Compliance of Essential Details Sought

Sr. No	EDS dated 01/04/2020	Compliance dated 11/05/2020
1	A document mentioning Not Applicable has been uploaded in the place of copy of document in support of the competence/authority. Upload the copy of documents in support of the competence/authority.	Rectified and document from Competent Authority uploaded.
2	A copy of attendance sheet (in regional language) has been submitted in place of Public Hearing details. Upload the copy of Public Hearing document, i.e., proceedings.	Rectified and details of public hearing uploaded.
3	A document mentioning Not Applicable has been uploaded in place of the copy of details of Tree Cutting and Planting of Trees. Upload the relevant document.	Rectified and Details of tree to be cut and plantation scheme uploaded.
4	Arrangement with Forest Department has been provided in place of the copy of details of Green belt plan. Upload the relevant document in this regard.	Rectified and Green Belt Plan Uploaded
5	Simple traffic data has been submitted in place of copy of Details of Traffic Density Impact Assessment and Modelling Study. Please upload the proper report as mentioned above.	Rectified and Impact assessment & modeling study uploaded
6	The EIA/EMP report does not have a cover page. Also, it is nowhere mentioned in the report that it is final EIA report.	Rectified and necessary correction was done in EIA report.
7	The QCI/NABET accreditation of EIA Consultant has expired on 01.03.2020 and this application for seeking EC has been submitted on 24.03.2020. Furnish a detailed clarification for submitting the application without having a valid accreditation or extension and misleading the Ministry in this regard.	The NABET validity document uploaded. The NABET accreditation is valid till 5th August 2020.

CONSULTANCY SERVICES FOR
PREPARATION OF DPR FOR DEVELOPMENT OF

ECONOMIC CORRIDORS, INTER CORRIDORS, FEEDER ROUTES TO IMPROVE THE EFFICIENCY OF FREIGHT MOVEMENT IN INDIA

UNDER BHARATMALA PARIYOJANA LOT 3
ANDHRA PRADESH, KARNATAKA, GOA & KERALA / PACKAGE 1

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Satellite Town Ring Road (STRR)
Bangalore West Side (NH 948A)
Phase-III

Proposal No. IA/TN/MIS/75239/2018
dated 06.06.2018 &
F. No 10-35/2018-I-A.III

Louis Berger

May 2020

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Abbreviations

Abbreviation	Description
AADT	Annual Average Daily Traffic
AAQ	Ambient Air Quality
BDL	Below Detectable Level
BIS	Bureau of Indian Standards
BMRDA	Bengaluru Metropolitan Region Development Authority
BNP	Bannerghatta National Park
CD	Cross Drainage
CO	Carbon Monoxide
COI	Corridor of Impact
CPCB	Central Pollution Control Board
CPR	Common Property Resource
DPR	Detailed Project Report
dB	Decibel
EAC	Environmental Appraisal Committee
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
FD	Forest Department
GoI	Government of India
GoK	Government of Karnataka
GoTN	Government of Tamil Nadu
GWQ	Ground Water Quality
Ha	Hectare
HMP	Hot Mix Plant
HC	Hydrocarbons
IC	Independent Consultant

Abbreviation	Description
IMD	India Meteorological Department
IRC	Indian Road Congress
ILO	International Labour Organisation
KLD	Kilo Liter per Day
LAO	Land Acquisition Officers
LHS	Left Hand Side
Ln	Equivalent Noise Level for Night-time
Ld	Equivalent Noise Level for Day-time
Leq	Equivalent Sound Pressure Level
MoRTH	Ministry of Road Transport & Highways
MoEF&CC	Ministry of Environment, Forest & Climate Change
NAAQ	National Ambient Air Quality
NH	National Highway
NHAI	National Highways Authority of India
NHDP	National Highways Development Program
NICE	Nandi Infrastructure Corridor Enterprises
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
PAH	Project Affected Households
PAP	Project Affected Persons
PM	Particulate Matter
PCU	Passenger Car Unit
PIU	Project Implementation Unit
PUP	Pedestrian Under Pass
PPE	Personal Protective Equipments
PRoW	Proposed Right of Way
R&R	Rehabilitation and Resettlement

Abbreviation	Description
RAP	Resettlement Action Plan
RHS	Right Hand Side
ROB	Railway Over bridge
RUB	Railway Under Bridge
RoW	Right of Way
SC	Scheduled Caste
SEF	Seasonal Correction Factor
SIA	Social Impact Assessment
SO_2	Sulphur Dioxide
STRR	Satellite Town Ring Road
SPCB	State Pollution Control Board
SWQ	Surface Water Quality
SQ	Soil Quality
ST	Scheduled Tribe
SW	Surface Water
TPP	Thermal Power Plant
TNPCB	Tamil Nadu Pollution Control Board
VOC	Vehicle Operating Cost
VUP	Vehicular Underpass
WMM	Wet Mix Macadam

CHAPTER-1: INTRODUCTION

1.1 PROJECT BACKGROUND

The Ministry of Road, Transport and Highways (MORTH), Government of India through National Highways Authority of India (NHAI) is implementing "Bharatmala Pariyojana", an umbrella program for the highways sector. This focuses on optimizing efficiency of freight and passenger movement across the country by bridging critical infrastructure gaps through effective solutions like development of economic corridors, inter-corridor, national corridors efficiency improvement, border & international connectivity roads, coastal & port connectivity roads and expressways.

In pursuance to above program, NHAI is undertaking "Satellite Town Ring Road (West Side), a newly declared highway as NH-948A" under the *Bharatmala Pariyojana (Lot-3).* The proposed project starts from Ch. 0.000 in Dabaspet and ends at Ch. 179.969 near Devarapalli village in Tamil Nadu/Karnataka Border. The project road is entirely a new Greenfield highway. The project road is falling in two states viz. Karnataka (length 134.942km) and Tamil Nadu (length 45.027km).

The STRR project alignment is passing through Bannerghatta National Park and its Eco-sensitive zone at design km 114 to km 118. In consideration to it, NHAI vide its letter no 1) *NHAI/12012/BM/Pkg.STRR/1/2017/PIU-NG (EXP)/92 dated 04.05.2018* and 2) NHAI*/12012/BM/ Pkg. STRR/1/2018/PIU-NG (EXP)/325 dated 13.07.2018* has categorised the project into 3 phases for expeditious implementation of the project. The entire corridor is proposed to be taken up in 3 phases as given in **Table 1.1 and Figure 1.1.**

Table 1.1: Phases of STRR

Phases	Description (Design km)	Length (km)	District	State
Phase-I	Ch. 0.000 to Ch. 82.200	82.200	Bangalore Rural	Karnataka
			Ramanagara	
Phase-II	Ch. 82.200 to Ch. 140.000	57.800	Ramanagara	Karnataka & Tamil Nadu
			Bangalore Urban	
			Krishnagiri	
Phase -III	Ch. 140.000 to Ch. 179.969	39.969	Krishnagiri	Tamil Nadu

This report is for Tamil Nadu portion of Phase-III of the Satellite Town Ring Road (West Side) starting from Ch. 140.000 to Ch. 179.969. The total length of this package is 39.969 km.

The development of the project is to improve the performance of the State's road transport network and make it a part of the ongoing Bharatmala Pariyojana (Lot-3) by improving road conditions and capacity, as well to avoid traffic congestion of Bangalore city in terms of heavy vehicles.

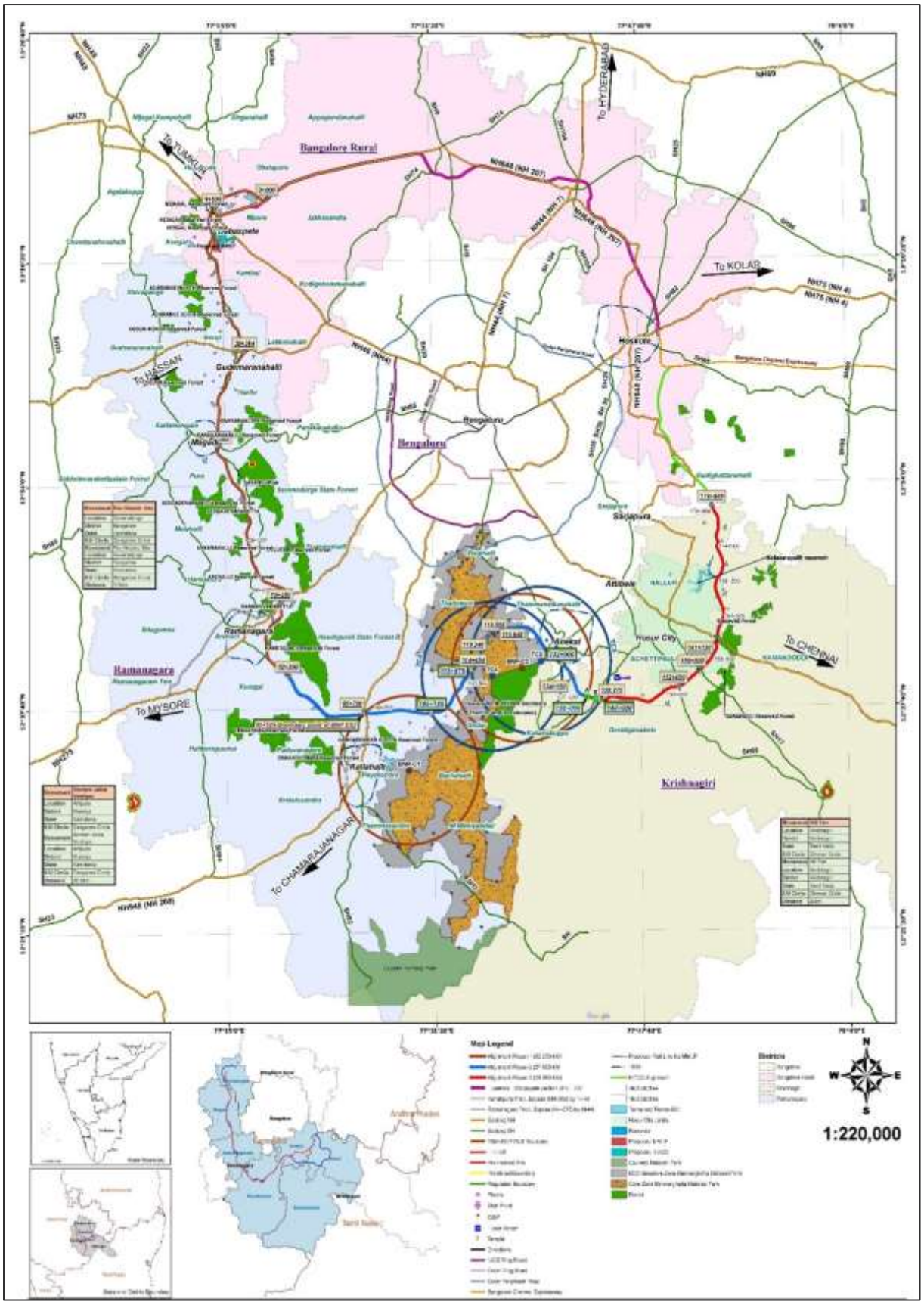


Figure 1.1 Location Map of Satellite Town Ring Road with all 3 phases

1.2 PROJECT LOCATION

The proposed alignment passes through the state of Tamil Nadu and comprises section of newly declared National Highway-948A. Tamil Nadu lies in the southernmost part of the Indian subcontinent and is bordered by the union territory of Puducherry and the South Indian states of Kerala, Karnataka, and Andhra Pradesh. It is bounded by the Eastern Ghats on the north, the Nilgiri mountains, the Annamalai Hills, and Kerala on the west, by the Bay of Bengal in the east, by the Gulf of Mannar and the Palk Strait on the southeast, and by the Indian Ocean on the south. The state shares a maritime border with the nation of Sri Lanka. The section of proposed road alignment traverses through Krishnagiri district of Tamil Nadu.

The district is located in the western part of the state of Tamil Nadu. **Figure 1.2** shows the location of Tamil Nadu State in the Indian Sub-continent and location of district Krishnagiri on the map of Tamil Nadu. **Figure 1.3** shows the physical map of district Krishnagiri district. The proposed alignment passes through Denkanikottai and Hosur taluks of Krishnagiri.

The proposed alignment section of NH-948A starts at Peddamadhagondapalli village (design km 140+000), near SH-17 A/S terminates at Devarapalli village (design km 179.969). The project road intersects the existing Ring Road of Hosur town (an automobile Hub of Tamil Nadu) and further connects with NH 207 and proposed Bangalore – Chennai Expressway. The design length of this stretch is 39.969 km.

