain cover will not be stacked on the road. To ensure elimination of excavation hazards, excavation will be carried in the presence of competent person. Suitable barricading will be provided around the excavation site. Suitable personal protective equipment will be provided to the workers. 		
B.3.8	Handling of Cement Bags	<ul style="list-style-type: none"> Cement bags will be stored and emptied in covered area to control fugitive dust emissions. While handling and emptying cement bags, workers will wear masks, hand gloves and protective goggles. Manual transferring of cement bags from one place to another place will not be allowed. For this purpose, trolley will be used. 	Contractor	Independent Engineer /PIU
B.3.9	Work-zone safety Management	<ul style="list-style-type: none"> The Contractor shall prepare the construction safety plan as per provisions under the IRC 67-2001, SP-55 for safe work zone to be duly approval by the environmental specialist of PIU/PMU prior to start of road works. Temporary barricades shall be provided to delineate construction zone as well material stacking areas. The construction site and the labour facility (if any) shall be appropriately barricaded to prevent entry and accidental tress passing of workers, staff and others into the construction site. All operational areas shall be access controlled. Watch and ward facilities at all times shall be provided by the contractor. Proper retro reflective warning signage will be installed on the access road next to the construction site about movement of construction machinery and vehicles. In excavations for longitudinal surface road drains, culverts etc., a high visibility warning and retro reflective signage shall be displayed in vermicular language and English. Entry of unauthorized persons should be restricted. Excavation of 1.5 metres deep or greater will be adequately barricaded. There shall be adequate lighting arrangement at night to prevent mishaps after construction activity ceases for the day 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> All the retro reflective Safety signage as per IRC 55 will be erected at construction site for generating awareness among local community and road user during the construction. 		
B.3.10	Sensitive Receptors- Impact Management	<ul style="list-style-type: none"> At each sensitive receptor like schools, religious places, shrines, community centers, grave yards etc and in general residential houses, the construction operations in these areas should be limited to time period of 7:30 am to 6:00 pm. Periodic maintenance and calibration of construction equipment's/ vehicles to meet applicable CPCB emission standards. Contractor to ensure regular dust suppression measures by way of standard and efficient water sprinkling through water tankers at these designated sensitive receptors. Noise barriers shall be installed during the construction phase to protect the school from the noise from construction activities. Adequate barricading and safety measures to protect dust pollution and noise impacts on sensitive receptors like schools and religious places etc. due to vehicle movement to be ensured prior to the start of work and their effectiveness to be checked during construction. 	Contractor	Independent Engineer /PIU
B.3.11	Occupational Health and Safety of Workers	<ul style="list-style-type: none"> The contractor will prepare and follow the OHS plan, including provisions for emergency response plan All workers will be provided with requisite personal protective equipment Emergency Telephone Numbers shall be displayed at camp and plant site. Medical facilities shall be provided for workers at Labour camp and plant site. 	Contractor	Independent Engineer /PIU
B.4	Pollution			
B.4.1.1	Water Pollution from Construction Wastes	<ul style="list-style-type: none"> The project roads are crossing natural streams at design chainage 25 locations, which remain dry in non-rainy days. The contractor will take all precautionary measures to prevent entering of wastewater into streams, water bodies or the irrigation system during construction. Contractor will avoid construction works close to the streams or water bodies during monsoon. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> Contractor shall not wash his vehicles in river water and shall not enter riverbed for that purpose. Any type construction wastes will not be disposed in rivers or water bodies. 		
B.4.1.2	Water Pollution from Fuel and Lubricants	<ul style="list-style-type: none"> The Contractor will ensure that all construction vehicle parking locations, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refuelling sites will be located at least 250 m away from rivers and irrigation canal/ponds. The Contractor will submit all locations and layout plans of such sites prior to their establishment and will be approved by the Environmental Specialist of PIU. Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refuelling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Wastewater from vehicle parking, fuel storage areas, workshops, wash down and refuelling areas will be treated in an oil interceptor before discharging into on land or into surface water bodies or into other treatment system. In all, fuel storage and refuelling areas, if located on areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage. Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites All oil spills, used oil will be disposed off in accordance with Andhra Pradesh Pollution Control Board (APPCB) guidelines. 	Contractor	Independent Engineer /PIU
B.4.1.2	Waste Water from Labour Camp	<ul style="list-style-type: none"> Waste water generated from the sanitary facilities at labour camp will be treated in septic tank followed by soak pit. No untreated raw sewage/waste water will be discharged into any river and water body. Workers will not be allowed for open defecation. Proper toilets fitted with septic tank and soak pit will be provided for workers at camp site. At the bridge construction site portable toilets shall be provided for workers and sewage from portable toilets shall be passed through septic tank followed by soak pit. 	Contractor	Independent Engineer /PIU
B.4.2	Air Pollution			

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
B.4.2.1	Dust Pollution	<ul style="list-style-type: none"> Road construction works specially earth work and movement of construction vehicles plying during construction phase will may add to dust and gaseous air pollution along the project road. Frequent dust suppression will be ensured for this stretch of the road by use of water tankers. The contractor will procure the construction machineries, which conforms to the pollution control norms specified by the MoEF&CC/CPCB/APPCB. The excavated earth /construction materials will be stored properly so that it does not generate fugitive emissions. Regular maintenance of vehicles to be used for materials transportation and equipment will be carried and vehicular pollution check should be made mandatory. <p>Mask and other PPE should be provided as a mandatory effort to the construction workers in dust prone areas.</p>	Contractor	Independent Engineer /PIU
B.4.2.2	Emission from Construction Vehicles, Equipment and Machineries	<ul style="list-style-type: none"> The contractor will ensure that all vehicles, equipment and machinery used for construction works are regularly maintained and conform that pollution emission levels and comply with the requirements of CPCB and/Motor Vehicles Rules. The contractor will submit Pollution Under Control (PUC) certificates for all vehicles for the project. DG set will be provided with chimney of adequate height as per CPCB guidelines (Height of stack in meter = Height of the building + 0.2 $\sqrt{\text{KVA}}$). The environmental monitoring is to be conducted as per the monitoring plan. 	Contractor	Independent Engineer /PIU
B.4.3	Noise Pollution			
B.4.3.1	Noise Levels from Construction Vehicles and Equipment's	<p>The contractor will confirm the following:</p> <ul style="list-style-type: none"> All construction equipment used in excavation, concreting, etc, will strictly conform to the MoEF&CC/CPCB/APPCB noise standards. All vehicles and equipment used in construction works will be fitted with exhaust silencers/mufflers. Maintenance and servicing of all construction vehicles and machineries will be done regularly. Only acoustic enclosures fitted DG sets will be allowed at the construction site and labour camp. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			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 and use of high noise generation equipment will be stopped during the night time between 10.00 pm to 6.00 am. Working hours of the construction activities will be restricted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors. Noise monitoring shall be carried out in construction areas through the approved monitoring agency. 		
B.5	Archaeological Resources and Cultural Properties			
B.5.1	Chance Found Archaeological Property	<ul style="list-style-type: none"> All fossils, coins, articles of value of antiquity, 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 will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Environmental Expert of the PIU of such discovery and carry out the PIU's instructions for dealing with the same, waiting which all work shall be stopped. The PIU will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site. 	Contractor	Independent Engineer /PIU
B.5.3	Impacts Cultural Properties	<ul style="list-style-type: none"> All necessary and adequate care shall be taken to minimize impact on cultural properties which includes cultural sites and remains, places of worship including mosques, temples, shrines, etc., graveyards, monuments and any other important structures as identified during design stage. Relocation and enhancement measures shall be taken up as per design and in consultation with local community. Access to such properties from the road shall be maintained clear and clean. 	Contractor	Independent Engineer /PIU
B.6	Personal Safety			
B.6.1	Personal Safety Measures for Labours and Staff	The contractor will take necessary measures for personal safety of workers:	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> • Protective safety shoes, gum boots, hand gloves, protective goggles, etc (as required) will be provided to the workers employed in excavation, steel rebaring and bending, concrete works, erection of pump station, etc. • Welder's protective eye-shields will be provided to workers who are engaged in welding works. • Earplugs will be provided to the workers exposed to high noise levels. • Safety vests will be used by workers when on construction site. • The Contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. • The contractor will comply with all the precautions as required for ensuring the safety of the workmen as far as those are applicable to this contract. • The contractor will make sure that during the construction work all relevant provisions of Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. • The Contractor will not employ any person below the age of 14 years for any work. 		
B.6.2	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 Environmental Expert 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 MoRTH specifications.</p> <p>Before taking up of construction, a Traffic Control Plan will be devised and implemented to the satisfaction of the Environmental Expert of PIU.</p>	Contractor	Independent Engineer /PIU
B.63	Emergency Management	<ul style="list-style-type: none"> • Emergency numbers will be displayed at the construction sites and camp site, • First boxes will be made available at construction site and camp site, 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> • Fire extinguishers for petroleum oil fire and electrical fire will be made available at camp site, fuel storage site, construction site etc. • Designated vehicles, which can be used as ambulance will be available at construction site at all the time. 		
B.6.4	Risk Force Measure	<ul style="list-style-type: none"> • The contractor will make required arrangements so that in case of any mishap during, operation of machinery/ construction vehicles, dismantling, excavation, concrete pouring, hot asphalt handling and erection of pumps, all necessary steps can be taken for prompt first aid treatment. • Construction Safety Plan for the all the road stretches, embankment development, protection works, works road longitudinal drains, ancillary sites to be prepared by the contractor and will identify necessary actions in the event of an emergency. 	Contractor	Independent Engineer /PIU
B.6.5	First Aid Facility	<p>The contractor will arrange for :</p> <ul style="list-style-type: none"> • A readily available first aid unit including an adequate supply of sterilized dressing materials, burn ointment and appliances as per the state Factories Rules will be maintained all the time by the contractor. • Availability of first aid trained persons will be ensured at the project site during construction phase. • Availability of suitable transport will be ensured at all times to take injured or sick person(s) to the hospital. 	Contractor	Independent Engineer /PIU
B.6.6	Informatory Signs and Hoardings	<ul style="list-style-type: none"> • The Contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required or as suggested by the Environmental Specialist of PIU. 	Contractor	Independent Engineer /PIU
B.7	Labour Camp and Project Site Management			
B.7.1	Accommodation for Laborers	<ul style="list-style-type: none"> • Contractor will follow all relevant provisions of the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. • The location, layout and basic facility provision of each labour camp will be submitted to Environmental Expert of PIU prior to their construction. • The construction will commence only upon the written approval of the Environmental Expert of PIU. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> The contractor will maintain necessary well ventilated living accommodation, toilets, bath rooms and ancillary facilities in functional and hygienic manner. Proper ventilation along with standard exhaust fans will be provided in labour accommodation rooms. Regular cleaning and sweeping will be ensured at the labour camp site. Systematic waste collection management at labour camp to be managed as per SWM Rules 2016. <p>Standard First Aid Kits/units including an adequate of sterilized dressing materials.</p>		
B.7.2	HIV/AIDS Prevention Measures	<ul style="list-style-type: none"> Necessary HIV/AIDS prevention measures will be taken at labour camp HIV/AIDS awareness program will be organized by the contractor's Environment & Safety Officer. 	Contractor	Independent Engineer /PIU
B.7.3	Potable Water for Workers	<ul style="list-style-type: none"> The contractor will construct and maintain labour accommodation in such a fashion that uncontaminated clean water is available for drinking, cooking, bathing and washing. The contractor will also provide potable water facilities within the precincts of workplace/pump stations in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. The contractor will also provide the following: <ol style="list-style-type: none"> Supply of sufficient quantity of potable water (as per IS) at construction site/labour camp (site 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 1 meter above the surrounding ground level. If water is drawn from any existing well/ hand pump, which is within 30 meters proximity of any toilet, drain or other source of pollution, the well will be disinfected before water is used for the drinking. <p>Environmental Expert of PIU will be required to inspect the labour camp once in a week to ensure the compliance of the EMP.</p>	Contractor	Independent Engineer /PIU
B.7.4	Sanitation and Sewage System at Labour Camp	<p>The contractor will ensure that :</p> <ul style="list-style-type: none"> The sewage system for the camp will be designed, built and operated in such a fashion that no health hazard occurs and no pollution to the air, ground water or adjacent water courses take place, 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> Separate toilets/bathrooms, as required, will be provided for men and women, marked in vernacular language, Toilets will be provided with septic tank followed by soak pit. Adequate water supply will be provided in all toilets and urinals, Night soil can be disposed of with the help of municipality or disposed of by putting layer of it at the bottom of a permanent pit prepared for the purpose and covered with 15 cm layer of waste or refuse and then covered with a layer of earth for a fortnight. 		
B.7.5	Waste Disposal	<ul style="list-style-type: none"> The contractor will provide garbage bins in the camp & construction site and ensure that these are regularly emptied and disposed off in a hygienic manner according to Solid Waste Management Plan as per Solid Waste Management Rule 2016. Burning of wastes at construction site & labour camp and road side will not be allowed. Solid waste generated at the construction site & labour camp, will be collected in covered waste bins and segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored in empty cement bags and to be sent for recycling through scrap dealer. Biodegradable (food waste, paper, etc) solid waste will be disposed in the compost pit. 	Contractor	Independent Engineer /PIU
B.8	Environmental Monitoring			
B.8.1	Environmental Monitoring- Construction Stage	<ul style="list-style-type: none"> Environmental monitoring for ambient air quality, noise levels and water quality will be carried out as per environmental monitoring plan and in accordance to instruction of Environmental Specialist of PIU. 	Contractor	Independent Engineer /PIU
B.8.2	Compensatory Plantation	<ul style="list-style-type: none"> Loss of trees will be compensated by 1:3 ratio (<i>i.e.</i> for loss of 1 tree 3 trees will planted) or greater and transplantation of the same trees may be envisaged wherever applicable. Regular monitoring will be carried out for plantation along the project road for cutting of trees. 	PIU	PMU
C.	Contractor's Demobilization			
C.1	Clean-up Operations, Restoration and	<ul style="list-style-type: none"> The contractor will prepare project and labour camp site restoration plan, which will be approved by the PIU / Environmental Expert. The clean-up and site restoration operations are to be implemented by the contractor 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
	Rehabilitation	<p>prior to demobilization from construction site and labour camp. The contractor will clear all temporary structures, debris, construction wastes, garbage, night soils, etc in environmental sound manner.</p> <ul style="list-style-type: none"> • All disposal pits or trenches will be filled in and effectively sealed off. • Construction places including camp and any other area used/affected due to the project operations will be left clean and tidy at the contractor's expense to the entire satisfaction to the PIU. 		
C.2	Land Rehabilitation	<ul style="list-style-type: none"> • All surfaces hardened due to construction activities will be ripped & imported materials thereon removed. • All rubbles to be removed from the site to an approved disposal site. Burying of rubble on site is prohibited. • Surfaces are to be checked for waste products from activities such as concreting or asphaltting and cleared in a manner approved by the Engineer. • All embankments are to be trimmed, shaped and replanted to the satisfaction of the PIU. • Borrow pits are to be closed and rehabilitated in accordance with the pre-approved management plan for each borrow pit. The Contractor shall liaise with the PIU regarding these requirements. 	Contractor	Independent Engineer /PIU
C.	Contractor's Demobilization			
C.1	Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> • The contractor will prepare project and labour camp site restoration plan, which will be approved by the PIU / Environmental Expert. The clean-up and site restoration operations are to be implemented by the contractor prior to demobilization from construction site and labour camp. The contractor will clear all temporary structures, debris, construction wastes, garbage, night soils, etc in environmental sound manner. • All disposal pits or trenches will be filled in and effectively sealed off. • Construction places including camp and any other area used/affected due to the project operations will be left clean and tidy at the contractor's expense to the entire satisfaction to the PIU. 	Contractor	Independent Engineer /PIU
C.2	Land Rehabilitation	<ul style="list-style-type: none"> • All surfaces hardened due to construction activities will be ripped & imported materials thereon removed. • All rubbles to be removed from the site to an approved disposal site. Burying of rubble on site is prohibited. 	Contractor	Independent Engineer/PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> • Surfaces are to be checked for waste products from activities such as concreting or asphaltting and cleared in a manner approved by the Engineer. • All embankments are to be trimmed, shaped and replanted to the satisfaction of the PIU. • Borrow pits are to be closed and rehabilitated in accordance with the pre-approved management plan for each borrow pit. The Contractor shall liaise with the PIU regarding these requirements. 		
D	Post Construction Stage			
D.1	Environmental Monitoring- Post Construction Stage	Environmental monitoring for ambient air quality, noise levels and water quality as per environmental monitoring plan and in accordance to instruction of Environmental Specialist of PMU.	PIU	PMU
D.2	Monitoring of Afforested and Landscape areas	Continuous watch and monitoring of plantation and landscape areas shall be done for its performance and survival rate. The plantation will be properly guarded by watch and ward personnel. Provision will be made for manure application and watering on schedule.	PIU	PMU
D.3	Soil Erosion and Monitoring of Borrow Areas	Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankments and other places expected to be affected, will be carried out once in every three months.	PIU	PMU