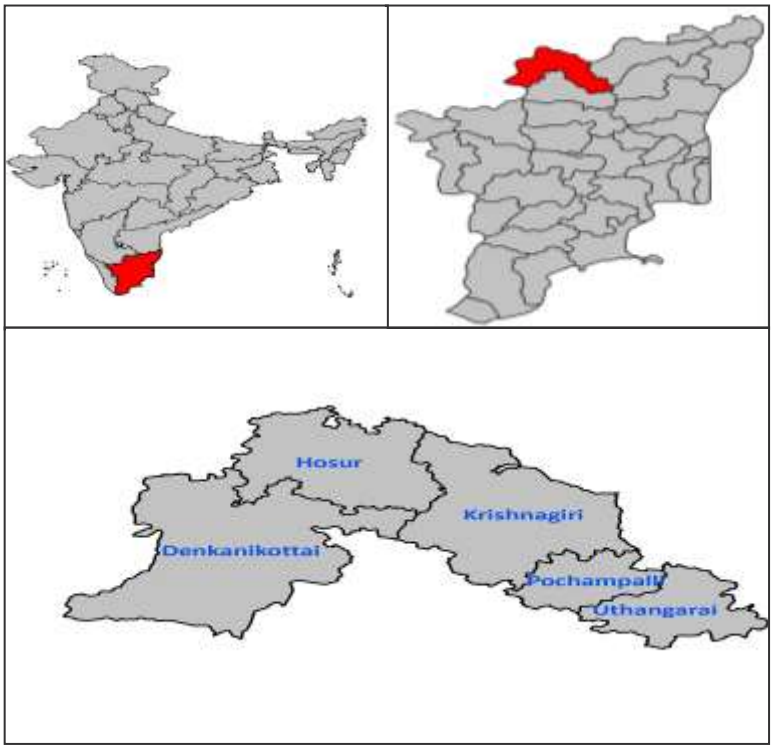


Figure 1.2: Location Map of Tamil Nadu State and District Krishnagiri

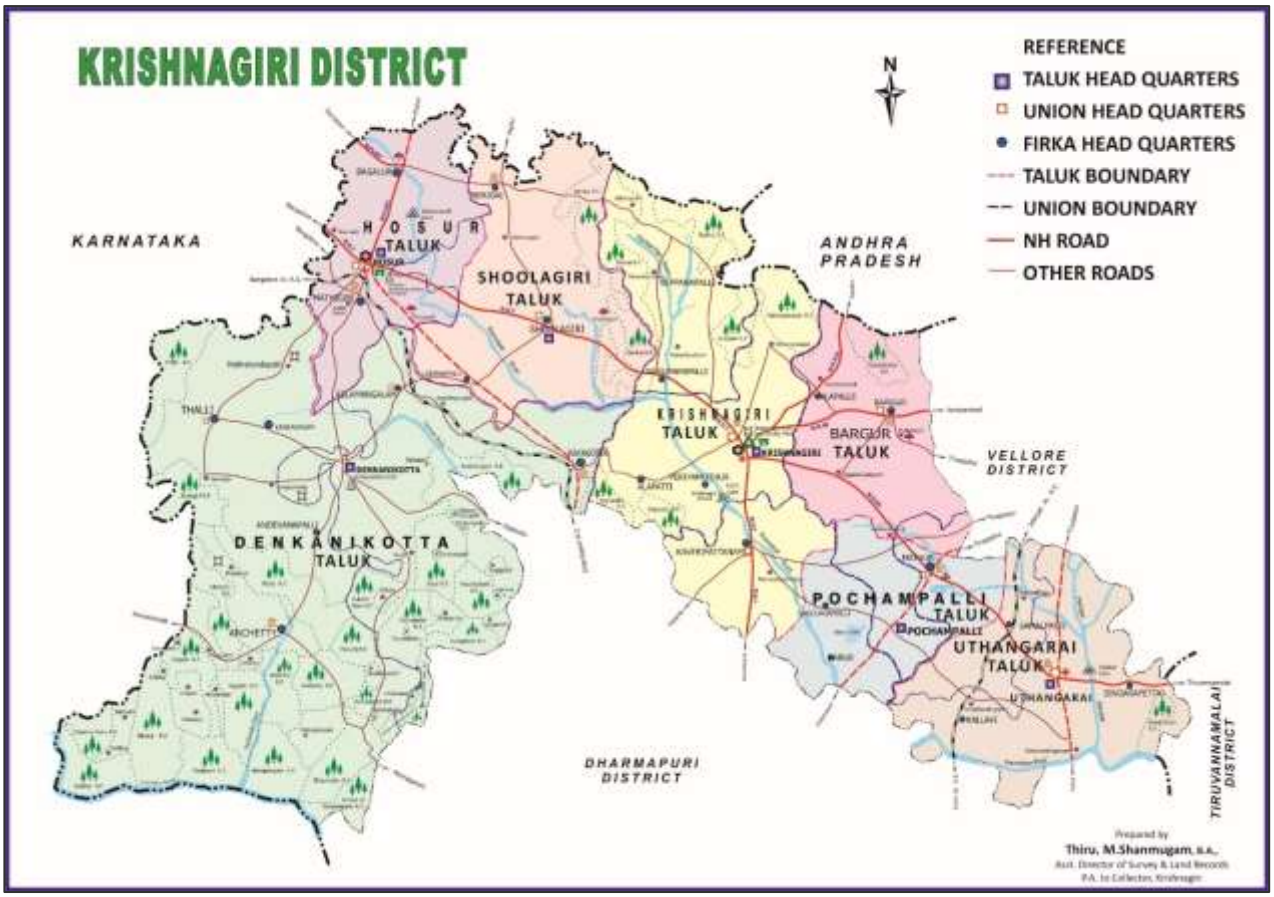


Figure 1.3 Physical Map of District Krishnagiri

The proposed road is passing through two villages in Krishnagiri district. The details of proposed alignment presented in **Table 1.2** and the key plan of project road section shown in **Figure 1.4.**

Table 1.2: Details of Project Section

National Highway No.	Project Road Stretch	State	Districts en-route	Taluks en-route	Length (km)
NH-948A	From Peddamadhagondapalli to Devarapalli Deeviripalli (Km 140+000 to Km 179.969)	Tamil Nadu	Krishnagiri	Denkanikottai	8.013
				Hosur	31.956

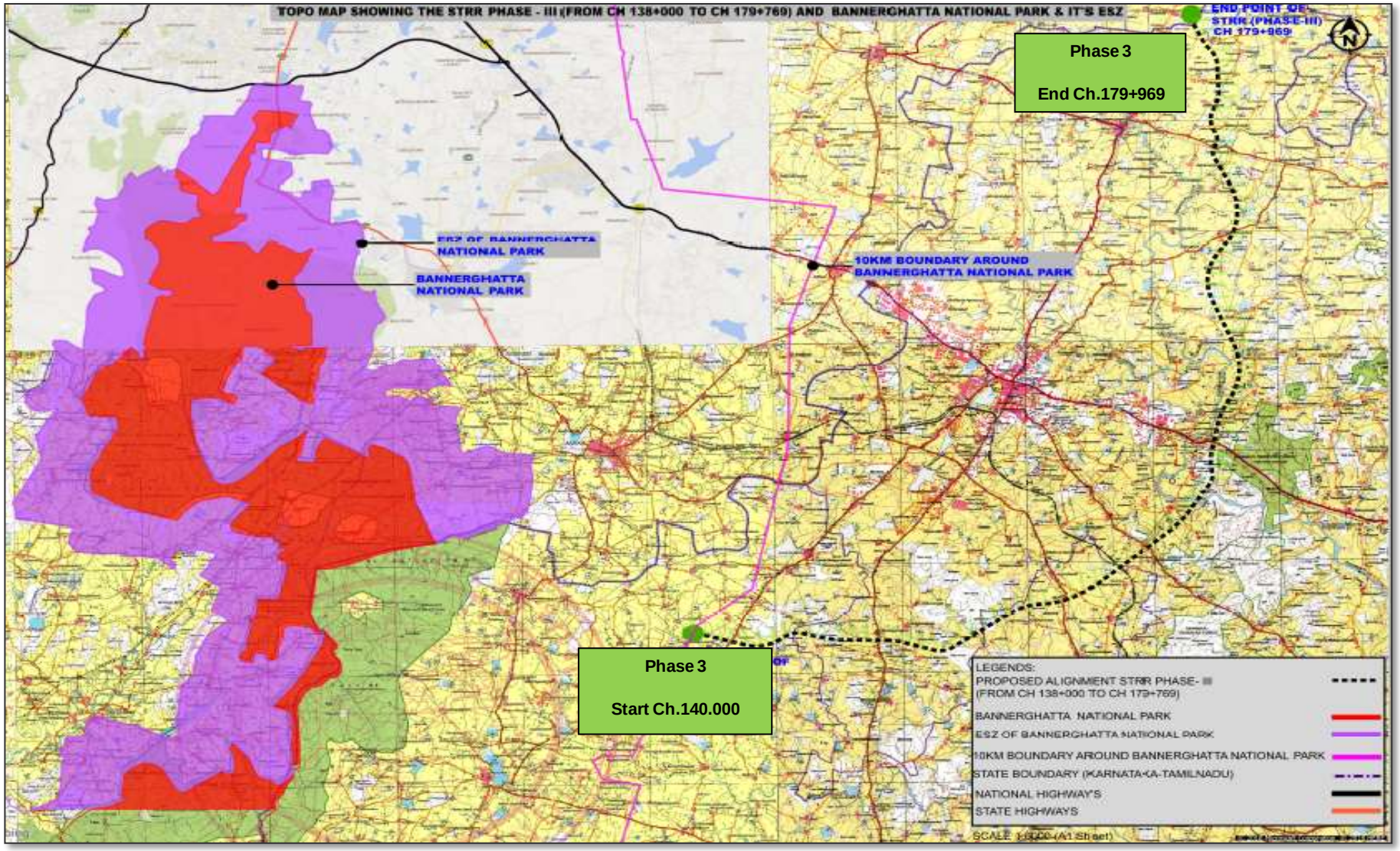


Figure 1.4: Key Plan of the Project Road (km 140.000 to km 179.969)

1.3 OBJECTIVE OF THE PROJECT

The National Highways Development Program (NHDP) has reached a certain level of maturity. It is now important to re-define road development and have a macro approach while planning expansion of the National Highways network. The focus has to be on recasting road development by bridging critical infrastructure gaps. Hence, Bharatmala Pariyojana is an umbrella program for the highways sector that focuses on optimizing efficiency of freight and passenger movement across the country by bridging critical infrastructure gaps through effective interventions like development of Economic Corridors, Inter Corridors and Feeder Routes, National Corridor Efficiency Improvement, Border and International connectivity roads, Coastal and Port connectivity roads and green-field expressways. A total of around 24,800 km are being considered in Phase I.

The Environmental Assessment (EA) has been conceived as an integral part of developing the project roads as Green Highways with below core objectives:

- Road up-gradation and improvements that are sustainable and ensures road safety
- Facilitate economic stimulation and improvement to community and cultural assets by integrating environmental enhancement measures along the project corridors through community partnering
- Energy and environmental stewardship through appropriate intervention in design and construction

This report is prepared to meet the statutory requirement of Ministry of Environment, Forests and Climate Change (MoEF & CC), Government of India.

The major objectives of this environmental assessment study are stated below:

- To present to decision makers a clear assessment of potential impacts associated with the proposed project intervention,
- To apply a methodology which assesses and predicts potential impacts and provides
  a) the means for impact prevention and mitigation,
  b) the enhancement of project benefits, and
  c) the minimization of long-term impacts;
- To provide a specific forum in which consultation is systematically undertaken in a manner that allows stakeholders to have direct input to the environmental management process.
- To assess the analysis of alternatives to bring environmental considerations into the upstream stages of development planning as well as the later stage of site selection, design and implementation, and
- To recommend the environmental management measures to reduce adverse impacts.

In order to achieve these objectives, detailed surveys and other studies have been/being carried out along the project roads to identify specific significant environmental issues. For investigation / monitoring purpose, the study area has been defined as under.

- Corridor of Impact (COI): PROW of 70m
- Project Influence Area (PIA): 10 km on either side along the proposed alignment.
- Project District (PD): The district(s) through which project road passes.

1.4 PROJECT PROPONENT

The National Highways Authority of India was constituted by an act of Parliament, the National Highways Authority of India Act, 1988. It is responsible for development, maintenance and management of National Highways entrusted to it and for matter connected or incidental thereto. Ministry of Road Transport & Highways (MoRT&H), Government of India has embarked upon the Bharatmala Pariyojana to deliver substantial improvement in highway network in India. In the proposed development project, National Highways Authority of India (NHAI) has been entrusted to implement and monitor the development of new National Highways under Bharatmala Pariyojana (Lot-3) which is presently administered by NHAI's Project Implementation Unit (PIU) Bangalore (expressway), Bangalore, Karnataka. The NHAI has appointed M/s Louis Berger Consulting Private Limited for providing consultancy Services for Preparation of Detailed Project Report for development of National Highway sections under Bharatmala Pariyojana (Phase-III), starting from Peddamadhagondapalli (Km 140+000) to Devarapalli i (Km 179+979) with total length of 39.969 Km in the state of Tamil Nadu. The scope also includes an Environmental and Social Impact Assessment study to establish the Environmental and Social Impacts of the project.

1.5 LITIGATION STATUS

It is understood from the discussions held with NHAI that there is no litigation (s) pending against the proposed project and there are no directions from any court of law/any-statutory authority against the project passes orders.

1.6 ENVIRONMENTAL LEGISLATIONS

Ministry of Environment, Forest and Climate Change (MoEF&CC): The primary responsibility for administration and implementation of the GoI policy with respect to environmental management, conservation, ecologically sustainable development and pollution control rests with the MoEF&CC Established in 1985; the MoEF&CC is the agency primarily responsible for review and approval of EIA"s pursuant to GoI legislation. The MoEF&CC has set up regional offices responsible for collecting and furnishing information relating to EIA projects, pollution control measures, enforcement of legislations and environmental protection in special conservation areas such as wetlands, mangroves and biological reserves.

Tamil Nadu State Pollution Control Board (TNPCB): The objective of TNPCB is to control, prevent and abate pollution in the state to protect the environment from degradation by effective monitoring and implementation of state pollution control legislations and are also involved in implementation, supervision and monitoring activities pertaining to Central Pollution Control Acts and Rules vests with the Central Pollution Control Board (CPCB), Government of India.

The Government of India has formulated various policy guidelines; acts and regulations aimed at protection and enhancement of environmental resources. The following **Table 1.3** summarizes the existing legislations pertaining to the project, the various clearances required for the project and the status as on date.

Table 1.3: Summary of Relevant Environmental Laws & Regulations

S. No	Law / Regulation / Guidelines	Objectives	Implementing / Responsible Agency
1.	The Environmental (Protection) Act. 1986, and its rules	The Umbrella Act for protection and improvement of the environment. Establishes the standards for emission of noise in the atmosphere.	MoEF&CC; GoI; Department of Forest, GoTN; CPCB; TNPCB,
2.	Environment Impact Assessment Notification (2006) and amendments made thereafter	To provide environmental clearance to new developmental activities following environmental impact assessment	MoEF&CC; GoI; CPCB; TNPCB,
3.	Notification for use of Fly ash, 2016	Promoting the utilization of fly ash in the manufacture of building materials and in construction activity within a specified radius of 300 kilometers from coal or lignite based thermal power plants	MoEF&CC, TNPCB
4.	The Water (Prevention and Control of Pollution) Act, 1974	To control water pollution by controlling discharge of pollutants as per prescribed standards	CPCB; TNPCB
5.	The Air (Prevention and Control of Pollution) Act. 1981	Empowers to control air pollution by controlling emission of air pollutants as per prescribed standards, SPCB to set and monitor air quality standards and to prosecute offenders, excluding vehicular air and noise emission.	CPCB; TNPCB & Transport Department; State Govt.
6.	Noise Pollution (Regulation And Control) Act, 1990. Noise Pollution (Regulation and Control) Rules (2000) The Noise Pollution (Regulation and Control) Amendment Rules (2006)	To regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise.	CPCB; TNPCB,& Transport Department of State Government
7.	Indian Forest Act 1927, The Forest (Conservation) Act. 1980, Forest (conversion) Rules 1981, Forest Conservation Rules (Notification) 2003	To consolidate the laws related to forest, the transit of forest produce and the duty livable on timber and other forest produce. Conservation of Forests, Judicious use of forestland for non-forestry purposes; and to replenish the loss of forest cover by Compensatory Afforestation on degraded forestland and non-forest land. Procedure for submission of the proposals seeking approval for Central Government for diversion of forestland to non-forest purposes.	MoEF&CC; Department of Forest, State Government
8.	National Forest Policy1952 National Forest	To maintain ecological stability through preservation and restoration of biological diversity.	Forest Department, GoI and State Government of Tamil Nadu

S. No	Law / Regulation / Guidelines	Objectives	Implementing / Responsible Agency
	Policy(Revised) 1988		
9.	National Environment Appellate Authority Act (NEAA) 1997	Address Grievances regarding the process of environmental clearance.	National Environment Appellate Authority
10.	The National Highway Act (1956)	For Land Acquisition	NHAI; Revenue Department, GoTN
11.	The Land Acquisition Act 1894	Set out rule for acquisition. of land by government	Revenue Department State Government.
12.	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (also Land Acquisition Act, 2013)	For payment of compensation and assistance, different entitlements payment of compensation and Assistance, resettlement and rehabilitation of project affected population due to acquisition of lands and structures.	NHAI, Competent Authority (Revenue Department)
13.	Wild Life Protection Act, 1972 The Wild Life (Protection) Amendment Act (2002)	To protect wildlife in general and National Parks and Sanctuaries in particular. To protect wild animals, birds and plants with a view to ensure the ecological and environmental security of the country.	Chief Conservator of Wildlife, Wildlife Wing, Forest Department, State Government National/State Board for Wildlife
14.	Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010)	To provide for the preservation of Ancient and historical monuments and archaeological sites and remains of national importance and protection sculptures, carvings and other like objects.	Archaeological Department, GoI; Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH),
15.	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989	To consolidate and amend the laws related to motor vehicles. Licensing of driving of motor vehicles, registration of motor vehicles, with emphasis on road safety standards and pollution control measures, standards for transportation of hazardous and explosive materials To check vehicular air and noise pollution.	RTO Office, GoTN
16.	The Explosives Act (& Rules) 1884 (1983)	Sets out the regulations as to regards the use of explosives and precautionary measures while blasting & quarrying.	Chief Controller of Explosives
17.	Public Liability and Insurance Act,1991	Protection to the general public from accidents due to hazardous material	SPCB
18.	Hazardous and Other Wastes (Management &Transboundary Movement) Rules, 2016	Protection to the general public against improper handling and disposal of hazardous wastes	SPCB

S. No	Law / Regulation / Guidelines	Objectives	Implementing / Responsible Agency
19.	Minor Mineral and concession Rules, 2004	For opening new quarries.	District Collector
20.	The Mining Act (1952)	The mining act has been notified for safe and sound mining activity.	Department of mining, GoTN
21.	Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996	Protection against chemical accident while handling any hazardous chemicals resulting.	District & Local Crisis Group headed by the DM and SDM
22.	Construction and Demolition Waste Management Rules 2016	To promote an integrated approach , whereby environmental management of construction and demolition waste is given due consideration throughout the duration of the project	MoEF&CC ,SPCB

1.6.1 The Environment (Protection) Act, 1986

The Environment (Protection) Act, popularly known as EP Act, is an umbrella legislation that supplements existing environmental regulations. Empowered by the EP Act, the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India has issued the following notifications regulating siting of industry and operations, procuring clearance to establish industries and development of projects with appropriate EIA studies, coastal zone regulations and other aspects of environment are:

- Empowers the Government of India (section 6) to make rules to regulate environmental pollution by stipulating standards and maximum allowable limits to prevent air, water, noise, soil and other environmental pollutants.
- Prohibits operations that emit pollutants more than standards (section 7).
- Regulates handling of hazardous substances and identifies persons responsible for discharges and pollution prevention (section 9).
- Section 17 deals with offences committed by Government Departments.
- Formulated Environmental (Protection) Rules, 1986, Hazardous Wastes (Management and Handling) Rules, 1989 and Manufacture, Storage & Import of Hazardous Chemical Rules, 1989 in accordance with the sections 6, 8 and 25 of EP Act.
- The act has been supplemented with EIA notification 2006

1.6.2 Environmental Impact Assessment Notification, 2006

The primary responsibility for administration and implementation of the GoI policy with respect to conservation, ecologically sustainable development and pollution control rests with the Ministry of Environment, Forests and Climate Change (MoEF&CC). The MoEF&CC is responsible to enforce the regulations established pursuant to the National.

Conservation Strategy, National Forest Policy, 1988, the Policy for Abatement of Pollution (1992) and the Indian Environmental Protection Act 1986, revised in 1994 and amendments thereafter.

The GoI EIA Notification on Environmental Clearances (September 14, 2006) replacing the EIA Notification of 1994, sets out the requirement for Environmental Assessment in India. This states that

Environmental Clearance (EC) is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts. The categorization for highways and roads projects is as given in **Table 1.4.**

Table 1.4: Categorization of Highway & Road Projects

Project or Activity		Category with threshold limit		Conditions if any
		A	B	
7(f)	Highways	i) New National Highways and ii) Expansion of National Highways greater than 100 km involving additional right of way or land acquisition greater than 40m on existing alignments and 60m on realignments or by-passes.	All New State Highway projects ii) State expansion Highway projects in hilly terrain (above 1,000m AMSL) and or ecologically sensitive areas	General Condition shall apply. Note: Highway include expressways

Source: MoEF&CC's EIA Notification 2006 and its amendments thereafter

Category A projects requires EC from the National's Ministry of Environment, Forest and Climate Change (MoEF&CC).

Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA).

General Condition (GC): Any project or activity specified in Category 'B' will be treated as Category A, if located in whole or in part within 5 km from the boundary of:

(i) Protected Areas notified under the Wild Life (Protection) Act, 1972,

(ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time,

(iii) Notified Eco-sensitive areas,

(iv) Inter-State boundaries and international boundaries.

1.6.3 Water (Prevention and Control of Pollution) Act, 1974

Water Act is the first environmental regulation that brought at the state and center levels, pollution control boards to control / regulate environmental pollution in India. Amended twice in 1978 and 88, the Act vests regulatory authority on the State Pollution Control Boards and empowers them to establish and enforce effluent standards for industries and local authorities discharging effluents.

- Section 73 vests regulatory authority on the State Pollution Control Boards and empowers them to enforce effluent discharge standards to prevent water pollution (both for industries and local authorities)
- Section 24 of the act prohibits use of stream or well or on land disposal for polluting substances that violate disposal standards laid down by the board
- Section 25 of the act requires an application to be made to the state board to establish any treatment and disposal system that is likely to discharge sewage or trade effluent in to a stream or well or sewer on land
- Sections 41 and 44 provide for penalties for not complying with the various provisions or directives of the board

- Section 48 deals with offences committed by Government Departments
- Section 55 asserts that all local authorities shall render help & assistance and furnish information to the board as required for discharge of functions, and shall make available to the board, for inspection and examination, such records, maps, plans and other documents as may be necessary

The act empowers the board to levy and collect cess on water consumed by the industry or local authority and to utilize and augment resources for the PAT@pollution Control Boards. In line with this provision, The Water (Prevention & Control of Pollution) Rules, 1975 were formulated

1.6.4 Air (Prevention and Control of Pollution) Act, 1981

Like Water Act, the Air Act provide regulatory authority from the State Pollution Control Boards and empowers them to enforce air quality standards for the prevention of air pollution in the country. Section 21 of the act requires an application to be made to the state board to establish or operate any industrial operation.

1.6.5 Forest (Conservation) Act, 1980 as Amended in 1988, 2003

As per Section 26 of Indian Forest Act, 1927 several activities are prohibited in forest areas and prior approval is required from the Central government to use forestland for non-forest purposes**.** The Forest (Conservation) Act, 1980 prohibits large-scale diversion of forestland for non-forest use. As amended in 1988, no State Government or authority shall make such diversions except with the prior approval of the Central Government.

1.6.6 Wildlife Protection Act, 1972

This act is promulgated to provide for the protection of wild animals, birds and plants and for matters connected therewith. The provisions under this act are as below:

- Section 9 of the Act mentions that no person shall hunt any wild animal.
- The act prohibits picking, uprooting, damaging, destroying, acquiring any specified plant from any forest land
- It bans the use of injurious substances, chemicals, explosives that may cause injury or endanger wildlife in a sanctuary
- No alteration of the boundaries of a National Park shall be made except on a resolution passed by the Legislature of State
- Destruction or damage of wildlife property in a National Park is prohibited

1.6.7 Manufacture, Storage and Import of Hazardous Chemical Rules, 1989, 2016

These rules aim at controlling the generation, storage and import of hazardous chemicals. According to these rules, the user of hazardous chemicals has to perform the following and dispose hazardous waste as mentioned in the rules:

- Identify the potential hazards of the chemicals and take adequate steps to prevent and control such hazards
- Develop or provide information about the chemical in the form of safety data sheets
- Label the specified information on the container of the hazardous chemical

1.6.8 The Motor Vehicles Act, 1988

In 1988, the Indian Motor Vehicles Act empowered the State Transport Authority (usually the Road Transport Office) to enforce standards for vehicular pollution prevention and control. The authority also checks the emission standards of registered vehicles, collects road taxes and issues licenses. In August 1997, the Pollution under Control certificate (PUC) program was launched as an attempt to crackdown on the vehicular emissions in the States. Since this act is applicable for all states, this will be applicable for this project.

1.6.9 Ancient Monuments and Archaeological sites and Remain Act, 1958

An Act formulated for the preservation of ancient and historical monuments and archaeological sites and remains of national importance, for the regulation of archaeological excavations and for the protection of sculptures, carvings and other like objects.

1.6.10 Ancient Monuments and Archaeological sites and Remain (Amendment and Validation) Act, 2010

This act clearly demarcates the buffer area surrounding the protected monument into prohibited area (100m) and regulated area (200m). Thus, the construction related activities shall be prohibited within the buffer area.

1.6.11 The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013

In India, a new bill, Land Acquisition and Rehabilitation and Resettlement Bill has been passed by the Parliament in 2013 to repeal the Land Acquisition Act of 1894. This is the first National/ Central Law about Rehabilitation & Resettlement of families affected and displaced as a result of land acquisition. Only R&R provisions will apply when private companies purchase land for a project, and the same exceeds the area thresholds set by the State Governments for such purchase.

As per this Act, compensation will be given within a period of three months from the date of the award. Where an award has been made but the affected individuals have not accepted compensation or have not yet given up possession, and the proceedings have been pending for 5 years or more, provisions of the new law will apply. This Act stipulates mandatory consent of at least 70% of affected people for acquiring land for Public Private Partnership (PPP) projects and 80% for acquiring land for private companies. Under the new legislation, compensation for the owners of the acquired land will be four times the market value in rural areas and twice in urban areas. It also stipulates that the land cannot be vacated until the entire compensation is awarded to the affected parties.

1.6.12 Other Legislation Applicable to Road Construction Projects

Environmental issues during road construction stage generally involve equity, safety and public health issues. The road construction agencies require complying with laws of the land, which include *inter alia,* the following:

- ***Workmen's Compensation Act 1923*** (the Act provides for compensation in case of injury by accident arising out of and during the course of employment);
- ***Payment of Gratuity Act, 1972*** (gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years);
- ***Employees PF and Miscellaneous Provision Act 1952*** (the Act provides for monthly contributions by the employer plus workers);

- ***Maternity Benefit Act, 1951*** (the Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.);
- ***Contact Labor (Regulation and Abolition) Act, 1970*** (the Act provides for certain welfare measures to be provided by the contractor to contract labour);
- ***Minimum Wages Act, 1948*** (the employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the act);
- ***Payment of Wages Ac 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);
- ***Equal Remuneration Act, 1979*** (the Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees);
- ***Payment of Bonus Act, 1965*** :the Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages);
- **Industrial Disputes Act, 1947**:the Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment);
- ***Industrial Employment (Standing Orders) Act; 1946*** (the Act provides for laying down rules governing the conditions of employment);
- ***Trade Unions Act, 1926*** **(**the Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities);
- ***Child and Adolescent Labour (Prohibition and Regulation) Act, 1986*** (the Act prohibits employment of children below 14 -18 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);
- ***Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979*** (the inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home to the establishment and back, etc.);
- ***The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996*** **and** ***the Cess Act of 1996*** (all the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.);
- ***The Factories Act, 1948*** (the Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities);

1.6.13 Environmental Legal Framework of Tamil Nadu State

The environment legal framework in Tamil Nadu State is summarized in Table below:

Table 1.5 Environmental Legal Framework of Tamil Nadu State

S. No	Applicable Acts	Year	Objective	Applicability
1.	Tamil Nadu State Environment Policy (Draft)	2017	Sustainable development of the State	Direct
2.	Tamil Nadu State Water Policy	1994	To protect and conserve water resources	Direct
3.	Tamil Nadu Water (Prevention and Control of Pollution) Rules	1983	To control water pollution by controlling emission & Water pollutants as per the prescribed standard	Direct
4.	Tamil Nadu Air (Prevention and Control of pollution) Rules	1983	To control air pollution by controlling emission and air pollutants according to prescribed standard	Direct
5.	Tamil Nadu Groundwater (Development and Management) Bill	2000	To protect groundwater resources, to provide safeguards against hazards of its over exploitation and to ensure its planned development and management in the State of TN and for matters connected therewith or incidental thereto	Direct
6..	Tamil Nadu Aquaculture (Regulation) Act	1995	For regulation of coastal aquaculture in the State	Indirect
7.	Tamil Nadu Ancient and Historical monuments and Archaeological sites and remains Rule	1971	Provides procedure for moving antiquities	Direct
8.	Costal Regulation Zone in Tamil Nadu	2011	Identifying and categorizing the coastal areas up to 500 meters from the high tide line	Direct
9.	EIA Notification by MOEF&CC	2006	Establishment of the State level environmental impact assessment authority for environmental clearance of Category B projects.	Not Applicable
10.	Fly Ash Notification	2016	Promoting the utilization of fly ash in the manufacture of building materials and in construction activity within a specified radius of three hundred kilometers from coal or lignite based thermal power plants	Direct
11.	Tamil Nadu Forest Act	1882	Protection of wildlife (wild animals, defined plants and birds) and to control poaching, smuggling and illegal trade in wildlife and its derivatives.	Direct

1.6.14 MORTH & IRC Specifications

Specifications for Road and Bridge Works, Fourth Revision, MORTH, Published by IRC, 2001

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. Provisions of clause 501 Annexure A cover the environmental aspects as given in **Table: 1.6.**

Table 1.6: Environmental aspects as per clause 501 Annexure A of IRC, 2001

General	• The contractor shall take all necessary measures and precautions to carry out the work in conformity with the statutory and regulatory environmental requirements • The contractor shall take all measures and precautions to avoid nuisance or disturbance from the work. It shall be precautionary measures than abatement measures taken after generation of nuisance • In the event of any spoil, debris, waste or any deleterious material from site being deposited on adjacent land, the same shall be removed and affected area shall be restored to its original state
Water	• The contractor shall prevent any interference with supply/abstraction of water resources • Water used for dust suppression shall be reused after settlement of material in collected water • Liquid waste products to be disposed off such that it does not cause pollution • No debris is to be deposited or disposed into/adjacent to water courses
Air	• The contractor to devise and arrange methods to control dust, gaseous or other airborne emissions in such a way that adverse impacts on air quality is minimized • Dust shall be minimized from stored material and stockpiles by spraying water • Covering of material likely to rise dust during transport is to be covered with tarpaulin • Spraying of water on haul roads if found necessary
Noise	• The contractor shall use all necessary measures to reduce noise from construction equipment and maintain all silencing equipment in good condition
Control of wastes	• No uncontrolled disposal of wastes shall be permitted. The contractor shall make specific provisions for disposal of all forms of fuel and engine oil, all types of bitumen, cement, surplus aggregate, gravels, bituminous mixtures etc. conforming to local regulations and acceptance of the engineer
Emergency Response	• The contractor shall plan and provide for remedial measures in case of occurrence of emergencies as spillages of oil, bitumen or chemicals

In addition to the above conditions, avoidance measures and control of activities having potential for generation of environmental impacts are devised. These 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 and villages where excavation is carried out
Clause 305.2.2.2	Locations 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 geotextiles for control of soil erosion
Section 810	Use of Metal beam crash barriers for safety, relevant regulations and specifications
Clause 1010	Quality of water for curing and construction
Clause 2501	Precaution during river training works

Guidelines for Environmental Impact Assessment, IRC: 104-1988, IRC SP 108: 2015

The guidelines endorse application of Environmental Protection Act, 1986 for highway projects. It recommends that the methods of measuring air pollution should be in conformance with IS: 5182-1977 and in case of noise pollution: IS: 3028-1980, Measurement of noise emitted by moving road vehicles; IS: 4758-1968, Method of measurement of noise emitted by machines; IS: 10399-1982, Method of measurement of noise emitted by stationary road vehicles are to be followed. As regards Highway aesthetics, use of provisions made in IRC: SP: 21-1979, Manual on landscaping of roads are to be followed**.**

Guidelines for Environmental Impact Assessment, IRC: 104-1988 91.