9.4 Clause for Nonconformity to Environmental Management Plan (EMP) - Protection of the Environment

The Contractor will implement necessary mitigation measures for which responsibility is assigned to him as stipulated in the EMP. Any lapse in implementing the same will attract the damage clause as detailed below:

- Any complaints of public, within the scope of the Contractor, formally registered with the PIU and communicated to the Contractor, which is not properly addressed within the time period intimated by the PIU shall be treated as a major lapse.
- Non-conformity to any of the mitigation measures like unsafe conditions, non-collection of excavated material (during laying of drainage pipes) regularly and other unattended Health, Safety & Environment (HSE) issues, as stipulated in the EMP Report (other than stated above) shall be considered as a minor lapse.
- On observing any lapses, PIU shall issue a notice to the Contractor, to rectify the same.
- Any minor lapse for which notice was issued and not rectified, first and second reminders shall be given after ten days from the original notice date and first reminder date respectively. Any minor lapse, which is not rectified, shall be treated as a major lapse from the date of issuing the second reminder.
- If a major lapse is not rectified upon receiving the notice PIU shall invoke reduction, in the subsequent interim payment certificate.
- For major lapses, 10% of the interim payment certificate will be withheld, subject to a maximum limit of about 0.5% of the contract value.
- If the lapse is not rectified within one month after withholding the payment, the amount withheld shall be forfeited immediately.

9.5 Environmental Monitoring Plan

The monitoring programme consists of performance indicators, reporting formats and necessary budgetary provisions. The contractors monitoring plan should be in accordance with the baseline environmental monitoring, locations provided in the Environmental impact assessment report.

The monitoring plan has the following objectives:

- To ensure effective implementation of EMP
- To evaluate the performance of mitigation measures proposed in the EMP
- To comply with all applicable environmental, safety, labour and local legislation
- To ensure that public opinions and obligations are taken into account and respected to the required satisfaction level
- To modify the mitigation measures or implementing additional measures, if required

The monitoring requirement for the different environmental components have been prepared is presented in **Table 9.2** below;

9.6 Performance Monitoring Indicators

Environmental components identified of a significance in affecting the environment at critical locations have been suggested as Performance Indicators. For example near the construction site, a thick layer of dust over the nearby vegetation/leaf is an indication that the dust control measures are not effective. The performance indicators will be evaluated under three heads as mentioned below:

- Environmental condition indicators to determine efficacy of environmental mitigation measures for controlling air, noise and water pollution.
- Environmental management indicators to determine compliance with the suggested environmental management measures.
- Operational performance indicators have also been devised to determine efficacy and usefulness of the proposed mitigation measures for the project road.

The performance indicators and monitoring plan prepared for the project road are presented in **Table 9.2**. Details of the performance indicators parameters for each of the component have to be identified and reported during all stages of the implementation.

Table 9.2: Performance Indicators and Monitoring Plan

Sn.	Description of Item	Indicator	Stage	Responsibility
1.	Verification and Identification of the earth borrow areas and stone quarries	Compliance of site selection Criteria	Pre Construction	Contractor
2.	Identification of locations for the construction camp and construction plants sites	Compliance of site selection Criteria	Pre Construction Phase	Contractor
3.	Progress on the Tree Removal	Tree Cutting	Pre Construction Phase	PIU/PMU
4.	Location of the temporary storage areas for excavated materials to be reused in road construction, embankment and sub grade.	Storage of excavated materials	Pre Construction and Construction Phase	Contractor
5.	Implementation of mitigation measures specified in the EMP	Prevention/ Control of Pollution	Construction Phase	Contractor
6.	Environmental monitoring as per the conditions stipulated in the consents / as described in environmental monitoring plan	Environmental Conditions at Construction Sites/Plants/ Camps	Construction Phase	Contractor
7.	Environmental monitoring in accordance with the frequency and duration of monitoring as well as the	Ambient Air Quality, Ambient Noise Level, Ground	Construction Phase	Contractor through External agency and will be

Sn.	Description of Item	Indicator	Stage	Responsibility
	locations as per the monitoring plan. Before the onset of monsoon all the debris/excavated materials will be cleaned from the work sites and disposed of temporarily stock piled debris for final disposal properly away from the water bodies.	and Surface Water Quality, Silting of Water bodies		supervised by the Environmental Specialist of Independent Engineer/PIU / PMC
8.	Monitoring of work zone safety	Use of PPEs and signages.	Construction Phase	Contractor and will be supervised by the Environmental Specialist of Independent Engineer / PMC
9.	Implementation of the enhancement measures suggested for the pond redevelopment areas, cultural/community properties	Enhancements/ Shifting	Construction Phase	Contractor
10.	Reporting of accidents at work sites/road construction sites	Accidents Reporting	Construction Phase	Contractor
11.	Plantation of shrubs and grass in high embankment/ enhancement sites and incidental spaces	Landscaping	Construction and Defect Liability Period	Contractor
12.	Compensatory tree plantation and Reporting of the Survival Rate. The survival rate should be monitored and reported on quarterly basis.	Tree Plantation and Survival Rate	Construction and Operation Stage	Forest Department and PMU/PIU
13.	Verification of the borrow area redevelopment as specified in the redevelopment plan and satisfaction of the owners/IRC guidelines	Status of Borrow Area	Construction and Operation Stage	Contractor & PMU/PIU
14.	De-mobilization of Camps and Plant on completion of works	Clean-up and restoration of the site.	De-mobilization	Contractor and will be supervised by the Environmental Specialist of

Sn.	Description of Item	Indicator	Stage	Responsibility
				Independent Engineer / PMC

9.7 Monitoring Parameters and Standards

The environmental monitoring parameters and National Ambient Air Quality Standards are discussed below:

9.7.1. Ambient Air Quality Monitoring (AAQM)

The ambient air quality parameters viz: Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Carbon Monoxide (CO), Particulate Matter (PM₁₀, PM_{2.5}), shall be monitored six monthly at identified locations from the start of the construction activity. The ambient air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in **Table 9.3**. The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan.