The guidelines endorse application of Environmental Protection Act, 1986 for highway projects. It recommends that the methods of measuring air pollution should be in conformance with IS: 5182-1977 and in case of noise pollution: IS: 3028-1980, Measurement of noise emitted by moving road vehicles; IS: 4758-1968, Method of measurement of noise emitted by machines; IS: 10399-1982, Method of measurement of noise emitted by stationary road vehicles are to be followed. As regards Highway aesthetics, use of provisions made in IRC: SP: 21-1979, Manual on landscaping of roads are to be followed

1.7 LEGAL FRAMEWORK

Ministry of Environment, Forest and Climate Change (MoEF&CC) : The primary responsibility for administration and implementation of the GoI policy with respect to environmental management, conservation, ecologically sustainable development and pollution control rests with the MoEF&CC Established in 1985; the MoEF&CC is the agency primarily responsible for review and approval of EIA"s pursuant to GoI legislation. The MoEF&CC has set up regional offices responsible for collecting and furnishing information relating to EIA projects, pollution control measures, enforcement of legislations and environmental protection in special conservation areas such as wetlands, mangroves and biological reserves.

Tamil Nadu State Pollution Control Board (TNPCB): The objective of TNPCB is to control, prevent and abate pollution in the State to protect the environment from any degradation by effective monitoring and implementation of state pollution control legislations and are also involved in Implementation, supervision and monitoring activities pertaining to Central Pollution Control Acts and Rules vests with the Central Pollution Control Board (CPCB), Government of India.

1.7.1 Environmental Standards and Code of Practice

- Environment Impact Assessment Guidance Manual for Highways, Ministry of Environment, Forest and Climate Change (MoEF&CC), 2010
- Environment Impact Assessment Notification dated 14th September 2006- Ministry of Environment, Forest and Climate Change (MoEF&CC) and amendments in 2009.
- Guidelines for Environmental Impact Assessment of Highway Projects, IRC: 104-1988, MoEF&CC 1989.
- Environment Impact Assessment – A Manual, 2001 - Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India
- Handbook on Environmental Procedures and Guidelines, 1994 Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India
- Guidelines on requirements for Environmental Clearance for Road Projects, IRC: 93-2011.
- Recommended Practice for Treatment of Embankment slopes for Erosion Control, IRC: 56-1974.
- Highway Safety code, IRC, specified publication number 44.
- Recommended Practice for use and upkeep of Equipment, Tools and Appliances for Bituminous pavement construction IRC:72-1978
- Environmental Guidelines for Rail/Road/Highway Project – 1989, Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India
- Guidelines for use of Fly Ash in Road Embankments-IRC: SP: 58-2001
- Guidelines for Environmental Impact Assessment of Highway Projects-IRC: 104-1988
- Guidelines on Road Drainage-IRC: SP: 42-1994
- Report containing recommendations of the IRC regional workshops on Highway Safety-IRC: SP: 27-1984
- Recommended practice for Borrow pits for Road Embankments constructed by Manual operation-IRC: 10-1961
- Guidelines for Pedestrian Facilities- IRC: 103-1988
- Guidelines on Safety in Road Construction Zones- IRC: SP: 55:2001
- Manual on landscaping of roads IRC: SP:21 – 2009
- Guidelines on Preparation and Implementation of Environment Management Plan-IRC:SP:108-2015

1.7.2 Environmental Permits / Approvals Required

The proposed road development project of NH-948A is a New National Highway with an additional ROW requirement of 70m. Hence, as per EIA notification 2006, the proposed project falls under "Category A" and attracts the conditions of obtaining prior Environmental Clearance from Ministry of Environment, Forest & Climate Change (MoEF&CC).

Therefore, Form 1 including Terms of Reference (TOR) for the EIA study along with Pre-Feasibility Report (PFR) in prescribed format was submitted to MoEF&CC to get it approved by Expert Appraisal Committee under the category of Infrastructure Projects of MoEF&CC, GoI. Terms of Reference for EIA was finalised in the minutes of the 191st Meeting of the Expert Appraisal Committee (MoEF&CC) for

Projects related to Infrastructure Development, Industrial estate/parks/complexes/areas, Export Processing Zones, Special Economic Zones, Biotech Parks, Leather Complexes and National Highways projects to be held on 25th June, 2018 held on Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi. The project was reconsidered during the 195th Expert Appraisal Committee meeting of MoEF&CC held on 30-31st August 2018 meeting, where the committee again recommended the project for grant of TOR with revised length of Phase-III project by two kms.

The summary of clearances & NOCs applicable with agency responsible for obtaining clearance, and a stage at which clearance will be required is given in **Table 1.7.**

Table 1.7: Summary of Clearances & NOC's applicable during pre-construction/design stage

S. No	Type of clearance	Statutory Authority	Applicability
1	Prior Environmental Clearance	Expert Appraisal Committee, MoEF&CC	Category 'A' project
2.	Tree felling permission	State Department of Environment & Forest	For roadside tree cutting

Table 1.8: Summary of Clearances & NOC's applicable during construction stage

S. No	Type of clearance	Statutory Authority	Applicability	Project stage
1.	Prior Environmental Clearance	Expert Appraisal Committee, MoEF&CC	Category 'A' project	Pre-construction
2.	Tree felling permission	State Department of Environment & Forest	For tree cutting along the project corridor	Pre-construction
3.	Forest Clearance	State Government and MOEF&CC	Proposed road alignment is passing through Bannerghatta National Park, which is also notified Forest.	Pre-construction
4.	Wildlife Clearance	State Government and MOEF&CC	Proposed road alignment is passing through Bannerghatta National Park.	Pre-construction
5.	NOC and Consents Under Air, Water, EP Acts & Noise rules of SPCB	State Pollution Control Board	For establishing plants	Construction (Prior to work initiation)
6.	NOC And Consents Under Air, Water, EP Acts & Noise rules of SPCB	State Pollution Control Board	For operating Hot mix plants and batching plants	Construction (Prior to work initiation)
7.	Permission to store Hazardous Materials	State Pollution Control Board	Storage & Transportation of Hazardous Materials and Explosives	Construction (Prior to work initiation)
8.	PUC certificate for use of vehicles for construction	Department of Transport	For all construction vehicles	Construction (Prior to work initiation)
9.	NOC for water extraction for	Ground Water Authority	Ground water extraction	Construction (Prior to work initiation)

S. No	Type of clearance	Statutory Authority	Applicability	Project stage
	construction and allied works			
10.	Explosive License	Chief Controller of Explosives	For storing fuel oil, lubricants, diesel etc.	Construction stage (Prior to storing fuel, lubricants and Diesel, etc.)
11.	Permission for storage of hazardous chemical	SPCB	Manufacture storage and Import of Hazardous Chemical	Construction stage (Prior to initiation of any work)
12.	Labor license	Labor Commissioner Office	Engagement of Labor	Construction stage (Prior to initiation of any work)
13.	Quarry Lease Deed and Quarry License from	State Department of Mines and Geology	Quarry operation	Construction stage (Prior to initiation of Quarrying)

1.8 REPORT STRUCTURE

The EIA report has been structured into the following chapters:

Chapter 1: Introduction: This chapter consist of purpose of EIA, project proponent, description of project, and its importance.

Chapter 2: Project Description: This chapter consist of project interventions which will have impact on environment.

Chapter 3: Description of the Environment: This chapter consist of baseline environmental condition of project area and corridor of impact.

Chapter 4: Anticipated Environmental Impacts & Mitigation Measures: This chapter consist of examination of environmental impacts which will be induced due to proposed project interventions and their mitigation measures.

Chapter 5: Analysis of Alternatives (Technology and site): This chapter consist of various site and technological alternatives for the proposed project.

Chapter 6: Environmental Monitoring Program: This chapter consist of monitoring indicators, monitoring schedule, monitoring frequency and reporting mechanism.

Chapter 7: Additional Studies: This chapter consist of public consultation public hearing, and issues raised during public hearing.

Chapter 8: Project Benefits: This chapter consist of regional and local benefits to society and environment.

Chapter 9: Environmental Management Plan: This chapter consist of generic and site-specific impacts and mitigation measures, implementation and responsibilities and cost estimates for EMP.

Chapter 10: Summary and Conclusion: This chapter consist summaries environmental Impact Assessment.

Chapter 11: Disclosure of Consultant engaged: This chapter consist of details of the consultants engaged along with their capabilities and experience.

CHAPTER-2: PROJECT DESCRIPTION

2.1 INTRODUCTION

Bangalore city a is thickly populated city. Therefore, it is important to ensure safe, smooth, efficient, and high-speed transport corridor in the city and impetus that the infrastructure of the city and adjoining towns matches with the anticipated development. The National Highways NH 648 (NH 207), NH 48 (NH 4), NH 275, NH 948, NH 209 & NH 75 (Hassan road), and majority of State Highways SH 3, SH 85, & SH 35 pass through Bangalore city comprising heavy commercial traffic movement. Most of these traffic pass through the Bangalore city resulting into huge traffic jams. In addition, the Nandi Infrastructure Corridor Enterprises (NICE) Road currently has only four lane configuration with almost reaching its optimum capacity of traffic. The STRR will function as an alternative and has huge potential for the traffic to be diverted. Further, provision of STTR will ensure better connectivity to the satellite town around Bangalore and high-speed connectivity primarily to Bangalore International airport and to proposed Bangalore – Chennai Expressway.

The Government of Karnataka took steps to improve and augment road network within and in the neighbouring areas of the city to match with its pace of development. Bangalore Metropolitan Regional Development Authority (BMRDA) had planned Satellite Town Ring Road consisting the length of 204 km to match these requirements around Bangalore city. The STRR connects important towns viz. Dobbaspet, Doddaballapura, Devanahalli, Sulibele, Hoskote, Sarjapur, Attibele, Anekal, Tattekere, Kanakapura, Ramanagara and Magadi

BMRDA assigned M/s SECON for the consultancy services to undertake the topographical & Cadastral surveys, finalize the proposed alignment and to prepare the land acquisition report in year 2006. Subsequently, the same agency was engaged to carry out the consultancy for Techno –Economic Feasibility Report in 2007.The notification for land acquisition for STRR & Individual Town Ring (ITRR) issued on 12/09/2007 and the project report approved by BMRDA on 10/06/2008. The proposed STRR alignment has been declared as State Highway (special)-2 as per the provisions of Karnataka Highways Act 1964 and the SE, PWD, Bangalore circle nominated as 'The Highway Authority'. Land acquisition processes initiated vide notification NO4017-07-08 dated 19/10/2007. However, the project was shelved due to the paucity of funds within the state government.

Therefore, reviving the STRR project, considering current development in the region was absolute necessity on priority basis. Thus, it was proposed to consider a six-lane carriageway configuration throughout as minimum requirement. Further Hosur, an automobile industry town is located in the vicinity, about 7km away from Karnataka state border. This city generates huge amount of traffic and currently experiencing massive traffic congestion. Therefore, it was also envisaged connecting Hosur city with the proposed STRR alignment to improve overall connectivity within the region.

2.2 DESCRIPTION OF THE PROJECT

The proposed STRR alignment is passing through Bannerghatta National Park (BNP) and its eco-sensitive zone (ESZ) at design Chainage km 114 to km 119. In consideration to it, NHAI has categorised the project in 3 phases for expeditious implementation of the project. The entire corridor is proposed to be taken up in 3 phases as give below in **Table 2.1:**

Table 2.1: Details of Proposed STRR

Phases	Description (Design km)	Length (km)	District	Length under District (km)	State
Phase-I	Ch. 0.000 to Ch. 82.200	82.200	Bangalore Rural	19.500	Karnataka
			Ramanagara	62.700	
Phase-II	Ch. 82.200 to Ch. 140.000	57.800	Ramanagara	37.700	Karnataka & Tamil Nadu
			Bangalore Urban	15.042	
			Krishnagiri	5.058	
Phase-III	**Ch. 140.000 to Ch. 179.969**	**39.969**	**Krishnagiri**	**39.969**	**Tamil Nadu**

Accordingly, this report deals with Phase III of STRR.

The details of the proposed alignment sections of STRR are given in **Table 2.2.**

Table 2.2: Details of the Proposed Alignment Sections of STRR

NH Section	Geo-Coordinates		Design/ Proposed Chainage (km)		Length (km)
	Start Point	End Point	From	To	
Peddamadhagondapalli to Devarapalli section of NH-948A	12°38'10.56"N 77°44'18.46"E	12°52'16.64"N 77°53'22.84"E	140.000	179.969	39.969
Total					**39.969**

2.3 EXISTING PROJECT FEATURES

The entire section of the proposed alignment is a new alignment.

2.3.1 Existing ROW:

It is entirely a new alignment, thus, there is no existing Right of Way (ROW)

2.3.2 Land Use and Roadside Environments

The project road starts from km 140.000 and terminates at km 179.969. The following table indicates the distribution of length of project road and percentage length in terms of land use and roadside environment. The existing land use within the project influence area is shown **in Table 2.3.**

Table 2.3: Summary of Land Use and Road Side Environment

Land Use Pattern (km and percentage)					Total Length (km)
Description	Urban Built-up	Rural Built-up	Agricultural	Barren	
Approx. Length (km)	Nil	2	25	13	40
Percent (%)	0	5	62.5	32.5	100

2.3.3 Villages and Urban-Built Up Sections

Around 95% length of the project road passes through non-built up area and the balance 5% length traverses through built-up area. There are 24 villages located along the proposed alignment as given in **Table 2.4.**

Table 2.4: Villages along the Proposed Alignment

Name of Taluka	Name of Village	Chainage (km)		Village Length (m)
		From	To	
Denkanikottai	1) Peddamadhagondapalli	140.000	140.796	796
	2) Madhagondapalli	140.796	141.847	1051
	3) Kalugondapalli	141.847	142.086	239
Hosur	1) S. Mudugadapalli	142.086	145.726	3640
	2) Mugalur	145.726	147.582	1856
	3) Gopanapalli	147.582	148.956	1374
Denkanikottai	4) Hosapuram	148.956	150.275	1319
	5) Kundhumaranapalli	150.275	151.342	1067
	6) Biramangalam	151.342	154.883	3541
Hosur	4) Thorapalli Agraharam	154.883	158.895	4012
		159.665	160.375	710
	5) Mornapalli	158.895	159.665	770
		160.375	161.896	1521
	6) Allur	161.896	164.783	2887
	7) Attur (H/o Muthalli)	164.783	165.074	291
	8) Muthali	165.074	165.750	676
	9) Pathamuththali	165.750	167.889	2139
	10) Karupalli	167.889	169.683	1794
	11) Nandimangalam	169.683	171.607	1924
	12) Attur (H/o Paduthepalli)	171.920	172.424	504
	13) Paduthepalli	171.607	171.920	313
		172.424	173.826	1402
	14) Thummanapalli	173.826	175.012	1186
		175.678	176.004	326
	15) Mallasandram	175.012	175.678	666
	16) Pattavarapalli	176.004	176.846	842
	17) Alasapalli	176.846	178.409	1563
	18) Deeviripalli	178.409	179.969	1560
Total				**39,969**

2.4 PROPOSED PROJECT FEATURES

The salient features of proposed project alignment given in **Table 2.5.**

Table 2.5: Salient Features of Proposed Project Alignment

<table>
<tr><th>S. No</th><th>Particulars</th><th>Proposed (Design)</th></tr>
<tr><td colspan="3">Technical Features</td></tr>
<tr><td>1</td><td>State and District</td><td>State: Tamil Nadu; District: Krishnagiri</td></tr>
<tr><td>2</td><td>Length</td><td>39.969 km</td></tr>
<tr><td>3</td><td>No. of affected villages by land acquisition</td><td>24 nos.</td></tr>
<tr><td>4</td><td>Total Area of Land Acquisition</td><td>351.30</td></tr>
<tr><td>5</td><td>Seismic Zone</td><td>Zone-II</td></tr>
<tr><td>6</td><td>Proposed Carriageway</td><td>4/6-lane divided carriageway configuration</td></tr>
<tr><td>7</td><td>Proposed ROW</td><td>70 m</td></tr>
<tr><td>8</td><td>Design Speed</td><td>100 kmph</td></tr>
<tr><td>9</td><td>Embankment</td><td>About 2-3m on existing ground generally</td></tr>
<tr><td>10</td><td>Tunnels (length, seepage, emergency exit, drilling/blasting, etc.)</td><td>Not applicable. No tunnel involved in the project</td></tr>
<tr><td>11</td><td>Junctions/ Fly Over/Interchange</td><td>4 Interchanges
<table>
<tr><th>Proposed STRR (km)</th><th>Description</th></tr>
<tr><td>144.788</td><td>Attibele - Denkanikottai Road</td></tr>
<tr><td>152.035</td><td>Attibele - Rayakottai Road</td></tr>
<tr><td>155.240</td><td>Hosur-Dharmapuri</td></tr>
<tr><td>161.099</td><td>Bangalore - Krishnagiri Road</td></tr>
</table></td></tr>
<tr><td>12</td><td>Vehicular Underpasses</td><td>3VUP, (refer Table no 2.6 and 2.10 respectively)</td></tr>
<tr><td>13</td><td>ROB</td><td>-Nil</td></tr>
<tr><td>14</td><td>RUB</td><td>1 no (km 154.503)</td></tr>
<tr><td>15</td><td>Major Bridges</td><td>1 no (km 158.470)</td></tr>
<tr><td>16</td><td>Minor Bridges</td><td>12 nos. (refer Table no 2.7(b))</td></tr>
<tr><td>17</td><td>Culverts (Widening/Reconstruction/New)</td><td>46 nos. (refer Table no 2.10)</td></tr>
<tr><td>18</td><td>Service Road</td><td>NA</td></tr>
<tr><td>19</td><td>CBR adopted for pavement design</td><td>8% as per IRC standards</td></tr>
<tr><td>20</td><td>Median</td><td>5m provided</td></tr>
<tr><td>21</td><td></td><td></td></tr>
<tr><td>22</td><td>Slope protection</td><td>Turfing/ stone pitching</td></tr>
<tr><td>23</td><td>Safety Measure</td><td>Safety Barriers provided</td></tr>
<tr><td>24</td><td>Lighting</td><td>Lighting in all proposed interchanges and toll plaza etc.</td></tr>
<tr><td>25</td><td>Horticulture and landscaping</td><td>Throughout</td></tr>
<tr><td colspan="2">Environmental Features</td><td></td></tr>
<tr><td>26</td><td>Whether passing through Wildlife area/Protected area/CRZ</td><td>No</td></tr>
</table>

S. No	Particulars	Proposed (Design)
Technical Features		
	area/Mangroves area/Critically Polluted area	
27	Protected Monuments & structures	Nil
28	Land Use Pattern	Land use within 10km buffer from either side of project roads: • Vegetation/agricultural :85% • Plantation : 4% • Barren/fallow land : 3% • Forest land : 3% • Water bodies : 3% • Settlement : 2%
29	Forest Land Diversion	Nil
30	Tree	12111
31	River crossings	Ponnaiyar River (km158.470)
32	Ponds	7 Nos. (Refer Table 2.11)
33	Terrain	Mix of Plain and rolling
34	Green belt development	As per IRC SP 21:2009 /MORTH Code/Guidelines and Green corridor's terms of reference for plantation by GHD/NHAI
35	Compensatory Plantation	Ten times the trees cut has been proposed as Compensatory Afforestation
36	Mangroves, sand dunes etc.	N/A
37	No. of social structures Affected	182 nos.
38	Civil Construction Cost	INR 756.68 Crore
39	Environmental Management Cost including Corporate Environmental Responsibility Cost	INR 8.68 Crore

Table 2.6: List of Vehicular Underpasses

S No.	Design Chainage (km)	Span
1.	152.665	1x20x5.5
2.	166.475	1x20x5.5
3.	174.185	1x20x5.5

Source: Final Feasibility Report

Table 2.7(a): List of Major Bridge

S. No.	Design Chainage (Km)	Proposed Structure Type			Proposed Span Arrangement (m)	Total Width (m)
		Type of Superstructure	Type of Substructure	Type of Foundation		
..	158.470	Precast PSC I-Girder	Wall Type Pier and Abutment	Pile	3x25.0	2x14.5

Table 2.7(b): List of Minor Bridges

S. No.	Design Chainage (Km)	Proposed Structure Type			Proposed Span Arrangement (m)	Total Width (m)
		Type of Superstructure	Type of Substructure	Type of Foundation		
1	148.433	Precast RCC I-Girder	Wall Type Pier and Abutment	Open	2x15	2x14.5
2	149.640	Precast RCC I-Girder	Wall Type Abutment	Open	1x15	2x14.5
3	150.611	Precast RCC I-Girder	Wall Type Abutment	Open	1x15	2x14.5
4	155.360	RCC Box	RCC Box	RCC Box	1x10	2x14.5
5	156.370	Precast RCC I-Girder	Wall Type Abutment	Open	1x15	2x14.5
6	157.760	Precast RCC I-Girder	Wall Type Pier and Abutment	Open	2x16	2x14.5
7	158.350	Precast PSC I-Girder	Wall Type Abutment	Pile	1x25	2x14.5
8	162.627	Precast RCC I-Girder	Wall Type Abutment	Open	1x15	2x14.5
9	164.710	Precast RCC I-Girder	Wall Type Abutment	Open	1x15	2x14.5
10	165.000	Precast RCC I-Girder	Wall Type Pier and Abutment	Open	2x15	2x14.5
11	173.380	Precast RCC I-Girder	Wall Type Pier and Abutment	Open	2x16	2x14.5
12	179.200	Precast RCC I-Girder	Wall Type Abutment	Pile	1x20	2x14.5

Source: Final Feasibility Report

Table 2.8: Location of Overpasses

S. No.	Design Chainage (Km)	Span Arrangement (m)	Vertical Clearance (m)	Remarks (NH/SH/MDR/ Other Road)
1.	149.270	2x23.5	5.5	Other Road (Earthen Road)

Table 2.9: Location of RUB

S. No.	Design Chainage (Km)	Span Arrangement (m)
1	**154.503**	**1x12+2x20+1x12**

Table 2.10: Location of Culverts

S.No.	Design Chainage (km.)	Type	Span (no x m)
1	144+410	Box Culvert	2 X 2
2	145+028	Box Culvert	3 X 2.5
3	145+458	Box Culvert	3 X 2.5
4	146+090	Box Culvert	3 X 2.5
5	147+500	Box Culvert	2 X 2

S.No.	Design Chainage (km.)	Type	Span (no x m)
6	147+620	Box Culvert	2 X 2
7	148+955	Box Culvert	2 X 2
8	150+890	Box Culvert	3 X 2.5
9	151+415	Box Culvert	2 X 2
10	151+620	Box Culvert	2 X 2
11	152+250	Box Culvert	2 X 2
12	152+910	Box Culvert	2 X 2
13	153+380	Box Culvert	2 X 2
14	155+670	Box Culvert	2 X 2
15	157+170	Box Culvert	2 X 2
16	159+095	Box Culvert	3 X 2.5
17	159+480	Box Culvert	2 X 2
18	160+775	Box Culvert	5 X 2.5
19	161+280	Box Culvert	2 X 2
20	161+574	Box Culvert	2 X 2
21	161+780	Box Culvert	2 X 2
22	162+314	Box Culvert	3 X 2.5
23	163+445	Box Culvert	2 X 2
24	163+820	Box Culvert	2 X 2
25	164+430	Box Culvert	3 X 2.5
26	166+290	Box Culvert	3 X 2.5
27	166+765	Box Culvert	2 X 2
28	167+228	Box Culvert	2 X 2
29	167+625	Box Culvert	2 X 2
30	168+643	Box Culvert	2 X 2
31	168+905	Box Culvert	2 X 2
32	169+370	Box Culvert	3 X 2.5
33	170+140	Box Culvert	2 X 2
34	170+790	Box Culvert	2 X 2
35	171+380	Box Culvert	2 X 2
36	171+565	Box Culvert	3 X 2.5
37	171+570	Box Culvert	3 X 2.5
38	173+740	Box Culvert	2 X 2
39	174+320	Box Culvert	2 X 2
40	174+770	Box Culvert	3 X 2.5
41	174+905	Box Culvert	3 X 2.5
42	175+945	Box Culvert	3 X 2.5
43	176+632	Box Culvert	2 X 2
44	177+710	Box Culvert	3 X 2.5
45	178+437	Box Culvert	2 X 2
46	179+609	Box Culvert	2 X 2

Table 2.11: Location of Ponds

S.No.	Taluka	Village	Design Chainage	Survey Number	Affected Area
1.	Denkanikottai	Biramangalam	150+700	842	3.5908
2.		Madhagondapalli	140+800	273	0.3778
3.		Peddamadhagondapalli	138+850	179/1	0.2490
4.				179/2	0.5431
5.	Hosur	Moranapalli	161+200	655/1	1.6583
6.				767	0.6250
7.				768/2	0.0700
8.		Nandhimangalam	169+400	201 & 202	1.0615
9.		S. Mudhuganapalli	145+000	54	0.1684

Source: Final Feasibility Report

2.5 TRAFFIC

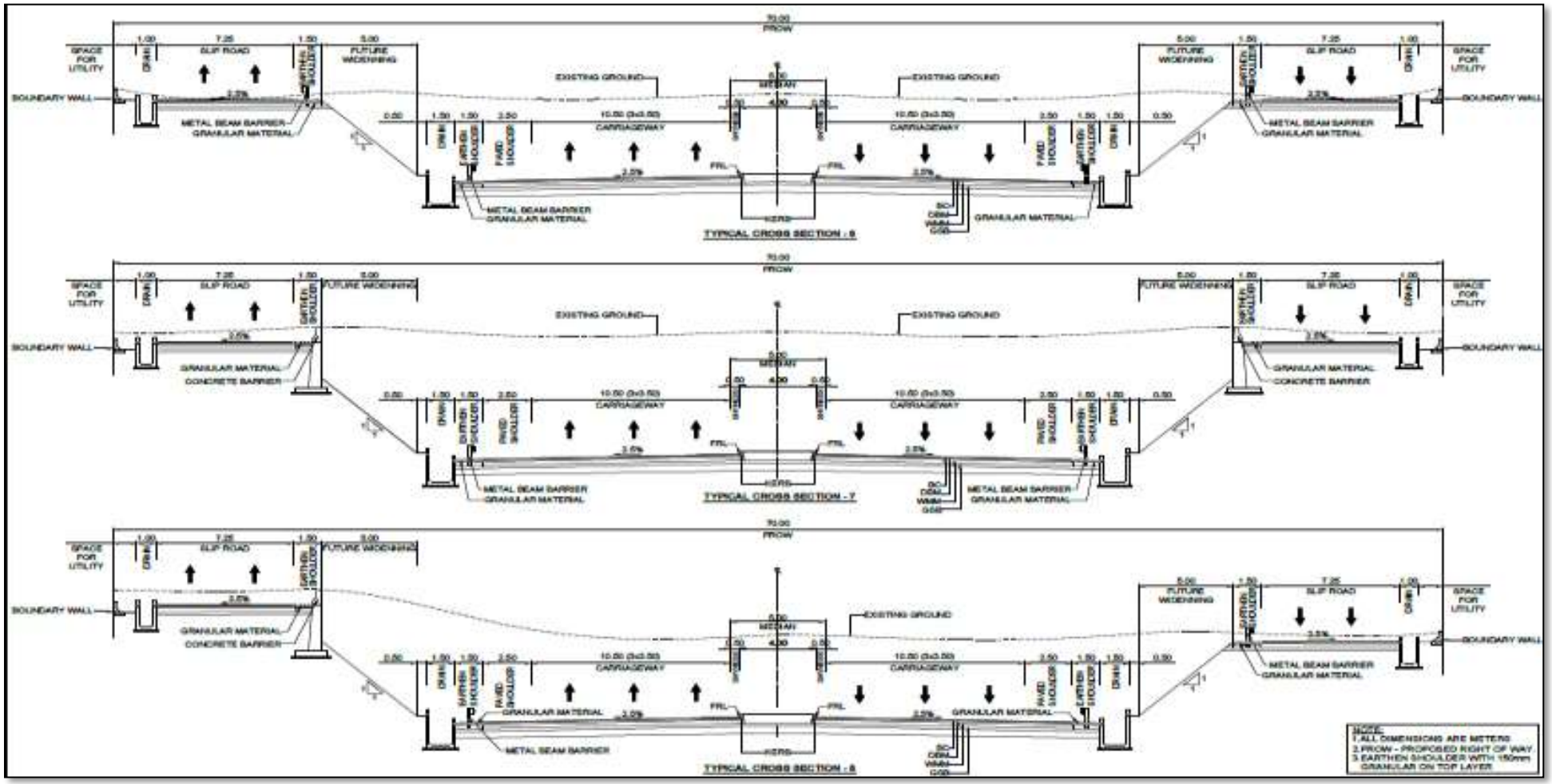
The traffic survey was conducted for the baseline traffic for the proposed road. The future traffic projection was carried out based on future growth factor in the study area. The traffic was projected for year 2030, 2040 and 2050. The projected traffic volume is given in **Table-2.12.**