Table 9.3: National Ambient Air Quality Standards

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural & other areas	Ecologically Sensitive Area (Notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide, (SO ₂), µg/m ³	Annual* 24 hours**	50 80	20 10	-Improved West and Gaeke -Ultraviolet fluorescence
2	Nitrogen Dioxide, (NO ₂) µg/m ³	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochhieser (Na-Arsenite) -Chemiluminescence
3	Particulate Matter(size less than 10 µm), or PM ₁₀ µg/m ³	Annual* 24 hours**	60 100	60 100	-Gravimetric -TOEM -Beta attenuation
4	Particulate Matter(size less than 2.5 µm), or PM _{2.5} µg/m ³	Annual* 24 hours**	40 60	40 60	-Gravimetric -TOEM -Beta attenuation
5	Carbon Monoxide (CO), µg/m ³	8 hours* 1 hours**	02 04	02 04	-Non Dispersive Infra Red (NDIR) spectroscopy

*Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals

**24 hourly or (8 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

9.7.2. Noise Quality Monitoring

The noise levels shall be monitored at designated locations in accordance with the Ambient Noise Quality standards given in **Table 9.4**. The duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan.

Table 9.4: National Ambient Noise Quality Standards

Area Code	Category of Zones	Limits of Leq in dB(A) Day*	Night*
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zone**	50	40

*Daytime shall mean from 6:00m to 10:00 pm and Night shall mean from 10:00 pm to 6:00 am

**Silence zone is defined an area up to 100 meters around premises of hospitals, educational institutions and courts, Use of vehicles horns, loud speakers and bursting of crackers are banned in these zones

9.7.3. Water Quality Monitoring

Water quality parameters such as pH, BOD, COD, DO coli form count, total suspended solids, total dissolved solids, Hardness, Conductivity etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board specifications presented in **Table 9.5** The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan.

Table 9.5: Surface Water Standards

S. No	Parameters	IS:2296 (Class C)	Method Adopted
1.	pH	6.5-8.5	pH meter
2.	BOD (3 day, 27°C)	3.0	DO-Azide modification of Wrinkler's Method
3.	Temperature (°C)	NS	Thermometer
4.	Dissolved oxygen	4	Azide modification of Wrinkler's method
5.	Color (Hazen)	300	Visual Comparison method
6.	Chloride (Cl)	600	Argentometric Titration
7.	Total Dissolved Solids	1500	Gravimetric Analysis
8.	Sulphates (SO ₄)	400	Barium Chloride method
9.	Oil and Grease	0.1	Partition -Gravimetric method
10.	Nitrates	50	Chromotropic acid
11.	Total Coliform (MPN/100 ml)	5000	Multiple Tube Fermentation Technique

NS: Not specified. All the values in mg/l if otherwise mentioned

9.8 Monitoring Plans for Environment Conditions

For each of the environmental components, the environmental monitoring plan specifies the parameters to be monitored; location of the monitoring sites and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction stages is presented in **Table 9.6**. Monitoring plan does not include the requirement of arising out of regulation provision such as obtaining Consents for plant site operation.

Table 9.6: Brief Description of Measures

Sl. No.	Locations of Work Site	Site Safety Measures
1	Construction Sites	Caution boards, Safety Cones, Delineators
2	Deep Cutting	The construction zone should be barricaded with G.I Sheet or arrangement to be made as per plan approved by the PIU / PMU. [Provide Safety Sign Boards and Safety Barriers marked with reflective tapes]
3	Temporary Diversion (if any)	Diversion Board, Barricading [Provide 'Diversion Ahead' boards at 50m, 100m and 150m ahead of diversions with reflective tape for illumination at night at the all diverted locations]
4	Safety for the Workers	Helmets, Safety-Shoes, Goggles, Dusk mask. etc

Furthermore, periodical site monitoring should be carried out by the Environmental Expert of PIU for surveillance & monitoring of road safety during the road construction. The brief description of measures has been given in **Table 9.7**:

Table 9.7: Environmental Monitoring Plan

Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Implementation
Ambient Air	Construction	PM _{2.5} , PM ₁₀ , SO ₂ , NO ₂ & CO	National Ambient Air Quality Standards (NAAQM) 2009	Two samples for one week (on non consecutive days) for in winter and summer seasons (six monthly).	24 Hours Sampling, 2 Samples in on Week	Construction labour camps, plants sites and settlements along the work zones (Locations will be decided by Environmental Expert of Independent Engineer /PMC)	Contractor
Ground Water	Construction	Organoleptic and Physical, Chemical & Bacteriological Parameters	Potable Water Standards (IS 10500: 2012)	Winter and Summer Seasons	Grab Sampling Once	Construction labour camp, plants sites, settlements along the work zones (locations will be decided by Environmental Expert of Independent Engineer /PMC)	Contractor
Surface Water	Construction	pH, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), BOD, COD, Oil & Grease (O&G) and Turbidity	Indian Standards (IS:2296-1982) for inland surface waters	Winter and Summer Seasons	Grab Sampling Once from	Construction labour camp, plants sites, River and Ponds (locations will be decided by Environmental Expert of Independent Engineer /PMC)	Contractor
Noise	Construction	Level Equivalent L _{Day} and L _{Night} based on hourly Noise Measurements	Ambient Noise Standards	Winter and Summer Seasons	Hourly noise measurements for one day in winter and summer seasons	Construction labour camp, plants sites, settlements along the work zones (locations will be decided by Environmental Expert of Independent Engineer /PMC)	Contractor

9.9 Environmental Reporting System

The environmental reporting system for the suggested monitoring programme will function at two levels:

- Reporting for environmental condition indicators and environmental management indicators
- Reporting for operational performance indicators at the PMU/PIU level. Environmental monitoring involves regular checking of the environmental management issues detailed in the EMP and to ascertain whether the mitigation measures are achieving desired objectives for environmental protection, with the progress of the works. It provides the necessary feedback for the project management to keep the programme on schedule for achieving the expected outcomes.

The Contractor, Independent Engineer /PMC and PMU/PIU will operate the reporting system for environmental conditions and environmental management indicators. The reporting system is presented in **Table 9.8**. The reporting schedule for contractors and construction supervision consultant have been prepared, which are on the basis of the implementation of EMP by the Contractor and monitoring by the Independent Engineer /PMC and PMU/PIU.

The reporting system will start with the Contractor who is the main executor of the implementation EMP activities. The Contractor will report to the Independent Engineer /PMC, who in turn will report to the PMU/PIU. The reporting system will comprise the following:

- The contractor will submit monthly environmental compliance reports along with formal monthly project progress report to the Independent Engineer
- The Independent Engineer will submit separate quarterly environmental monitoring reports to PMU/PIU in addition to submission of the summary of the activities of the month in the formal monthly report including any deviations and corrective actions
- PMU/PIU will be responsible for the preparation of the targets for identified non compliances for the EMP compliance
- Solutions for further effective implementation may also emerge as a result of the compliance monitoring reports.

The photographic records will be kept to provide useful environmental monitoring tools. All material sources points, disposal locations, plants locations, camp locations, crusher locations etc will be photographed and kept as a record. A full record of construction activities and EMP implementation will be kept as part of normal contract monitoring system. The Reporting and Monitoring Systems for various stages of construction and related activities have been proposed in **Table 9.8**.

Table 9.8: Environmental Reporting System

Item	Contractor	Construction Supervision Consultant (Independent Engineer /PMC)		PMU/PIU	
	Implementation and Reporting to Independent Engineer /PMC	Supervision	Reporting to PMU/PIU	Oversee Compliance Monitoring	Report to World Bank
Pre Construction Stage					
Sites of Camps and Plants	Weekly	Weekly	Monthly	Monthly	Quarterly
Locations of Borrow Area	Weekly	Weekly	Monthly	Monthly	Quarterly
Location of Stone Quarry	Weekly	Weekly	Monthly	Monthly	Quarterly
Shifting of Community/ Cultural Structures	Weekly	Weekly	Monthly	Monthly	Quarterly
Tree cutting and Clearing of Vegetation	Weekly	Weekly	Weekly	Weekly	Monthly
Construction Stage					
Monitoring of construction site and construction Camp	Regular	Regular	Monthly	Monthly	Quarterly
Pollution Monitoring	Six Monthly	As required	In Monthly Report	In Quarterly Report	In Quarterly Report
Monitoring of Enhancements	Weekly	Weekly	Monthly	Monthly	Quarterly
Top soil Preservations	Weekly	Weekly	Monthly	Monthly	Quarterly
Borrow area/ quarry area/ debris disposal area	Weekly	Weekly	Monthly	Monthly	Quarterly
Tree plantation	Monthly	Monthly	Monthly	Monthly	Quarterly
Demobilization of Plants					
Clean-up of plants & camps sites and Restoration of Sites	Monthly	Monthly	Monthly	Monthly	Quarterly

9.10 Institutional Arrangements for Environmental Management

The environmental management requirements/guidelines/plans need to be applied and implemented at all stages of the project. This requires an institutional mechanism to deal with various processes and requirements at each stage. Within the institutional framework proposed for the project, preparation, implementation, supervision and monitoring of environment functions, particularly the Environment Management Plans (EMP), will be carried out at the three levels - national center, state level and the project/community level with an inbuilt mechanism for coordinating activities between the said levels.

Implementation Structure

The Externally-Aided Projects Cell (EAP-Cell) at MoRTH, supported by a Project Management Consultants (PMC), will have the overall project implementation responsibility.

At the central level, the Chief Engineer, Externally Assisted Projects (CE, EAP), MoRTH, Govt. of India will be responsible for the over-all implementation of EMF and EMP. The CE, EAP will have all delegated administrative and financial decisions regarding the implementation of the project as well as environment management and safeguard related functions. CE (EAP) will be assisted by a team comprising Executive Engineer (EE) designated as an Environment and Social Officer (ESO) and a suitable number of technical and secretarial staff. The EE will ensure that all project activities are complied with as per the EMF and EMP.

MoRTH will engage a Project Management Consultant (PMC), which will include an Environment Specialist, to work with the CE, EAP's team. The PMC will be responsible for training, guidance, and recommendations for handling policy and implementation issues at the state and sub-project levels to comply with the EMF and requirements laid out in the EMP.

At the state level, the National Highways (NH) divisions in the state Public Works Department will be responsible for the project execution. In Project Co-ordination Unit, there will be an Environment Officer who will coordinate the preparation/implementation of EMP. He/she will ensure that these comply with requirements laid out in the EMF for GNHCP and are implemented in accordance to provisions laid out in the contract documents.