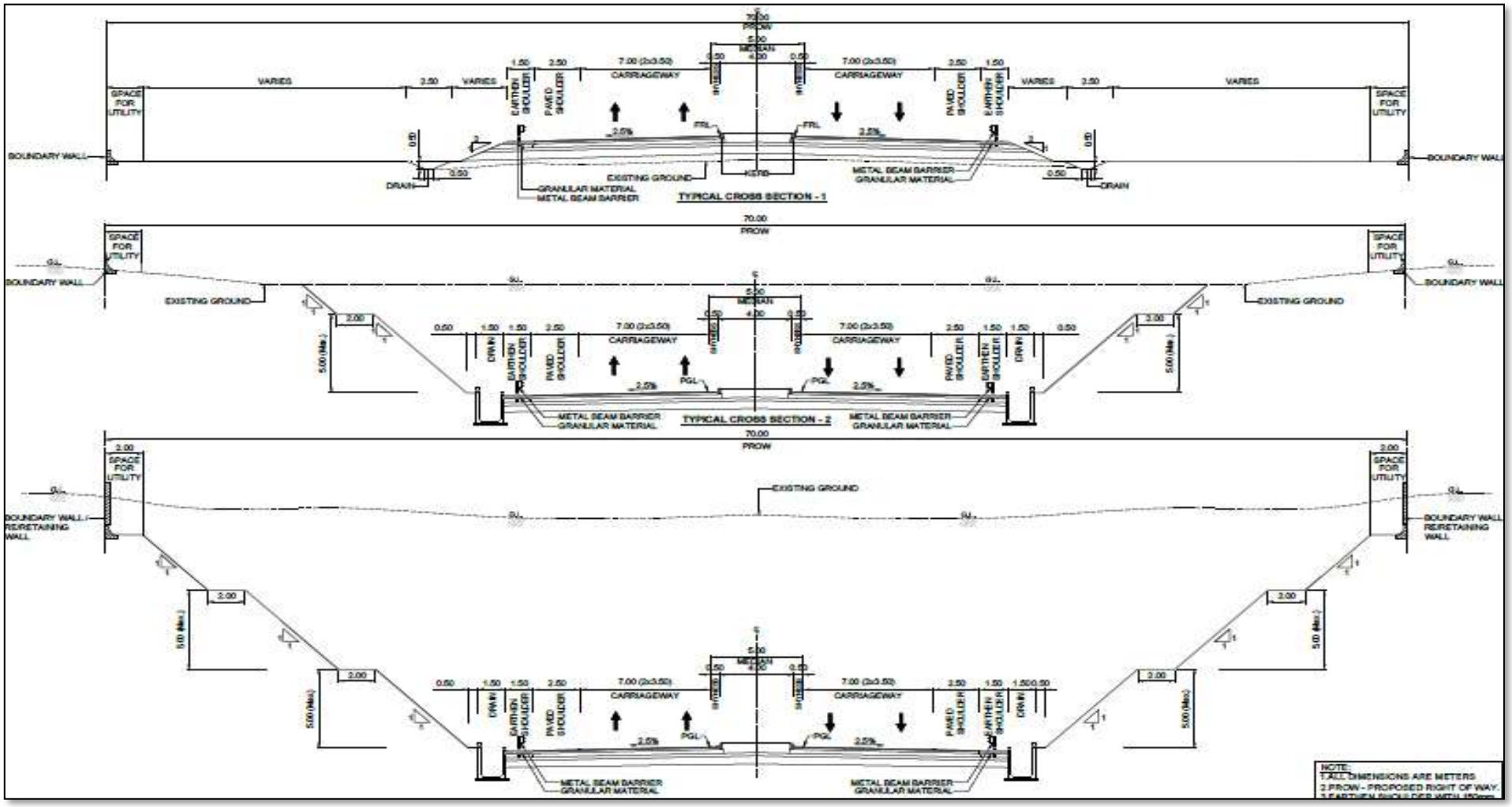
Table 2.12: Projected Traffic

Year	Car	Mini Bus	Bus	LCV	2 AT	3 AT	MAV	2W	3W	Total
2018 (Baseline Traffic)	3631	50	**341**	**488**	332	201	241	4572	234	10091
2030	22919	244	**1670**	**3849**	1253	760	1180	26983	1528	60386
2040	57616	523	3584	11691	2073	1257	2421	68213	4222	151601
2050	140931	1097	7518	32207	3278	1988	4655	167762	11326	370762

2.6 PROPOSED CARRIAGEWAY CONFIGURATION AND CROSS SECTIONS

The proposed road shall be developed with 6 lane divided carriageway as per drawings enclosed in **Figure 2.2.**





Source: Final Feasibility Report

Figure 2.1: Typical Cross Sections adopted for the project road.

2.7 CONSTRUCTION MATERIAL

Fly Ash shall be used to the minimum extent of 30% of total fill material for the embankment. The fly ash shall conform to IRC SP: 58-2001. TCS of Embankment with Fly ash is given in **Figure 2.2.** The material and quantity is given in **Table-2.13**.

Table 2.13: Construction Material Requirement

S. No	Item	Quantity	Source
1.	Aggregate	13.88 Lakh Cum	Identified Quarries
2.	Earth	63.82 Lakh Cum	Identified Borrow Areas
3.	Sand	4.75 Lakh Cum	Identified Sand Quarries
4.	Cement	1.17 Lakh Tonnes	Identified nearest Cement Factory
5.	Bitumen	0.22 Lakh Tonnes	Approved Refinery
6.	Steel	0.29 Tonnes	Identified Steel Plants
7.	Water	130 KLD (Approx.)	Ground / Surface Water
8.	Fly Ash	593434 Cum	Nearby Thermal Power Stations

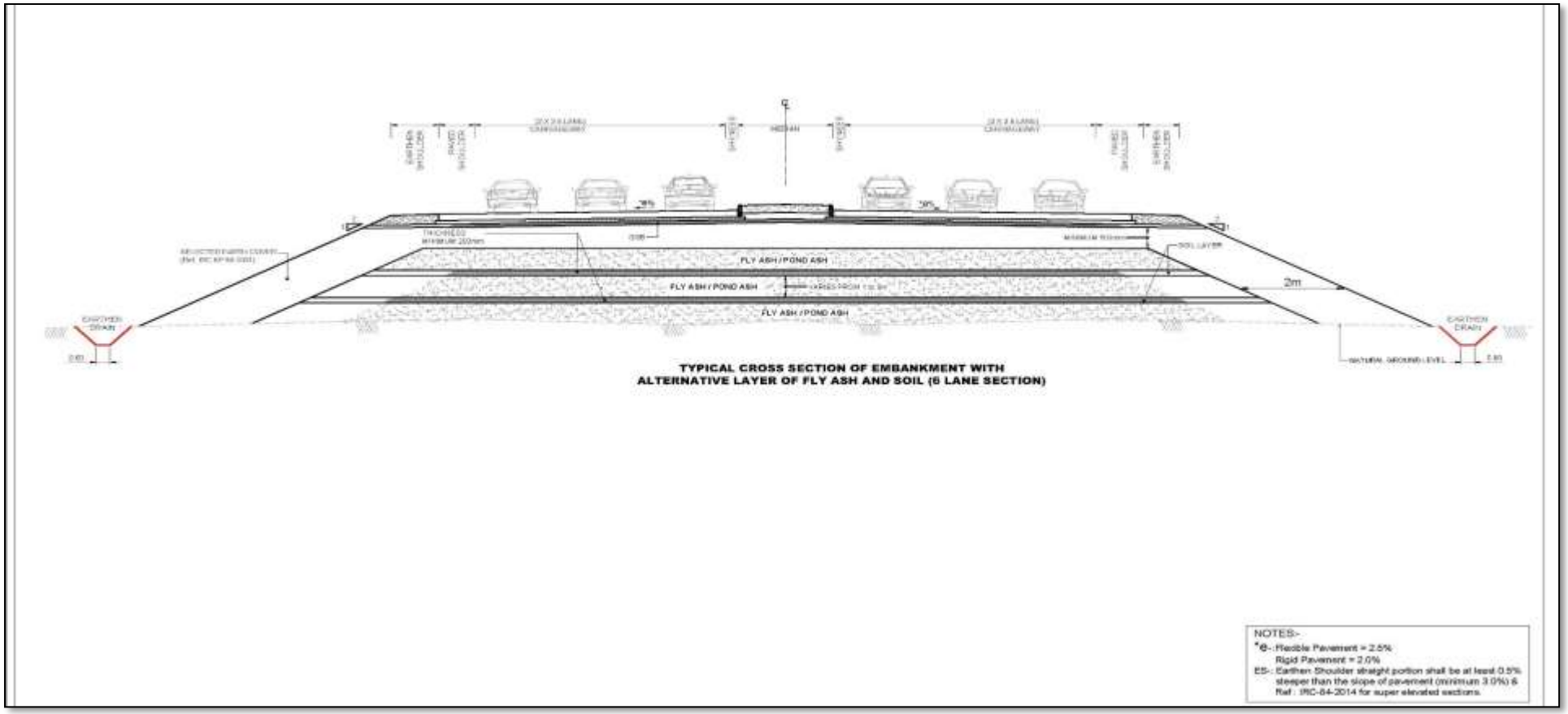


Figure 2.2: Typical Cross Section of Embankment with Fly ash

2.8 DESIGN PARAMETERS

2.8.1 Parameters

The design parameter adopted for structure are as below.

- The width of structure as per required IRC standards shall be follow**.**
- Vertical clearances of 5.50m is provided for vehicular underpasses (VUP)
- Bridges across the canals have been design to clear the width of such canals as well as road/ cart/ rock alongside by a single span.
- Earthquake loads shall be calculated as per IRC-6 of bridge code, section-II. Project is located in seismic zone II.

2.8.2 Road Side Safety Measures

2.8.2.1 Guard Rail / Concrete Barriers

Where the embankment height is more than 3m, Metal Crash Barriers (Guard Rails)/ Concrete Barriers have been provided all along the Highway. The design of the safety barriers will be in conformity with the guidelines and type design of the MORTH.

The safety barrier of rigid, flexible, or semi rigid type in accordance with MORTH guidelines/ circulars shall be provide at following locations

- Where height of embankment is 3m or more
- Where embankment is retained by a retaining structure
- Where median is depressed, flushed or having the width less than 4.5m, the barriers shall be for both direction of travel
- On valley side of highway in mountainous and steep terrain
- Between main carriageway and footpath in bridges.
- At hazardous locations identified in schedule B or through safety audit
- Guard post shall be provided on either side of the carriageway, at location where embankment height varies between 2 to 3m as per design standards.

2.8.2.2 Lighting

Lighting have been proposed all along including High Masts and all interchanges, Toll Plaza, Amenity and Truck Parking areas conforming to norms, specifications and other requirements in accordance with provision of IRC: SP: 87-2013.

2.8.3 Median Plantation

Raised median being provide to separate the two carriageways, will have plantation as per MORTH guidelines to cutoff the glare from vehicles coming from opposite direction thereby enhancing the traffic safety.

2.8.4 Fencing

- Fences of greenfield roads are integral to the facility placed within the PROW to help enforce observance of the acquired access rights besides human, animal conflict with fast moving vehicles
- Access control extends to the limits of the legal access control on the ramps terminals along

the ramp to the beginning of the taper on the local road.

- Fencing shall be standard chain link type or of similar suitable arrangement as per standards.
- The fencing will be placed at the end of PROW on Both Side and to separate the service road from Highway.

2.8.5 Landscaping and Arboriculture

A proper landscape has been proposed to be provided along the alignment, especially in the new alignment, toll plaza areas, rest and services areas to fit in with the surroundings for pleasing appearance, reducing headlight glare and adverse environmental effects such as air pollution, noise pollution and visual intrusion.

The proposal for landscaping includes the following:

- Treatment of embankment slopes as per standards depending upon soil type involved.
- Turfing of slopes of high embankment for controlling rain and wind erosion
- Planting of low height shrubs on medians for reducing glare effect and visual intrusion.
- Grading of ground between the embankment toe and PROW and provision of surface drain along the ROW. This will help in physical delineation of the PROW and avoid encroachment at later date.

2.8.6 Highway Landscaping

Trees shall be planted in the PROW on either side of the road, at suitable locations with staggered pitch as per IRC: SP-21: 2009. The choice of the trees shall also made as per the same code. Local, indigenous species that grow in the project area microclimate shall be planted. Indicative arrangements for plantation of trees shall be in accordance with the MORTH Technical Circular No. *NHI-41 (34)/69 dated*. A spacing of 10-15m c/c recommended for spacing of trees parallel to the roads. Setback distance of trees needed in different situations shall be as per the IRC: SP: 21-2009 and the IRC: 66-1976.

For safe traffic operation, vertical clearance between the crown of the carriageway and lowest part of the overhang of the tree available across the roadway shall conform to the standard laid down in IRC: SP: 21: 2009. The pit size, fencing watering and manuring requirements shall also conform to the above standard. Planting shall be such that it does not obstruct the visibility of traffic from any side and shall be pleasing in appearance.

2.8.7 Land Requirement

The land requirement for construction of the road is estimated to be 348.29 ha. The details will be determined once the LA plan and Land Acquisition Report will be prepared as part of Social Impact Assessment (SIA) study taking into consideration the total households and structures to be affected.

2.8.8 Traffic Signs and Pavement Markings

Traffic signs and pavement markings shall include roadside signs, overhead signs; curb mounted signs and road marking along the Project Highway. The design and marking for the Project Highway shall as per the design standard indicated in “Manual of Specifications and Standards for Six-laning of National Highways through Public Private Partnership” and the location for various treatments shall finalized in consultation with the Independent Engineer.

The road signs erected on the project road shall conform to IRC: 67 “Code of Practice for Road Signs”. For overhead signs, the MoRT&H Standards shall be followed. The variable message signs shall provide as per guidelines vide IRC: SP: 85-2010.

The overhead sign shall be the reflector type with high intensity retro-reflective sheeting conforming to ASTM D 4956-01, Type VIII and/or Type IX of micro prismatic type. The retro reflective sheet of Engineering Grade shall not be used. The height, lateral clearance, location and instillation shall be as per relevant clauses of MORT&H specifications. Overhead sign shall be installed ahead of major intersections/flyovers, toll plazas and urban areas as per detailed design requirements. The minimum number of overhead signs shall be 2 per major junctions.

Road marking shall be as per IRC: 35. These markings shall applied to read centerline, edge lines, continuity line, stop line, give way lines, diagonal/chevron marking, and Zebra crossing etc.

2.8.9 Road Furniture

Road furniture such as traffic signs, kilometer posts, hectometer stones, ROW pillars etc. shall be provided as per relevant IRC SP 84 specifications.

2.8.10 Boundary Stones

Road land (ROW) boundary shall be demarcated by putting RCC boundary pillars of size 60cm x 15cm x 15cm embedded in concrete (as per IRC:25) along the Project Highway at 50 m interval on both sides. All the components used in delineating road land boundary shall be aesthetically pleasing, sturdy and vandal proof. The road land boundary shall be demarcated in consultation with NHAI.

2.8.11 Hectometer/Kilometer Stones

The hectometer and kilometer stones shall provide as per MORTH specifications.

2.8.12 Traffic Blinker Signal (L.E.D) at Intersections

Traffic blinker signal (L.E.D) shall be provided at all at-grade intersections and median openings/Median gap-in as per the design standards.

2.8.13 Crash Barriers

Crash barriers shall provide at desired location as per IRC SP 84.

2.8.14 Highways Encroachment

An encroachment is any object placed without permission within the legal limits of a highway right-of-way or in any way interfere with the land within the limit of a highway or the roadway or any structure forming a part of the highways. These include hording signs, fences, walls and lights, squatters and hats/market of agricultural produce on the side of road.

Objects are generally not permitted in the right-of-way, unless the objects serve an official highway purpose instances as public utility electric poles, mailboxes, telephone line.

2.8.14.1 Prevention and Removal of Encroachment

The control of encroachment is essential for mainly public safety and legal liability.

Encroachment of highway right of way thought the squatters, market of agricultural produce, illegal hording signs etc. may interfere with a driver's view of other traffic, official traffic signs, and traffic signals. Moreover, accidents may result. If a motorist collides with an illegally placed object, the owner of the object and the authority may be used for the resulting injuries or damages. Moreover, it needs legal actions to clear the site from the squatters if they finally established.

2.9 PROJECT BENEFITS

This is a proposed project is a new alignment with 6-lane highway for capacity argumentation of transportation need. Therefore, project will also have considerable benefit in terms of Environmental Benefit in the region as whole, economic benefit/fuel saving, social benefit and thus by national benefits.

2.10 WATER REQUIREMENT

Acquisition and management of water for construction is an issue that must addressed by the contractor. The Contractor expected to obtain water for construction purposes that is of a high-water quality. The total water requirement during construction and operation phase and wastewater generated during project cycle is given in **Table-2.14.**

Table 2.14: Water Requirement and wastewater generated (L/Day)

Sr. No	Water Requirement	Remarks
Construction Phase for construction	1131839	The water will be used for curing and construction purpose. No wastewater generation.
Construction Phase for Workers and labor camp	157680	Approximately 2628 persons will work during construction phase of the project and use water 60 LPD. The wastewater will be 80% of the total water used.
Opeartion Phase	2760	Approximately 23 persons will be employed for maintenance and use water 120 LPD

2.11 COST ESTIMATES

The estimated civil cost of the project will be approx. INR 756.68 Crores.

CHAPTER-3: ENVIRONMENT BASELINE DATA

3.1 INTRODUCTION

In order to assess environmental impacts due to the proposed project, it is essential to monitor the environmental quality prevailing at the project site and its surrounding areas prior to implementation of the project. Previous chapters have highlighted scope of environmental assessment, existing features of the proposed road, methodology and regulations applicable to environmental assessment. In this chapter, an attempt has been made to prepare a baseline environmental setting of the project area.

The parameters of environmental impact can be identified by elaborating the various aspects of environment which can be divided as:

(i) Physical aspect which include topography, geological aspects, soil characteristics, etc.;

(ii) Drainage aspect which includes water environment i.e. surface water and groundwater condition

(iii) Meteorological aspects which includes the air environment and micro-climatic factors including the air quality

(iv) Biological aspect including the type of flora and fauna; and lastly (v) socio-economic aspects relating to demographic and socio-economic conditions of the population around the project site.

(v) Socio-economic aspects relating to demographic and socio-economic conditions of the population around the project site.

Based on the existing environmental scenario potential impacts of proposed road will be identified and accordingly management plan will be proposed in subsequent sections. The baseline environmental conditions will help in comparing and to monitor the predicted negative and positive impacts resulting from the project during construction and operation phases.

Data was collected from secondary sources for the macro-environmental setting like climate, physiography (Geology and slope), biological and socio-economic environment. First-hand information have been collected to record the micro-environmental features within and adjacent to the project corridor. Collection of first hand (Primary) information includes preparation of base maps, extrapolating environmental features on proposed road design, tree inventories, location and measurement of socio-cultural features abutting proposed road. Data was collected at sites requiring for extraction of materials for construction but generally outside the project corridor e.g. borrows areas and quarries. Ambient air, Noise, Soil, and Water quality samples were collected at important locations in terms of environment quality to prepare a baseline database.

Following sections describe the nature, type and characteristics of the physical, biological, cultural and socio-economic components along the project road.

3.2 STUDY AREA AND PERIOD

As a primary requirement of EIA process, the direct influence area has been taken as the proposed RoW (70m) of the project road. Primary baseline data has been collected in the right of way as well as the area falling within 500 meters on either side of right of way and secondary data has been collected aerial distance of 10 km on either side of proposed project road. Baseline data of prominent environmental attributes like ambient air, water, soil, geology, water use, hydrology, noise, meteorology, socio-economic features, terrestrial ecology, aquatic ecology, land use etc. was collected. The baseline study for the project was conducted during the June 2018.

3.3 PHYSICAL ENVIRONMENT

Determination of baseline conditions of natural and physical environmental components along project road is vital for robust impact assessment. The project road section passes through Krishnagiri district of Tamil Nadu State. The components of the environment for which the information has been collected are described in the following subsections.

3.3.1 Geography and Topography

'Krishna' refers to 'black' and 'giri' refers to 'hill'. This district is gifted with black granite hillocks and named as "Krishnagiri". The region also came under the rule of Krishna Deva Raya and hence it might have been named after this king. In 2004, the district is carved out of Dharmapuri district as 30th district of Tamil Nadu. Krishnagiri district is located at the northwest corner of Tamil Nadu in between 11º 12'N to 12º 49'N Latitude, 77º 27'E to 78º 38'E Longitude. The district shares the boundaries of Vellore and Thiruvannamalai districts in the East, Bangalore Urban district of Karnataka state in the West, Chittoor district of Andhra Pradesh in the North and Dharmapuri District in the south.

The district forms part of the upland plateau region with many hill ranges and undulating plains. The western part of the district has hill ranges of Mysore plateau with a chain of undulating hills and deep valleys extending in NNE-SSW direction. The South Pennar River irrigates the flatlands.

The climate condition of the district is hot and dry in summer i.e. from March to May. In winter, it is very cold and misty i.e. from November to February. The normal rainfall of the district is 850.7 mm. Different types of the soil such as Black or mixed loamy red ferocious and gravel having high fertility due to its mixture absorbing character is found in the district. Red soils are observed in project are a near Hosur, Thally. In general, the soil in the district is quite loose and fresh with its colors from red to dark brown. The soil has low nitrogen and phosphate content with marked variation between different taluks. The major types of forest seen here are tropical, deciduous forests, thorny shrubs and bamboo forest. Dense forest cover is there in few part of Denkanikottai region. The other region contains shrubs, hills and hillocks with bushes.

The project road section of STRR (NH-948A) passes mainly through rolling terrain while few stretches passes through plain terrain.

The start and end Geo-coordinates of project road section are shown in **Table 3.1.**

Table 3-1: Geo-Coordinates (Longitude and Latitude) of the Project Road

Start/End	Design Chainage (km)	Section of the Project road of STRR (NH-948 A)	
		Latitude	Longitude
Start	140.000	12°38'8.07"N	77°44'28.16"E
End	179.969	12°52'16.64"N	77°53'22.8

Location Map of the project road is given in **Figure 3.1**

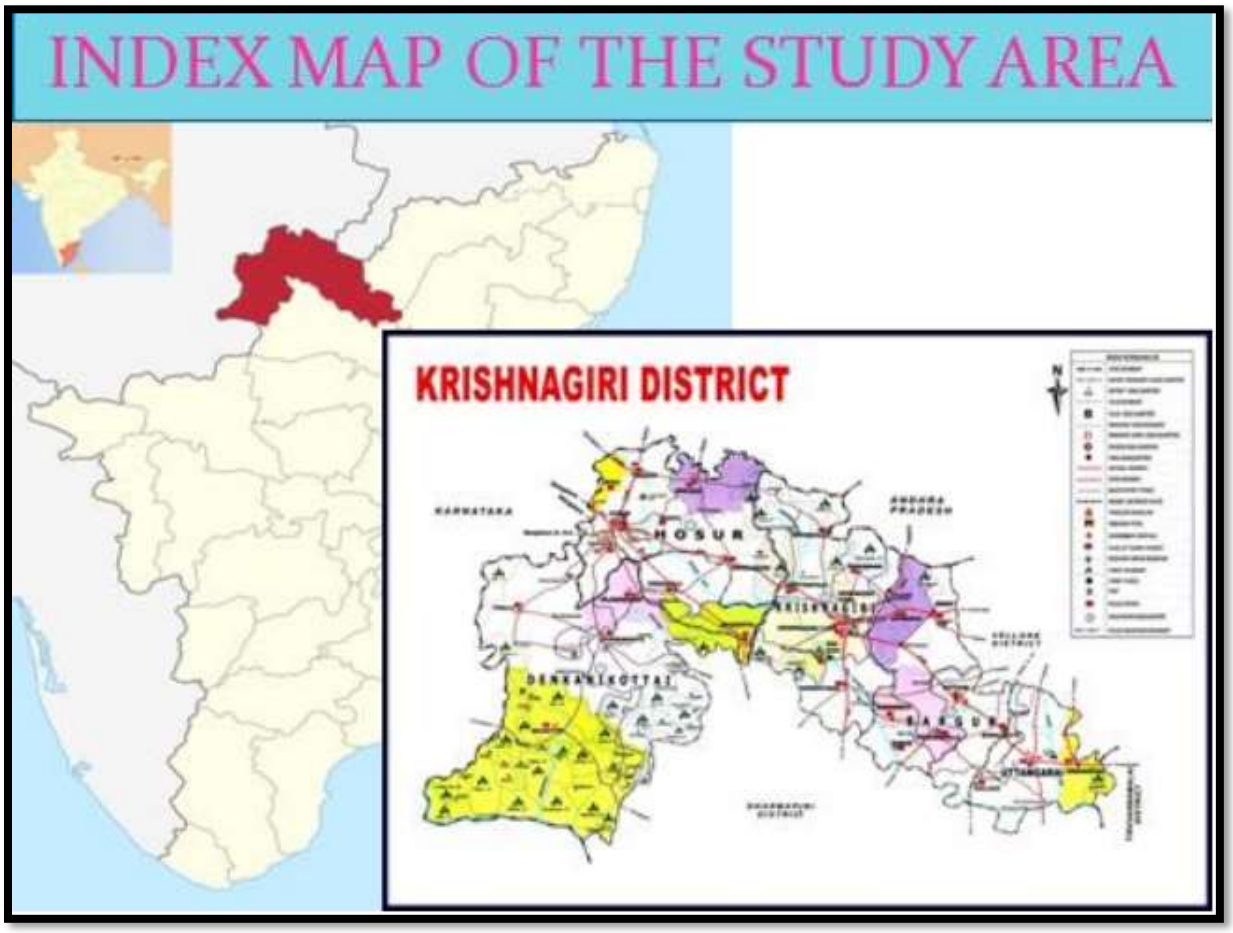
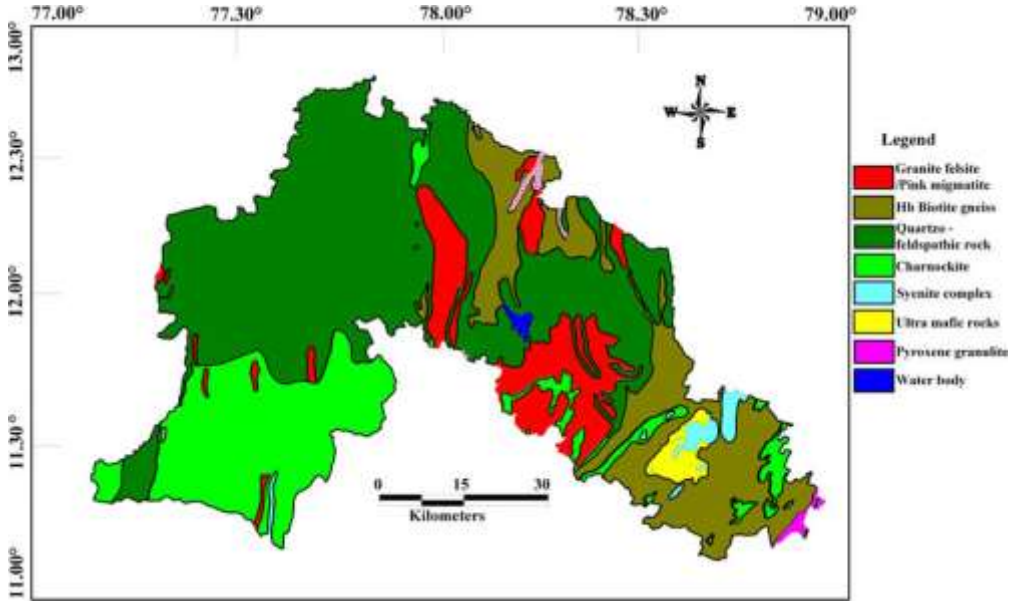