Finally, for the project road, a Project Site Team (PST) or Project Implementation Unit (PIU) will be responsible. The PST, to be headed by Executive Engineer, will oversee day to day implementation of environment, health and safety plan, including

on issues pertaining to tree cutting, plantation works, utility relocation and worksite safety management.

Supervision consultant/ Independent Engineer to be engaged by MORTH will provide the regular supervision and administration services. The Construction Supervision Consultant/Independent Engineer's team will have Environment and Safety personnel for day-to-day supervision and monitoring. The Environmental and Safety Officer on the Contractor's team must ensure compliance with the environmental contractual clauses and will report on progress or challenges to the Construction Supervisory team, as per the requirements/obligations stated in the Contract Document.

Independent Quality Assurance Consultants (QAC) would be engaged to oversee the quality of the green national highway upgrading contracts, including environment management, health and safety related aspects. This will determine whether the project is complying with regulatory performance standards. It entails a systematic, documented and periodic review of project implementation and could be a useful tool to improve project management performance on EHS aspects.

9.11 Environmental Management – Budget

Implementation of Environmental Management

The environmental budget for the various environmental management measures proposed for construction and operation of the project road is detailed in **Table 9.9**. 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.

Table 9.9 : Budget for Implementation of Environmental Management Plan

Sr. No	Component	Item	Unit Cost (INR)	Quantity	Total Cost
A. Construction Stage					
1.	Tree Cutting	Cutting of Road Side Trees for construction of road	Cost to be part of DPR		
2.	Environmental Monitoring	Ambient Air Quality noise and surface and ground water Monitoring as per monitoring plan,	Lump sum		1200000
3.	Topsoil Management				
4.	Air	Dust Suppression Measures	Cost to be part of DPR		
5.	Labour camp and ancillary facilities	Labour Camp and all associated facilities as per EMP	Cost to be part of DPR		
6.	Personal Protective Equipment's (PPE's)	Personal Protective Equipments like vest, helmet, safety shoe, hand gloves, gumboots, earplug, Harness belt, Welding Glasses etc	Cost to be part of DPR		
7.	First Aid Kits	First Aid Kits at the construction site, camp and ancillary sites	Cost to be part of DPR		
8.	Compensatory Plantation	Replantation of Trees (3:1)	1500	5892	8838000
9.	Oil Interceptor	Oil Interceptor at Workshop at Camp Site	40000		40000
10.	Borrow Area Rehabilitation and Quarry Management	Rehabilitation and Restoration	Cost to be part of DPR		
11.	Debris and Waste Disposal	Solid Wastes, Demolition Wastes, Hazardous Wastes	Cost to be part of DPR		
12.	Display of Safety Signages and Work Zone Safety	Sign boards, retro reflective tapes, cones, barriers	Cost to be part of DPR		
Project Enhancement					
13.	Embankment Strengthening (By way of plantation)	Grass Engraining with indigenous shrubs	Cost to be part of DPR		
14.	Protection on bridges, culvert and on high embankment	Slope Protection Measures	Cost to be part of DPR		
14.	Shifting of Community Property Resources,	Shifting and Relocation	Cost to be part of DPR		
Contingency Cost @ 5%					503900
Total Budget Cost					10581900

Annexure

Annexure

Annexure 1

Guidelines For Siting, Management And Redevelopment of Labour Camp

A. Overview

Labour camp include accommodation for workers/labourers along with other basic amenities such as kitchen, potable water supply, sanitation (toilets, bathrooms, washing areas and water supply for such needs), first aid room as well as garbage collection and disposal facility. The guidelines outlined here aims to facilitate the contractor in implementing the measures in the EMP there by reducing the impact on the environment.

B. Criteria for Locating the Site

To the extent possible/agriculture fertile land shall be avoided for locating camp site.

C. Finalization of Selected Site

After identification of the site, the Contractor should fill up the prescribed reporting format provided in EMP as annexure and submit the same for approval to the Environmental Expert of PIU. The selected site shall be approved by Environmental Expert of PIU, after considering the compliance. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the Environmental Expert of PIU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be restored at his own cost. After obtaining a written approval from the Environmental Expert of PIU for the selected site, the Contractor has to enter into an agreement with the landowner to obtain his/her consent before commencing any operation/activities in the land. The agreement should also mention its type, duration, amount and mode of payment as well as the preferences of the owner regarding site maintenance and redevelopment.

D. Designing And Setting Up of Labour Camp

The following facilities should be provided in a labour camp to ensure safe, clean and hygienic accommodation for the workers.

- (i) **Site preparation:** The site should be graded and rendered free from depressions such that the water does not get stagnant anywhere. Fencing should be constructed all around the camp to prevent the trespassing of humans and animals. The approved layout plan should be strictly adhered to while setting up the camp.
- (ii) **Accommodation:** Contractor will follow all relevant provisions of the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. The height of the worker's and labour accommodation shall not be less than 3m from floor level to the lowest part of the roof. The camp shall be floored with concrete, shall be kept clean, with proper cross ventilation, and the space provided shall be on the basis of one sqm per head or as per the relevant regulation, whichever is higher. Fire and electrical safety precautions shall be adhered to. Cooking, sanitation and washing areas shall be provided

separately. The contractor will maintain necessary living accommodation and ancillary facilities (including provision of clean fuel to prevent damage to forests and to prevent fuel wood cutting and burning by labour) in functional and hygienic manner. The site must be graded and rendered free from depressions such that water does not get stagnant anywhere. The entire boundary of the site should be fenced all around with barbed wire so as to prevent the trespassing of humans and animals.

- (iii) **Drinking Water:** The Contractor should provide potable water within the precincts of every workplace in a cool and shaded area, which is easily accessible as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. All potable water storage facilities will be on a safely raised platform that is at least 1m above the surrounding ground level. Such facilities shall be regularly maintained from health and hygiene point of view. If necessary, water purifier unit shall be installed for providing potable water.
- (iv) **Sanitation Facilities:** Adequate nos. of toilets shall be provided separately for males and females (depending on their strength), with markings for identification in vernacular language. All such facilities must have adequate water supply with proper drainage and disposal facility. They shall be maintained, cleaned and disinfected daily using proper disinfectants. Location and design of soak pit should be in such a way that it doesn't pollute the ground water. Drains and ditches should be treated with bleaching powder on a regular basis. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.

Portable toilets may be brought to use at construction site and the night soil from such units has to be disposed through designated septic tanks so as to prevent pollution of the surrounding areas. In the main camp, no night soil or sewerage shall be disposed of at any place other than the septic tanks constructed at the site. All these facilities shall be inspected on a weekly basis to check the hygiene standards.

- (v) **Waste Disposal:** The Contractor should provide garbage bins in the camp and ensure that these are regularly emptied and disposed off in a hygienic manner. No incineration or burning of wastes shall be carried out by the Contractor. Separate bins shall be provided for biodegradable and non-biodegradable wastes. The disposal of kitchen waste and other biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site. Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipe scrubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or sold /given out for recycling.
- (vi) **Day Crèche Facility:** At construction site, provision of a day crèche shall be made so as to enable women to leave behind their children while going to work. At least one attendant shall be provided to take care of the children at the crèche. At construction site where 20 or more women are employed, there shall be at least one shelter for use of children under the age of 6 years belonging to such women.

Shelters shall not be constructed to a standard lower than that of thatched roof, mud walls and floor with wooden planks spread over mud floor and covered with matting. Such areas shall be safely barricaded (no sharp sheets or barbed wires that may injure a child) from rest of the camp for the safety of children. Shelters shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate

provision to keep the place clean. The size of a crèche may vary according to the number of children on a camp site.

- (vii) Mess and Kitchen Facilities:** The Contractor shall adhere to the sanitary/hygiene requirements of local medical, health and municipal authorities at all times. Adoption of such precautions as may be necessary to prevent soil and water pollution at the site while operating mess or kitchen facilities.
- (viii) First Aid Facilities:** At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances should be provided. Suitable transport should be provided to facilitate taking injured and ill persons to the nearest hospital. Adequate personal protective equipments and fire fighting equipments as detailed out in EMP should be made available in the camp and provided to the staff / workers.
- (ix) Health Care Facilities:** Health problems of the workers should be taken care of by providing basic health care facilities. If there is no hospital or clinic, which can be accessed in half an hour's time, then a temporary health center should be set up for the construction camp. The health centre should have at least a doctor and a nurse, duty staff, medicines and minimum medical facilities to tackle first aid requirements or minor accidental cases, linkage with nearest higher order hospital to refer patients of major illnesses or critical cases.

The health centre should carryout quarterly awareness programme of HIV – AIDS with the help of AIDS control society as well as about community living and hygiene practices in day to day living. Posters should be exhibited in the health care clinic.

E. Operation of Labour Camp

Throughout the functioning period of the camp, hygienic environment must be ensured by (i) provision of safe drinking water, (ii) proper maintenance of toilets including daily cleaning and disinfection using proper disinfectants, (iii) regular cleaning of drains by removing the silt and solid waste, (if any) and (iv) appropriate waste management practices. While it is of utmost importance to ensure that fire-fighting equipments like fire extinguishers are in working condition, it should also be monitored that construction workers use the personal protective equipments provided to them and they are replaced when necessary. All these facilities should be inspected on a weekly basis to achieve the desired levels of safety and hygiene standards.

F. Preparation of Labour Camp Management And Re-development Plan

After the site for the labour camp has been finalized and approved by Environmental Expert of PIU, the Contractor should prepare a labour camp management and redevelopment plan to be submitted to PIU for approval prior to setting up of the camp and it should comprise the following details:

- Section-1:** Details of site: Copy of approved site identification report along with location plan, showing the site, its survey no., access road, project stretch, distance form the project stretch, surrounding features and land use like residences, water bodies etc., photograph of the site showing the topography and other existing features.
- Section-2:** Site preparation: Activities that should be undertaken for preparing the site based on EMP and this guideline.

- Section-3:** Arrangements/ facilities within the camp: List of facilities to be provided along with its details like area, no of people to be accommodated and a layout plan showing the plan of the site with all the facilities planned like quarters, labour camp, mess, common facilities, toilet facilities, etc.
- Section-4:** Mitigation measures that should be undertaken as per the EMP and this guideline while setting up of the camp and operation of the camp should be separately listed out here.
- Sectoin-5:** Other details: Any other relevant detail like list of awareness camp to be provided to workers, details of information dissemination etc. should be included.
- Section 6:** Re-development plan, which should indicate following points: (i) List of structures to be demolished and list of the clean-up activities that needs to be undertaken, (ii) Proposed use of the land in the post construction phase, if it is a public property, (iii) Presence of existing facilities that could be put in use by the land owner if it is a leased out private land or by the community in case of a public property.
- Section-7:** Annexure-(a) Working drawings: Electrical plan showing the electrical network planned for the site, location of generators, master switch boards etc. and plumbing drawing showing the network of water supply lines, water tank, drainage facilities etc. (b) Copy of permissions obtained from local governing body / community etc. as applicable, (c) Copy of agreement entered with site owner, in case of leased out site.

All the drawings should have north direction marked in it along with prevailing wind direction. Necessary dimensions and specifications should be provided where ever necessary. The labour camp management plan should be submitted to the Environmental Expert of PIU for a written approval before any physical work is undertaken on a particular site. The Environmental Expert of PIU will carefully examine the proposals in light of the various EMP and regulatory provisions and provide suggestions, as necessary to the Contractor who shall incorporate it in the management plan. Contractor shall be responsible for satisfactory and timely implementation of these EMP requirements.

G. Re-development of The Labour Camp

The Contractor should clear all temporary structures; dispose all building debris, garbage, night soils and any other waste as per the approved debris management plan. All disposal pits or trenches should be filled in, disinfected and effectively sealed off. Entire camp area should be left clean and tidy, in a manner keeping the adjacent lands neat and clear, at the Contractor's expense, to the entire satisfaction of landowner and the Environmental Expert of PIU.

These activities should be completed by the Contractor prior to demobilization. Once the Contractor finishes his job, he needs to obtain a certificate from the owner, stating that the site has been re-developed to his/her satisfaction and in tune with the agreement. Then following documents needs to be submitted to the Environmental Expert of PIU by the

- Copy of approved site identification report
- Photographs of the concerned site 'before' and 'after' setting up the camp.
- Certificate from the owner stating his/her satisfaction about status of re-development of the site.

Engineer-in-charge/Environmental Specialist of PIU shall ensure, through site verification that all clean-up and restoration operations are completed satisfactorily and a written

approval should be given to the Contractor mentioning the same before the 'works completion' certificate is issued/recommended. The PIU shall ensure through site inspection that the Contractor has restored the site properly & completely. The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be. Certification/documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor.

Annexure 2

Guidelines to Ensure Worker's Safety During Construction

In order to ensure worker's safety while undertaking various operations/stages of construction many safety measures needs to be followed, which are listed down below:

A. Labour Camp/ Site Office

- Install perimeter fencing.
- Ensure good visibility and safe access at site entrances.
- Provide adequate warning signs at the entrance and exit, as necessary.
- Provide adequate space/area for loading and unloading, storage of materials, equipment and machineries.
- Display emergency procedure and statutory notices at conspicuous locations.
- Provide areas for collecting garbage and other waste material, and also arrange for their regular/periodic disposal.
- Arrange appropriate storage, transportation and use of fuel, other flammable materials and explosives in line with the license requirements obtained from concerned authorities.
- Provide defined access roads and movement areas within the site.
- Ensure availability of first aid facilities and display notices at various work places showing the location of first aid facilities and emergency contact numbers. Provide and enforce use of PPE at construction sites.

B. House Keeping Practices

- Provide proper slope in kitchen, canteens, washrooms, toilets and bathrooms for easy and immediate draining of water.
- Keep all walkways and circulation areas clear and unobstructed at all times.
- Ensure that spillages of oil and grease are avoided and in case of accidental spills, these are immediately collected.
- Use metal bins for collection of oily and greasy rags.
- Do not leave tools on the floor or in any location where they can be easily dislodged.
- Keep windows and light fittings clean.
- Maintain the workplace floors dry and in a non-slippery condition
- Provide and maintain proper drainage system to prevent water logging and unhygienic conditions.
- Ensure that protruding nails in boards or walls are moved or bent over or removed so that they do not constitute a hazard to people.
- Store all flammable materials like HSD in appropriate container with proper cover and labels – as required for various products.
- Display 'no smoking' signs in areas with high risks of fire, (eg. near fuelling areas, diesel/oils/lubricant/paint storage area, hessians, rubber, wood and plastic etc.) in and around working area.

C. Safety During Excavation

- During excavation of foundations, necessary safety measures will be taken by the contractor.
- Excavation of 1.5 meters deep or greater require a sides protection unless the excavation is made entirely in stable rock
- Safe access and egress will be require including ladders, steps, ramps, or other safe means of exit of workers in excavated depth of 4 feet (1.22 meters) or deeper
- Excavated earth will be collected and disposed in pre-identified site with the approval of PIU.
- To ensure elimination of excavation hazards, excavation will be carried in the presence of competent person.
- Suitable barricading will be provided

D. Handling of Cement Bags

- Cement bags will be stored and emptied in covered area to control fugitive dust emissions.
- While handling and emptying cement bags, workers will wear mask and goggles and hand gloves.
- Manual transferring of cement bags from one place to another place will not be allowed. For this purpose, trolley will be used.

E. Steel Bars Reinforcement for Foundation and Roof

- Manual cutting of steel bars for reinforcement will be discouraged
- Only skilled workers will be deployed by the contractor for steel bar bending and rebaring reinforced structures.
- Correct hand and power tools will be used to tie and cut steel bars.
- Workers engaged in steel bar bending and reinforcement will be provided helmet, suitably strong and flexible leather gloves and safety shoes.
- Workers will take extra caution and attention when walking on steel bar matts and areas that contain exposed steel bar.
- First aid facilities will be provided at the site to provide first aid incase of cuts or injuries to workers. After providing first aid, injured worker will be taken to hospital for further treatment.

F. Operation of Trucks And Dumpers

- Ensure that only trained, authorized and licensed drivers operate the vehicles.
- Enlist help of another worker before reversing the vehicle.
- Switch-off the engine when not in use to save fuel, prevent accidents and unnecessary noise and air pollution.

- Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall by fixing a sturdy support below.
- Carryout periodic servicing as per the manufacturer's requirements. All records of maintenance and repairs should be in writing and available for verification.
- Keep the vehicle tidy and the cabin free from clumsy utilities, which might obstruct the controls and create hazards.
- Avoid carrying additional passengers in the cabin or on the body of the dumper, while in field operation other than the connected workers.
- Provide stop blocks when the vehicle is tipping into or running alongside excavations or when it is parked.
- Do not overload the vehicle.
- Carry only well secured loads and use proper covers and fasteners.

G. Manual Handling and Lifting

- Avoid manual handling of heavy materials.
- Pre-assess the actual requirement of manpower in case of emergency situations.
- All concerned persons shall be trained in proper methods of lifting and carrying.
- In all manual operations where groups of workers are involved, a team leader with necessary training to handle the entire work force in unison has to be provided for.
- Watch and ward to control/supervise/guide movement of equipments and machineries, loading and unloading operations, stability of the stockpiled materials and irregularly shaped objects have to be provided for safety and security of workers.
- Carriageway used by the workers must be free from objects.
- Loading and unloading from vehicles shall be under strict supervision.

H. Electrical Hazards

- Statutory warning leaflets/posters are to be distributed/displayed by the Contractor in the vicinity of work site for the benefit of all workers, officers and supervisors as well as the public, indicating the do's and don'ts and warning related to electrical hazards associated with operations to be executed/in progress.
- All wires shall be treated as live wires.
- Report about dangling wires to the site-in-charge and do not touch them.
- Only a qualified electrician should attempt electrical repairs.
- Train all workers about electrical safety.
- Shut down the equipment that is sparking or getting over heated or emitting smoke at the time of operation, if it is not the normal way of working of such machines.
- Inform technical person/s for required maintenance.
- Never use damaged wires for electrical connection.

I. Use And Storage of Flammable Gas

- Store filled gas/LPG cylinder in a secure area – mark this as a no smoking area.

- Transport, store, use and secure cylinders in upright position.
- Ensure proper ventilation at the ground level in locations where LPG is in use.
- Avoid physical damage to the cylinders.
- Never weld near the cylinder.
- Store empty cylinders secured and upright.
- Make sure that the cylinder is closed immediately after use.
- Investigate immediately if there is the smell of LPG or gas.
- Never use LPG on site.
- Make sure that there is no other unrelated fire in the vicinity of the cylinder.

J. Gas Welding

The welders and welding unit should follow all the basic principles of welding for safety and security:

- Use face shield to protect the eyes.
- Use goggles, particularly when chipping slag and cutting strips.
- Use gloves long enough to protect wrists and forearms against heat, sparks, molten metal and radiation hazards.
- Use high-top boots/gum boots to prevent sparks, splinters, sharp edges of metal and hot welded strips, welding rods, electric cables etc. from injuring the legs.
- Avoid inhaling the noxious fumes and gasses from burning electrodes by using gas masks and screen of the work area to prevent the glare moving outside it.
- Keep the key hung from the regulator control for split seconds operations to stop the valve in case of any accidental damage or leakage to supply pipeline that may catch fire and cause accidents in case Acetylene or LPG cylinder.
- The welding area should have sufficient openings with fixed exhaust ventilators or adequate air flow openings to remove poisonous fumes and gases.
- Take precautions of wearing hard hats or fiber helmets to prevent injury due to fall of any object and accidental injury from projections while welding.
- Welders operating above ground should have adequate safety belt secured to stable platform to prevent accidental fall or injury from the scaffold. All electrical and gas connection lines up to the welder should be sufficiently insulated and protected from sharp edges and sharp objects. These shall not come into contact with hot metal.
- Do not use gas cylinders for supporting work or as rollers.
- While using LPG cylinders for welding, follow all safety precautions as has been prescribed by the supplier company.
- Avoid fire hazards and accidents by posting safety supervisors to oversee the activities of workers.
- Do not store explosives, high inflammable materials, loose hanging overhead objects, hot welded strips etc. near gas cylinders.
- Close all valves, switches and circuits while leaving the work place under proper lock and key. In case of mobile units, proper carriage procedures have to be followed for safety and security of men and materials.

K. Fire Safety Practices

- Store flammable material in proper areas having adequate fire protection systems.
- Display sufficient warning signs.
- Install fire alarm wherever required and test regularly.
- Inspect fire extinguishers regularly and replace as necessary.
- Train selected personal on use of fire extinguishers
- Fire escape route should be kept clear at all times and clearly indicated
- Display escape route maps prominently on each side.
- Provide sufficient exit signs at prominent locations for directing people to the escape staircases and routes.
- Train workers about the escape route and assembly point/s.
- Carryout fire drill periodically.

L. Noise Hazards And its Control

- Plan camp lay-out in a manner that ensures barriers/buffers between residential/ office units and high noise generating zones.
- Use sound meters to measure the level of noise and if it exceeds 75 dB(A), then ensure preventive measures.
- Make personnel aware of noisy areas by using suitable warning signs and insist on use of ear protectors/ear plugs to prevent excess noise affecting the workmen.
- Reduce noise at source by: use of improved equipments; regular and proper maintenance of the machinery as per the manufacturer's manual; by replacing rickety and noisy equipments and machineries. Screening locations with noise absorbing material; making changes in the process/equipment; controlling machine speeds; ensuring that two noise-generating machines are not running at the same time close to each other at same location; using cutting oils and hydraulic noise breakers; providing vibration and noise absorbing platform and firm embedding of equipments with fasteners.
- Appoint a competent person to: carryout a detailed noise assessment of the site; designate ear protection zone/s; give training/instructions on the necessary precautionary measures to be observed by site personnel including using suitable type of ear protection equipments.

M. Personal Protective Equipment

General

- Provision of personal protective equipment has to be made over and above all measures taken for removing or controlling safety hazards on a work site.
- Ensure that sufficient personal protective equipments are provided and that they are readily available for every person who may need to use them.
- The Contractor's Project Manager shall ensure that all persons make full and proper use of the personal protective equipment provided.

- Provide instruction/s and training for the proper use and care of personal protective equipment.
- Ensure that the personal protective equipments are in good condition.
- Train workers to report unintentional damages for replacement and to always keep the personal protective equipment clean.
- PPE includes, but may not be limited to, hard hats, goggles, ear plugs, gloves, air filters/masks, boots, ropes etc.

Head Protection

- Hard hats are compulsory for all workers, supervisors and managers/officials while working and/or inspecting a work site.
- Hard hat areas shall be demarcated clearly.

Hearing Protection

- Provide ear plugs or ear muffs to the workers and to those who need to get in and out of a high noise area frequently. Use re-usable earplugs when the reduction required (15-25 dBA) is not excessive. Use earmuffs where a large attenuation of upto 40 dBA is demanded.
- Do not use dry cotton wool for hearing protection because it doesn't provide any such protection.
- Provide disposable ear plugs for infrequent visitors and ensure that these are never re-used.
- Replenish ear plugs from time to time for those who need to work continuously for a long period in a high noise area/s.
- Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with ear muffs.
- Use soap and water or the recommended solvent for cleaning ear muffs.

Respiratory (Protective) Equipment

- Wear suitable mask for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags, etc.
- Provide training to all persons using the masks/respirators for their correct fitting, use, limitations and symptoms of exposure.
- Clean and inspect all respirators before and after use.
- Store respirators properly when not in use.

Safety Footwear

- Wear suitable footwear for work
- Use safety footwear on site or in other dangerous areas.

- Wear suitable safety shoes or ankle boots when working anywhere where there is high risk of foot injuries from slippery or uneven ground, sharp objects, falling objects etc.
- All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.
- Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury.
- Keep shoelace knots tight.

Hand Protection

- Wear suitable gloves for selected activities such as welding, bending steel bars, cutting and manual handling of materials and equipment.
- Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery.
- Wash hands properly with disinfectant soap and clean water before drinking or eating.
- Wash hands immediately after each operation on site when the situation warrants.

N. First Aid

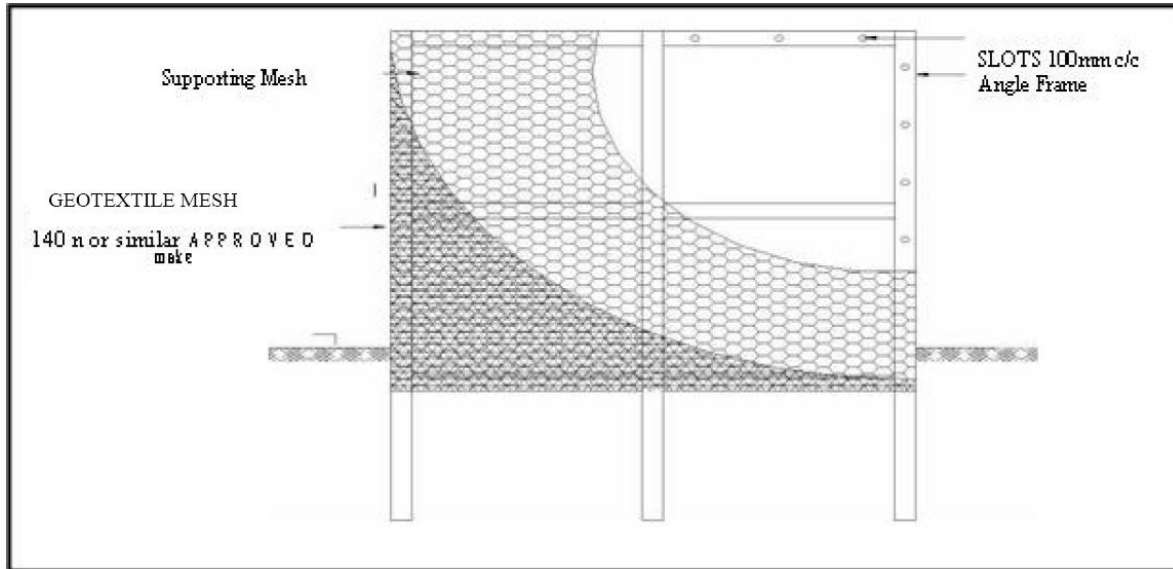
- Provide first aid boxes at every work site in a cool and shaded place.
- Ensure that training on the use of the first aid box is provided to at least every supervisor on the site.
- Display the list of persons along with their contact numbers who are trained on providing first aid.
- Ensure that every first aid box is marked "First Aid" in English and in local language.
- Check for expiry dates and replace the contents, as necessary.
- Maintain a register on health records including injuries/accidents.

O. Reporting of Accident and Investigations

- Any accident at the site will be reported.
- Carryout the investigation as quickly as possible.
- Investigation should be carried out both internally as well as through third party.
- Conduct interviews with as many witnesses as necessary including the affected persons and supervising officials.
- Do not rely on any one/limited source of evidence.
- Check all the log books, stock registers, issue registers, movement registers on site
- After completion of the investigation/enquiry, a summary of the facts recorded, sequence of happenings, persons-in-charge, persons examined, equipments and machineries tested, follow-up of action as per legal requirements, copy of station diary entry, hospital entry, safety regulations etc. to be prepared with a comparative analysis for proper assessment.

Annexure 3

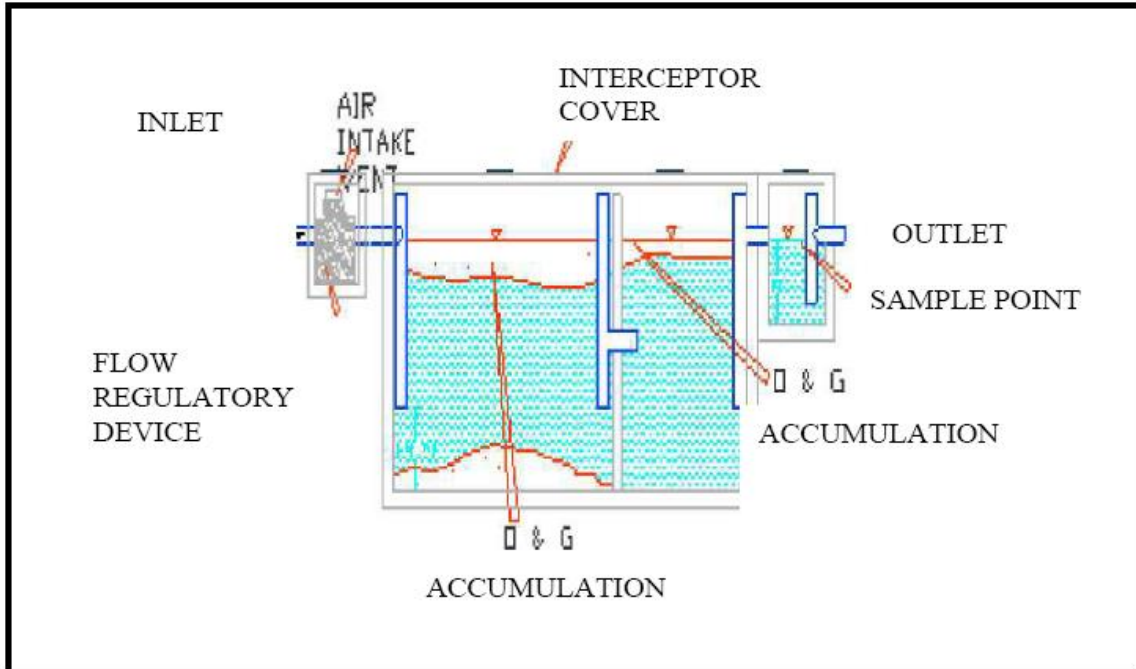
SILT TRAP



Note: Locations of silt traps will depend on Contractor's proposals for site facilities and work sites and should be provided in the Contractor's proposals. This will be checked by the Supervising Consultant and monitored by GEOTEXTILE MESH

Annexure 4

Oil Trap



Annexure 5

LIST OF PERSONAL PROTECTIVE EQUIPMENT

S.No	Part of the Body	Personal Protective Equipment
1.	Eye	Safety Glasses, Goggles
2.	Face	Face Shields
3.	Nose	Nose Masks
4.	Head	Helmets
5.	Feet	Safety Shoes
6.	Hands and arms	Gloves
7.	Bodies	Vests
8.	Hearing	Earplugs, Earmuffs

Annexure 6

TREE PLANTATION STRATEGY

1.0 Introduction

This is the most common impact of any road-widening project. If the location of the project road is in dry areas, the degree of impact is more than in a wet area where the trees can be planted and grown easily. The project road passes through forest areas and plantation exists along the project road. Therefore, plantation should be done along the project road.

2.0 Purpose of Tree Plantation

The objectives of planting trees and shrubs at selected enhancement sites against the felled trees are the following:

- To reduce the impacts of air and dust pollution and act as a natural filter to traffic emissions.
- To provide shade for the traffic as well as the pedestrians:
- To reduce the impact of vehicular noise caused by vehicles
- To arrest soil erosion on slopes
- Beautification of sites by planting selective ornamental shrubs, landscaping and turfing with grasses
- Planting trees on the roadsides is to produce a softer greener landscape.
- To raise social forestry in order to improve the
- To act as a natural filter to the traffic emissions.

3.0 Selection of Trees Species

The selection of the plants for greenery development is to be made as per the following criteria;

- Plants should be tall and fast growing with dense canopy cover;
- Preferably perennial and evergreen with large leaf area index;
- Indigenous plants;
- Resistant to air pollutants involved; and
- Should help to maintain the ecological and hydrological balance of the region.

The plant species that are selected based on the climatic condition, soil characteristics and conditions of the area. The row closest to the main carriage way will be of shade plants. Similarly, subsequent rows will comprise of ornamental and flowering species. Mainly native deciduous species, which retain their foliage longest, with high crown forms, resistant to fungus and insects with rapid growth rate are selected for avenues.

4.0 Tree Planting During Construction

4.1 Tree Planting Along The Roadsides

Tree plantation will be the responsibility of the Forest department. Necessary budget will be allocated for tree plantation and provided in the EMP. The total no of trees to be planted will be triple the number of trees that will be removed from the roadsides for the improvement of the project road.

5.0 Protection Measures

The protection measures are discussed in this section.

5.1 Barbed Wire Fencing

Barbed wire fencing around the plantation area will be provided to protect the plants. Angle iron will be fixed at a spacing of 5 m. with 3-stand stretched barbed wire.

5.2 Precautionary Measures

- Plantation will be made in the monsoon months (July -August)
- The height of the plants should not be less than 1 ft. and should be supplied in polythene bags which are not to be removed until the moment of planting.
- All plants supplied must be planted within three days of removal from the nursery.
- Arrangements must be made to water in case of insufficient rains after planting
- 2 kgs of compost/manure are suggested for each pit before plantation.

5.2.1 Shrubs

Prior to planting it is suggested to remove all loose debris, fill up with good soil and level the area. To ensure better growth and survival of grasses and shrubs, the surface should have sufficient layer of good quality soil (up to 45 cms). Shrubs which are suggested for the road side and open area spaces where available should be selected from the following and agreed with the Environmental Specialist of the Construction Supervising Consultants Environmental Specialist.

The Contractor will be responsible for planting of shrubs at enhancement sites and along bridge approaches during construction phase.

5.2.2 Turfing with Grasses

The Contractor will be responsible for turfing at enhancement sites and along bridge approaches during construction phase.

The cost for the turfing along the bridge approaches and high embankments are part of the Civil construction contract.

Grass lines are used to provide a strong surface cover at the slope but it also needs a well-prepared surface. If grass is to be effective, then it must be allowed to establish properly on a slope which is not subject to undue stress from erosion and mass movement in its initial stages. To ensure this the following measures are suggested for the grass turfing.

- A cover of 25 grams of grass seed per square metre of surface will be prepared
- Bed will be prepared in June. The seed sowing must be carried out before the onset of monsoon so that they yield desired results. Till the onset of the monsoon, watering of the surface to be done by tankers with controlled flow sprinklers.
- After sowing, mulch of prepared and dried out herbs will be laid over the whole seeded area in a thin layer so that the direct sunlight and transpiration loss may not affect the grasses

Contractor will ensure that the condition of the site is good enough for the successful establishment of grasses and shrubs. They will also supervise all field operations like preparation of surface, sowing of grasses and quality of grass seeds used.

6.0 Maintenance of Trees Planted

The trees planted once will be maintained at any cost for the full growth of at least for a period of three years. A programme of compensatory afforestation has been proposed, not only to replace the trees, which must be cut to accommodate road widening and improvements in geometric design, but also to upgrade the condition of adjacent areas. Trees will be re - planted at a rate of two for each one removed depending upon the location. Tree felling in other sites such as borrow areas- will be accommodated by the Contractor in the borrow area management plan.

Annexure 7

FORMATS FOR ENVIRONMENTAL MONITORING

EMS 1: CONSTRUCTION CAMP/ PLANT SITE MANAGEMENT PLAN

Sn	Description	Compliance
1	Name of the location	
2	Nearest road chainage.	
3	Name of the owner	
4	Area involved	
5	Arrangements with the owner (agreement with land owner, including the restoration aspects, should be attached as an Annexure)	
6	Existing land use	
7	Photographs depicting the present condition of the construction camp and access road.	
8	Land use of the area surrounding the borrow area including a map	
9	Site layout plan of the construction camp	
10	Establishment and maintenance of demarcated and labeled different areas within the camp	
11	Number of trees to be removed, if any, along with compensation measures	
12	Proposed top soil management	
13	Activities planned in the construction camp	
14	Machinery & equipment to be used on site	
15	Labour camp facilities onsite	
16	Health facilities	
17	Site drainage provisions	
18	Copy of the consents to establish and operate should be attached as an Annexure	
19	Conditions laid down in the clearance / licenses and plans	
20	Staff strength and details such as contractor staff vs sub contractors, women labour, migrant vs local labour and skilled & unskilled labour	
21	Access road condition and proposed maintenance	
22	Safety provision such as fire protection equipment and personal protective measure.	
23	Closure / completion plan Format EMS: 1A	

EMS 1A: CLOSURE PLAN CONSTRUCTION CAMP SITE

S.No	Description	Compliance
1	Name / identity of location	
2	Distance from the Project Road and side	
3	Name of the owner	
4	Details of the Land i. Survey Number ii. Boundaries iii. Other Revenue Details	
5	Details of settlements, sensitive areas, water bodies, wells and bore wells with in 500 m Population in Numbers Name of the Village Distance from the construction camp Details of water bodies/ sensitive areas/ wells/ bore wells	
6	Physical Details Number of Labour Stationed Number of Dwellings Constructed Number of toilets provided were dwellings demolished Was the wastewater treatment facilities demolished and cleared Was the solid waste generated cleared and disposed of properly; if yes specify the location and quantity. Whether any soil was contaminated with oils and waste oils was cleared and disposed safely, if yes specify the location and quantity. Was scrap generated while the construction removed, if yes specify the details such as where, when, to whom and quantity.	
7	Land Use before Establishment Proposed Use after completion of works	

EMS 2: BORROW AREA NO:

Sn	Description	Compliance
1.	Name / identity of location	
2.	Nearest project road chainage	
3.	Name of the owner	
4.	Area involved/capacity/quantity	
5.	Type of material proposed to be taken	
6	Arrangement with the owner including restoration aspect.	
7.	Existing land use	
8.	Land use of the area surrounding the proposed area	
9.	A map of the area	
10.	Number of trees to be removed, if any along with the compensation measure	
11.	Top soil management if required	
12.	Access road condition and proposed maintenance	
13	Photograph depicting the present condition of the proposed area and access road	
14.	Closure / completion plan EMS2A	

EMS 2A: CLOSURE PLAN FOR BORROW AREA

Sn	Description	Compliance
1	Name / identity of location	
2	Nearest Project chainage, distance from the Project Road and side	
3	Name of the owner	
4	Details of the Land i. Survey Number ii. Boundaries Other iii. Revenue Details	
5	Details of settlements, sensitive areas, water bodies within 500 m Population in Number Name of the Village Distance from the borrow area Details of water bodies/ sensitive areas/ wells/ bore wells	
6	Physical Details Length and width in meters Depth excavated in meters Quantity Excavated in cum Type of materials excavated	
7	Land Use before Opening Proposed Use before opening Details of surroundings	
8	Drawing showing the dimensions of the borrow areas, access roads and features of surrounding	
9	Number of trees removed (girth>300mm), if any along with the compensation measure	
10	Details of top soil Quantity excavated in cum Where was it used	
11	Initial access road condition and final access road condition	
12	Photographs depicting the original condition, during the operation, top soil management, and after closure	
13	Copy of the agreement with the Owner Details of the agreed	
14	Land use after rehabilitation Details should be submitted if the final	
15	Satisfaction certificate from the owner	
16	Details of the practical problems faced and solutions adopted, if	

EMS 3: CONSTRUCTION CAMP AND ENVIRONMENTAL MANAGEMENT

Sn	Issue	Status	
		Camp -1	Camp -2
1	Drainage System 1 . Closed drainage		
2	Disposal for Wastewater 1. Kitchen wastewater 2. Wastewater from water closets 3. Wastewater from bathrooms 4. Wastewater from the vehicular washings.		
3	Collection and Disposal of Solid Waste 1. Waste from the office 2. Waste from the kitchen 3. Waste from sweeping		
4	Drinking Water facility Source with quantity No of bore wells with capacity Location of the well and bore well Any treatment facility No of overheads tanks Test results of the Drinking Water		
5	First Aid Facility		
6	Roads in Camp Site Type of road Dust suppression practicing or not, if the roads are not tarred. Condition of the road.		
7	Fuel Storage 1. Impervious Base 2. Spills and Wastewater will be collected in a sump 3. Number of drums where wastes are collected. 4. Number of drums disposed 8 Garbage & Night Soil 1. Provision of Garbage Bins 2. Separation of Polythene materials 3. Records of solid waste removal from septic tanks		

EMS 4: TOP SOIL MANAGEMENT

Sn	Chainage in Km	Quantity in cum	Whether Preserved in accordance with specifications	Remarks
1				
2				
3				
4				
5				

EMS 5: CONSTRUCTION PLANTS AND POLLUTION CONTROL

Sn	Construction Plant	Locations	Capacity	Description of Pollution Control System/ Equipment	Remarks
1					
2					
3					
4					
5					

EMS 6: MACHINERY/ VEHICLES AND POLLUTION CONTROL

Sn	Machinery/ vehicles with capacity	Diesel consumed during the month	Engine oil consumed during the month	PUC certificate no and validity	Machinery new/ old	Remarks
1						
2						
3						
4						
5						

EMS 7: DETAILS OF THE DG SETS WITH THE POLLUTION CONTROL EQUIPMENT

Sn	Capacity in KVA	Vertical Stack If provided height in m	Noise Control System	Remarks
Camp Site				
Crusher				
Plant Site Site				
Construction Works				

EMS 8: DETAILS OF OIL STORAGE

Sn	Type of Product	Location	Number of Barrels	Capacity of barrels in Litres	Increase/ Decrease in Storage	Stored on Impervious base (Yes/No)	Remarks
1	Diesel						
2	Petrol						
3	Engine Oils						
4	Lubricants						

EMS 9: WORKING AT WATER COURSE AND POLLUTION CONTROL MEASURES

Sn	Location	Type	Stream/ Canal Diversion	Silt Fencing	Remarks

EMS 10: DETAILS OF THE GROUND WATER EXTRACTION

Sn	Location	Capacity of Motor Installed	Quantity of water drawn in Kilolitres			Ground water department	Type of source
			During the month	Up to end of last month	Total		
1							
2							
3							
4							

EMS 11: PERSONAL PROTECTIVE EQUIPMENT

Sn	Details of Equipment	Total Procured in No	Distributed in No	Available in Store in No	Remarks
1	Helmets				
2	Safety Shoes				
3	Safety Shoes				
4	Nose Masks				
5	Hand Gloves				
6	Goggles				
7	Safety Belts				
8	Ear Plugs				
9	Reflective Jackets				
10	Gum Boots				

EMS 12: STATUS OF CONSENTS AND PERMISSIONS

Plant	Consent	Number / Status	Validity Date	Remarks
Hot Mix Plants				
Crusher				
Batching Plant				
WMM Plant				
Crusher				
Labour License				

EMS 13: DEVIATIONS WITH CORRECTIVE ACTIONS

Sn	Deviation	Corrective Actions	Schedule

EMS 14: DETAILS OF TREE AND SHRUBS PLANTATION

Sn	Location/ Chainage in km	NO Planted in Number		Survival rate in %age Remarks	
		Trees	Shrubs		

EMS 15: PLANTATION OF SHRUBS AND GRASS

Sn	Location/ Chainage	Number of Shrubs planted	Area of gross planted	Survival at 6 months interval	Remarks

EMS 16: IMPLEMENTATION OF ENHANCEMENT MEASURES

Sn.	Type of Enhancement	Side of the Road (R/L)	Progress of Completion		
			Target Date	Actual Completion date	Reasons of delay if any

Annexure 8

Reporting Format Camp Site

Project Details		Date of Reporting	
1.	Name of project		
2.	Name and address of the Contractor		
3.	Contract date and duration		
B	Site Details		
1.	Place Name	Landmark	
2.	Area of site	Current land use	
3.	Ownership of the land	Owned / leased	Survey no.
4.	If leased / rented, name, address and contact details of owner		
5.	Distance from construction site		
6.	Distance from Water Body, Forest (if any)		
7.	Distance from the Populated Area		
8.	No of trees with girth > 0.3m on the site		
9.	No of trees to be cut		
10.	Is top soil conservation required (Yes/ No)		
List of enclosures:	(a) Location map		
	(b) Layout plan		
	(c) Photographs of the site		
	(d) List of machinery, equipments and vehicles to be used		
	(e) List of schools and hospitals with in 200 m distance from the boundary of the camp		
C. Submission Details	Submitted by (Environment & Safety Officer of Contractor)		Approved / Rejected by (Environmental Officer of PIU)
Signature & date			
Name			
Designation			
Remarks by Environmental Expert of PIU			
<p>* All distances are to be measured from the boundary of the site. Note: Contractor has to fill and submit this format to the Environmental Expert of PIU upon identification of labour camp site. Subsequently, the Environmental Expert of PIU has to visit the site and approve / reject the site with reasons. The Environmental Expert of PIU has to give a copy of this format to the contractor after his approval / rejection with remarks. On approval of a site, the Contractor has to prepare the Management and Redevelopment Plan for this site as per the Guidelines given in EMP and submit to Environmental Expert of PIU for approval</p>			

Format of Complaints (Grievance) and it's Reporting

A		Project Details		Information		
1.	Name of project					
2.	Name and address of the Contractor					
3.	Contract date and duration					
B		Details of Complaint Received		Site Name		
Sl. No.	Date of Complaint	Name and address of person with contact details	Complaint		Action taken with date	Signature of ESO of Contractor
1						
2						
3						
<p>A register in this format shall be maintained at each site office of the contractor. This same format shall be used to compile and report the details of complaints received at all site to the Environmental Expert of PIU along with the Monthly Report of the Contractor. The Environmental Expert of PIU has to give instruction to the Contractor, if any further action has to be taken on any complaint.</p>						

Checklist For Monitoring of Labour Camp Management

A	Project Details		Date of Monitoring:		
1.	Name of project.				
2.	Name and address of the Contractor				
3.	Contract date and duration				
4.	Name of Labour Camp				
B	Monitoring Details				
Sl. No.	Environmental Management Measures	Environmental Expert's observation (Yes / No / Not Applicable)	Corrective Proposed	Actions	Remarks
1.	Whether the camp are floored with concrete?				
2.	Are all the first aid facilities provided in the camp?				
3.	Whether the camp is located in such a way that there are no residences, public institutions or bio-sensitive area with in a radius of 500 m from the camp?				
4.	Whether the vehicle movement in and out of the camp is in a controlled manner?				
5.	Whether LPG for cooking is provided?				
6.	Whether safe drinking water is provided?				
7.	Whether all the drains and channels are covered?				
8.	Whether a green belt is provided along the periphery of camp?				
9.	Whether day care centres are provided with in the camp?				
10.	Whether sanitation facilities are provided separately for male and female?				
11.	Whether separate garbage bins are provided to collect the garbage?				
12.	Whether septic tanks with soak pits are provided?				
13.	Whether the location of soak pit is in such a away that it does not pollute the ground water?				

14.	Whether a qualified safety officer is appointed for ensuring safety?			
15.	Whether proper fencing of the camp is done?			
16.	Whether the workers are well aware of cleanliness, hygiene, community livings, AIDS etc.?			
17.	Whether all applicable clearances are obtained and valid till date?			
Signature of Environment and Safety Officer (ESO) of the Contractor with date			Signature of Environmental Expert of PIU with date	
<p>Note: The Environmental Expert of PIU has to use this format to monitor the implementation of Environmental Management Measures for each Labour Camp Quarterly. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESO of the Contractor. Environmental Expert of PIU has to attach this format to the Quarterly Report, with details of corrective action taken by the Contractor.</p>				

Check List For Monitoring of Redevelopment of Labour Camp Site

A Project Details		Date of Monitoring:		
1.	Name of project			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Name of Labour Camp			
B Monitoring Details				
Sl. No.	Environmental Management Measures	Environmental Expert's observation (Yes / No / Not Applicable)	Corrective Actions Proposed	Remarks
1.	Are all the temporary structures cleared as per the list in the redevelopment plan?			
2.	Are all building debris, garbage, night soils and POL waste disposed off safely?			
3.	Are all disposal pits or trenches filled, disinfected and effectively sealed off?			
4.	Are the facilities that could be put to re-use maintained well?			
5.	Are all the spills within the camp site effectively disposed off from the site?			
6.	All the area within the camp site is leveled and spread over with stored top soil.			
7.	Has the residual top soil been utilized effectively?			
8.	Has the entire camp area been made clean and tidy without disturbing the adjacent lands?			
9.	Are the 'before' and 'after' scenarios of the site documented through photographs and submitted to PIU?			
10.	Are the conditions mentioned by the owner in the agreement adhered to?			

11	If not, mention the details of the conditions that are not adhered to and further steps to be taken.			
12.	Can 'works completion' certificate be issued to this site?			
Signature of Environment and Safety Officer (ESO) of the Contractor with date			Signature of Environmental Expert of PIU with date	
<p>Note: The Environmental Expert of PIU has to use this format to monitor the implementation of Environmental Management Measures for the redevelopment of each Labour Camp Site as and when it is closed. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESO of the Contractor. Environmental Expert of PIU has to attach this format to the Quarterly Report, with details of corrective action taken by the Contractor.</p>				

Environmental Reporting Format

A	Project Details	Date of Reporting:	
1.	Name of project.		
2.	Name and address of the Contractor		
3.	Contract date and duration		
B	Implementation Status of Health and Safety Measures		
Sl. No.	Health and Safety Measures	Implementation Status (Yes / No)	Remarks
1	Appointment of qualified Environment and Safety Officer		
2	Approval for Construction Safety Management Plan by the Environmental Expert of PIU.		
3	Provision for flags and warning lights for potential hazards		
4	Provision of adequate staging, form work and access (ladders with handrail) for works at a height of more than 3.0 m		
5	Provision of adequate shoring / bracing / barricading / lighting for all deep excavations of more than 3.0 m depth.		
6	Provision for sufficient lighting especially for night time work		
7	Construction Workers safety – Provision of personnel protective equipment's		
	A. Helmets		
	B. Safety Shoe		
	C. Gumboot		
	D. Dust masks		
	E. Hand Gloves		
	F. Safety Belts		
	G. Reflective Jackets		
	H. Earplugs for labour		
8	Workers engaged in welding work shall be provided with welder protective shields		
9	All vehicles are provided with reverse horns.		
10	All scaffolds, ladders and other safety devices shall be maintained in as safe and sound condition		
11	Regular health checkup for labour/ Contractor's personnel		

12	Ensuring the sanitary conditions and all waste disposal procedures & methods in the camp.		
13	Provision for insurance coverage to the workers		
C.	Submission Details		
	Submitted by (Environment & Safety Officer of Contractor)	Approved by (Environmental Officer of PIU)	
Signature & date			
Name			
Designation			
Remarks by Environmental Expert of PIU			
<p>Note: Contractor has to fill and submit this format to the Environmental Expert of PIU along with the Monthly Report. The Environmental Expert of PIU has to visit the site and verify the details. Further mitigation measures, if required, can be suggested by the Environmental Expert of PIU. The Environmental Expert of PIU has to give back a copy of this format to the contractor after his approval with remarks.</p>			

Format For Register of Accidents and It's Reporting

A	Project Details	Date of Reporting:	
1.	Name of project		
2.	Name and address of the Contractor		
3.	Contract date and duration		
B	Details of Accident and People Involved in Accident		
	Name of site where accident happened		
	Name and address of people involved in the accident		
	Whether Contractor's personnel or General public		
	Details of Injury		
	Details of treatment given		
	Details of compensation given		
C	Type of Accident (√)		
	Fall of person from a height	<input type="checkbox"/>	Explosion
	Slip, trip or fall on same level	<input type="checkbox"/>	Fire
	Struck against fixed objects	<input type="checkbox"/>	Contact with hot or corrosive substance
	Struck by flying or falling objects	<input type="checkbox"/>	Contact with poisonous gas or toxic substances.
	Struck by moving objects	<input type="checkbox"/>	Contact with poisonous gas or toxic substances
	Struck / caught by cable	<input type="checkbox"/>	Hand tool accident
	Stepping on nail etc.	<input type="checkbox"/>	Vehicle / Mobile plant accident
	Handling without machinery	<input type="checkbox"/>	Machinery operation accident
	Crushing / burying	<input type="checkbox"/>	Other (please specify)
	Drowning or asphyxiation	<input type="checkbox"/>	
D	Agent Involved in Accident (√)		
	Machinery	<input type="checkbox"/>	Stair edge
	Portable power appliance	<input type="checkbox"/>	Excavation
	Vehicle or associated equipment /machinery	<input type="checkbox"/>	Ladder
	Material being handled, used or stored	<input type="checkbox"/>	Scaffolding
	Gas, vapor, dust, fume or oxygen	<input type="checkbox"/>	Construction formwork, shuttering and false work.
	Hand tools	<input type="checkbox"/>	Electricity supply cable, wiring switchboard and associated equipment
	Floor edge	<input type="checkbox"/>	Nail or chipping
	Floor opening	<input type="checkbox"/>	Other (Please specify)
	Left shaft	<input type="checkbox"/>	
E	Unsafe Action Relevant to the Accident (√)		
	Operating without authority	<input type="checkbox"/>	Failure to use proper footwear
	Failure to secure objects	<input type="checkbox"/>	Failure to use eye protector
	Making safety devices inoperative	<input type="checkbox"/>	Failure to use respirator

	Working on moving or dangerous equipment			Failure to use proper clothing
	Using un-safety equipment			Failure to use warn others or given proper signals
	Adopting unsafe position or posture			Horseplay
	Operating or working at unsafe speed			No unsafe action
	Unsafe loading, Placing, mixing et			Others (please specify)
	Failure to use helmet			
F	Lack of Safety Measures Relevant to the Accident (√)			
	No protective gear			Unsafe layout of job, etc.
	Defective protective gear			Unsafe process of job methods
	Improper dress / footwear			Poor housekeeping
	Improper guarding			Lack of warning system
	Improper ventilation			Defective tool, machinery or materials
	Improper illumination			No unsafe condition
	Improper procedure			Others (please specify)
G	Personal Factor Relevant to the Accident (√)			
	Incorrect attitude /motive			No unsafe personal factor.
	Unsafe act by another person			Other (please specify)
H	Details of Corrective and Preventive action taken			
1				
2				
3				
4				
I	Submission Details			
	Submitted by (Environment & Safety Officer of Contractor)		Approved by (Environmental Officer of PIU)	
Signature & date				
Name				
Designation				
Remarks by Environmental Expert of PIU				
<p>Note: Contractor has to fill this format as and when an accident happens and submit to the PIU along with the Monthly Report. The Environmental Expert of PIU has to visit the site and verify the details. Additional safety measures, if required, can be suggested by the PIU. The Environmental Expert of PIU has to give back a copy of this format to the contractor after his approval with remarks.</p>				

Reporting Format For Environmental Pollution Monitoring

A		Project Details		Date of Reporting:		
1.	Name of project					
2.	Name and address of the Contractor					
3.	Contract date and duration					
B						
Environmental Monitoring Details						
Sl. No	Details of Monitoring Location	Period of Monitoring	Details of values exceeding the relevant standards	Reasons for pollution	Details of Corrective actions taken	Remarks
a. Ambient Air Monitoring						
1.						
2.						
b. Water Monitoring						
1.						
2.						
c. Noise Monitoring*						
1.						
2.						
C						
Submission Details						
		Submitted by (Environment & Safety Officer of Contractor)		Approved by (Environmental Officer of PIU)		
Signature & date						
Name						
Designation						
Remarks by PIU						
<p>* Noise monitoring at the site will be done by the PIU (ERA), using the Noise Meter. The PIU has to give the monitoring results to the Contractor for corrective actions, if any, required and including in this report.</p> <p>Note: The Contractor has to conduct Environmental Monitoring through a NABL approved Laboratory as per the Environmental Monitoring Plan given in the EMP, fill this format and submit to the PIU along with the Monthly Report, if monitoring was due in that month. A copy of the monitoring report given by the Laboratory has to be attached to this format. The PIU has to visit the site and verify the details. Additional mitigation measures, if required, can be suggested by the PIU. The Environmental Expert of PIU has to give back a copy of this format to the contractor after his approval with remarks.</p>						