Figure 3.1: Location Map of the Project Road

3.3.2 Geology

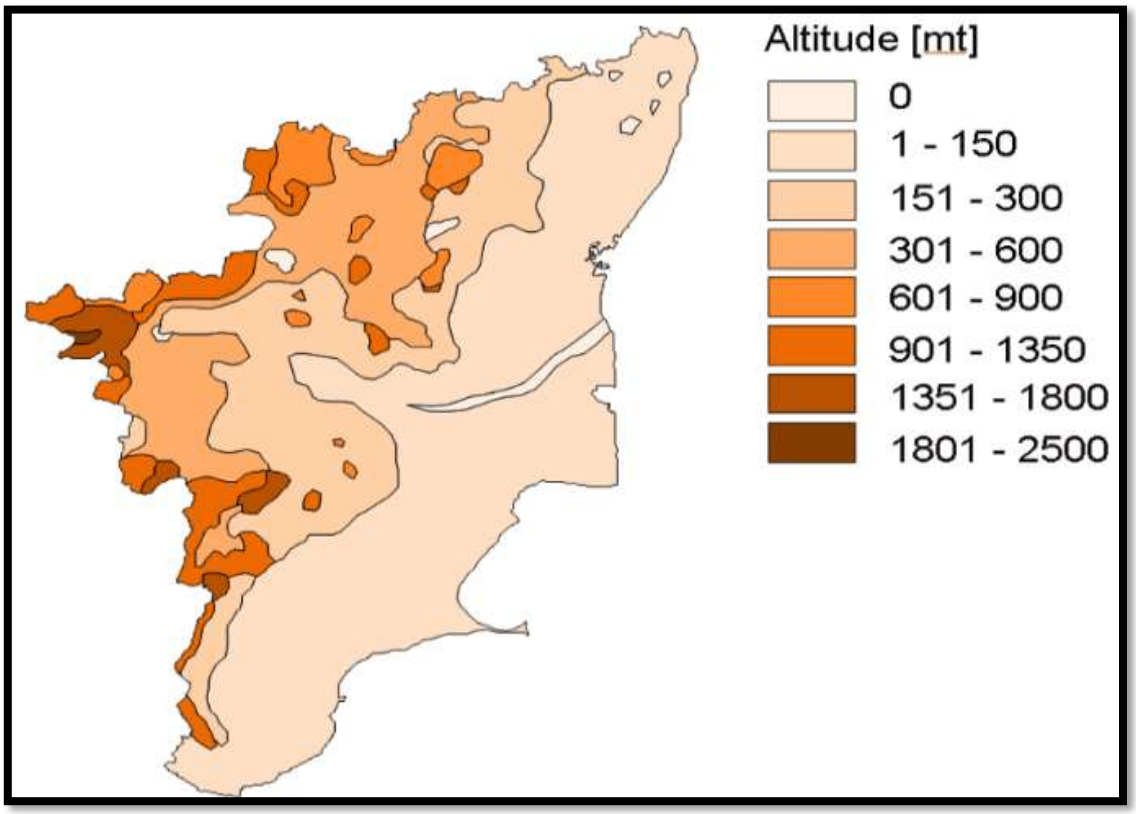
The geological formation of Krishnagiri district underlained by Archaean crystalline formations with recent alluvial deposits of limited area extent and thickness along the courses of major rivers. Granite, Charnockite, Pegmatite, Gneissic Rocks are found largely found in Krishnagiri. The prevailing rock of these districts is a light to dark-gray or whitish biotic granite gneiss, which varies considerably from place to place, in texture, structure and appearance, according to the fitness or coarseness of its constituent grains and the relative abundance or scarcity, and mode of deposition of the darker Ferro-minerals. These complex Gneissic masses have been styled as “Peninsular Gneiss”. The Geological map of project district showing project road sections of NH-948A is presented in **Figure 3.2.**



Source: https://www.researchgate.net/figure/Geology-map-of-the-study-area_fig5_257785893

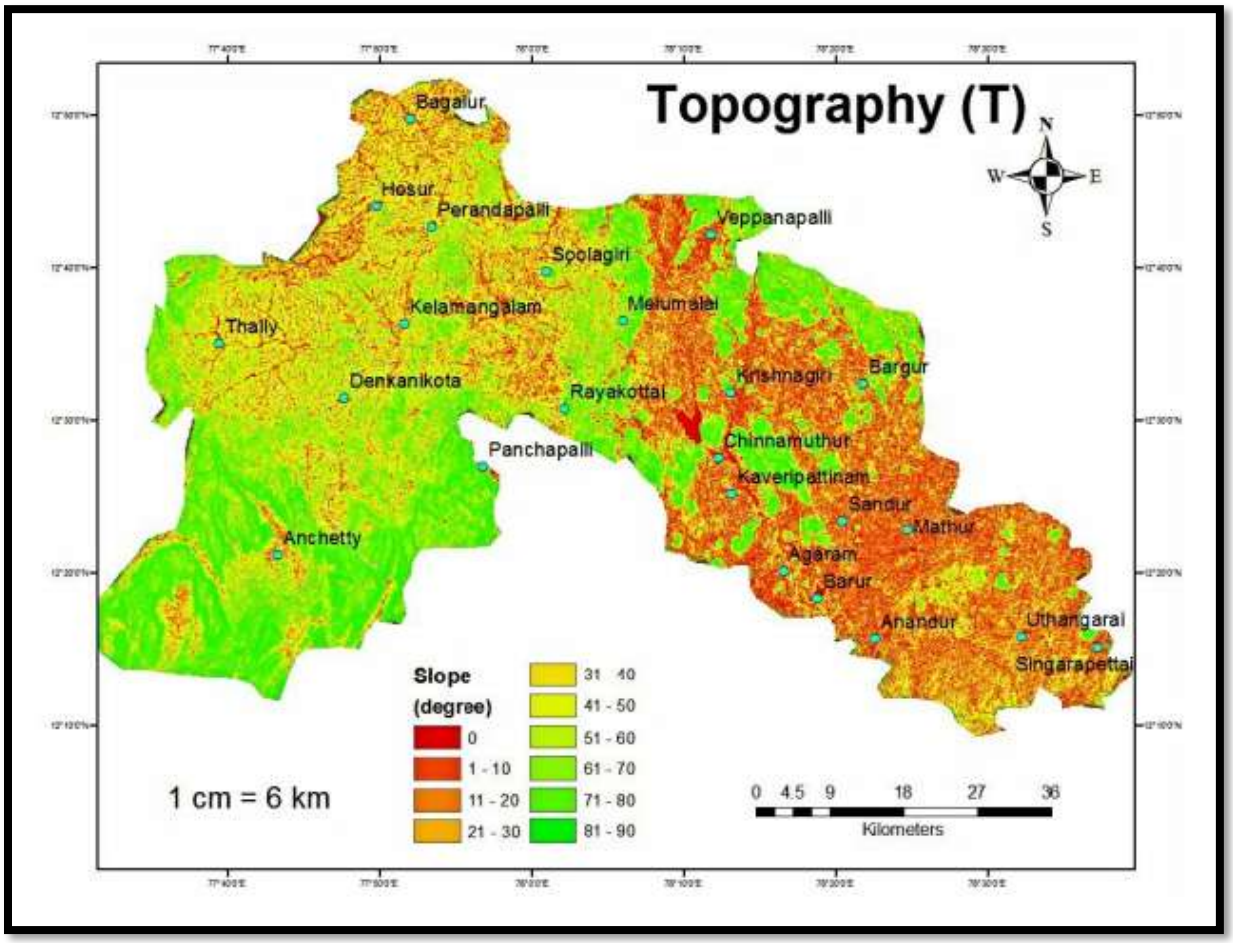
Figure 3.2: Geological Map of Krishnagiri District

The slope map of Tamil Nadu and project district showing project road sections of STRR (NH-948A) are presented in **Figure 3.3 and 3.4.**



Source: Mapsofnet.com

Figure 3.3: Slope Map of Tamil Nadu State



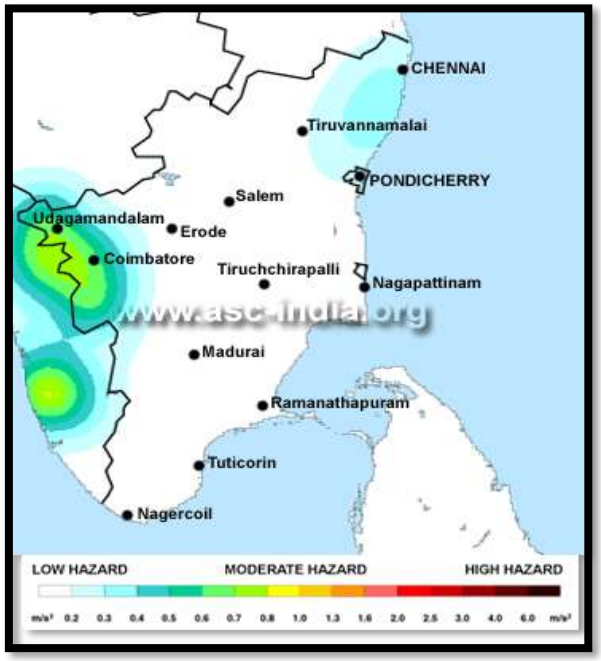
Source: International Journal of Innovative Research in Science, Engineering and Technology, Vol 3, Issue 3, March 2014

Figure 3.4: Slope Map of Krishnagiri District

As observed from above figure, land slope along the majority of project road section of NH-948A lies in low and rolling slope zone.

3.3.3 Seismicity

According to the Global Seismic Hazards Assessment Program (GSHAP) data, the state of Tamil Nadu falls in a region of low seismic hazard **(Figure 3.5).** As observed from figure, the entire project stretch falls in low hazard zone. In addition, as per the seismic zoning map of India (2014), the project stretch falls in Zone II, which is least active to moderate in, nature **(Figure 3.6).**



Source: http://mapsofindia.com

Figure 3.5 Seismic Zone Map of India, 2014

Figure 3.6: Global Seismic Hazards Assessment Program Map of Tamil Nadu

3.3.4 Land Use

3.3.4.1 Land Use Pattern of the District

The land use pattern of the district (**Table 3.2**) shows that forest area occupied a maximum percentage, nearly 40 percent, while the net-cropped area followed with 35 percent. The other types of land uses occupy a minimum percentage as less than 10 percent for each category. The land under non-agricultural uses (8.2 percent) is causing a concern, as the growth of these activities will reduce the agricultural growth in the district. The current fallow and barren lands occupying 8 percent of area can be reduced considerably by encouraging mango garden plantations. Meanwhile, the productivity of the crops has to be increased to compensate the reduction in land under agriculture by adopting modern practices and high yielding hybrid varieties.

Table 3-2: Land Use Pattern of Krishnagiri District

Sr No	Land Use Classification	2014-15	
	Particulars	**Area(ha)**	**Percent**
1	**Reporting Area For Land Utilization Statistics**		
(i)	Forest area	203964	39.7
2	**Not Available for Cultivation**		
(i)	Barren and Uncultivable uses	23937	4.7
(ii)	Land put to Non-Agricultural uses	41923	8.2
3	**Other Uncultivated Land Excluding Fallow Land**		
(i)	Cultivable Waste	4345	0.8
(ii)	Permanent Pastures and Other Grazing Land	7855	1.5
(iii)	Land Under Miscellaneous Tree Crops and Grooves not included in Net Area Sown	8344	1.6
4	**Fallow Land**		
(i)	Current Fallows	28909	5.6

Sr No	Land Use Classification	2014-15	
(ii)	Other Fallows Land	14147	2.8
5	**Net Area Sown**	180902	35.2
	Total Geographical Area	514326	100.0

Source: Key socio-economic data of Krishnagiri district, Tamil Nadu district fact book, 2018

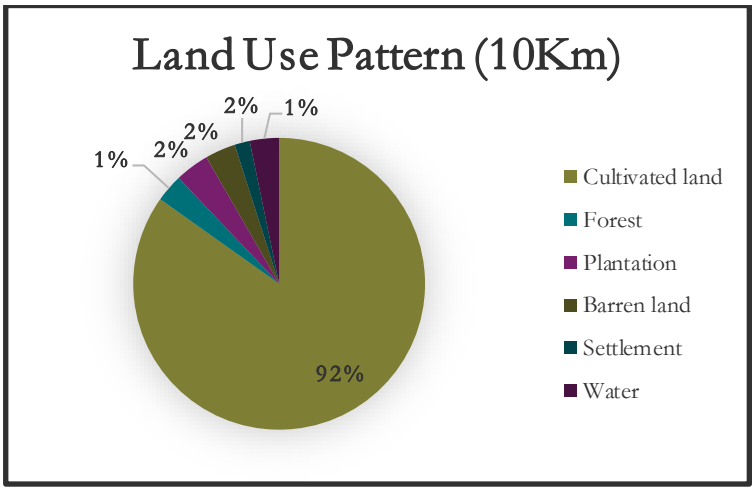
3.3.4.2 Land Use within 10km buffer length along the proposed alignment

The land use map for a buffer length of 10 km on either side of the proposed alignment of NH-948A has been prepared and shown in **Map: Land Use** shows the main land covers including Agriculture (92%), forest (1%), plantations (2%), settlements (1%), barren-land (2%), water bodies (2%) and other important physical features. The land use area of project area is given in **Table-3.3**.

Table 3.3: Land Use Pattern of the study area

Type of Land	% occupied	Area (Ha)
Cultivated	92%	106591.6572
Barren Land	2%	2317.20994
Plantation	2%	2317.20994
Forest	1%	1158.60497
Settlement	1%	1158.60497
Water	2%	2317.20994
Total	**100%**	**115860.497**

Figure 3.7 shows the percentage breakup of the different land covers within 10km buffer of proposal road.

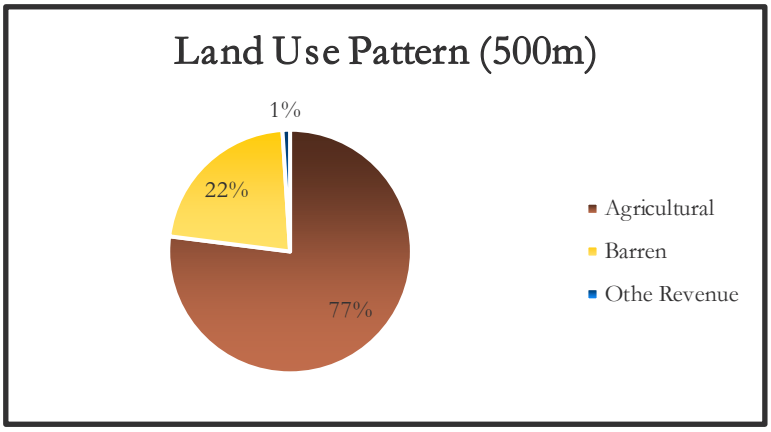


Source: Survey of India Topo sheet, Government of India

Figure 3.7: Percentage distribution of land use along within 10km buffer

3.3.4.3 Land Use along the proposed alignment (500m on either side)

The land use along the proposed road in Krishnagiri district (Tamil Nadu) is mostly agrarian (92%) except for small stretches of built up areas (1%) and barren land (2%). As the project is a Greenfield alignment, emphasis is given to avoid major built-up area and forest stretches. The land use pattern along the project road is given in **Figure 3.8.**



Source: Survey of India Topo sheet, Government of India

Figure 3.8: Percentage distribution of land use within 500m buffer

3.3.5 Soil

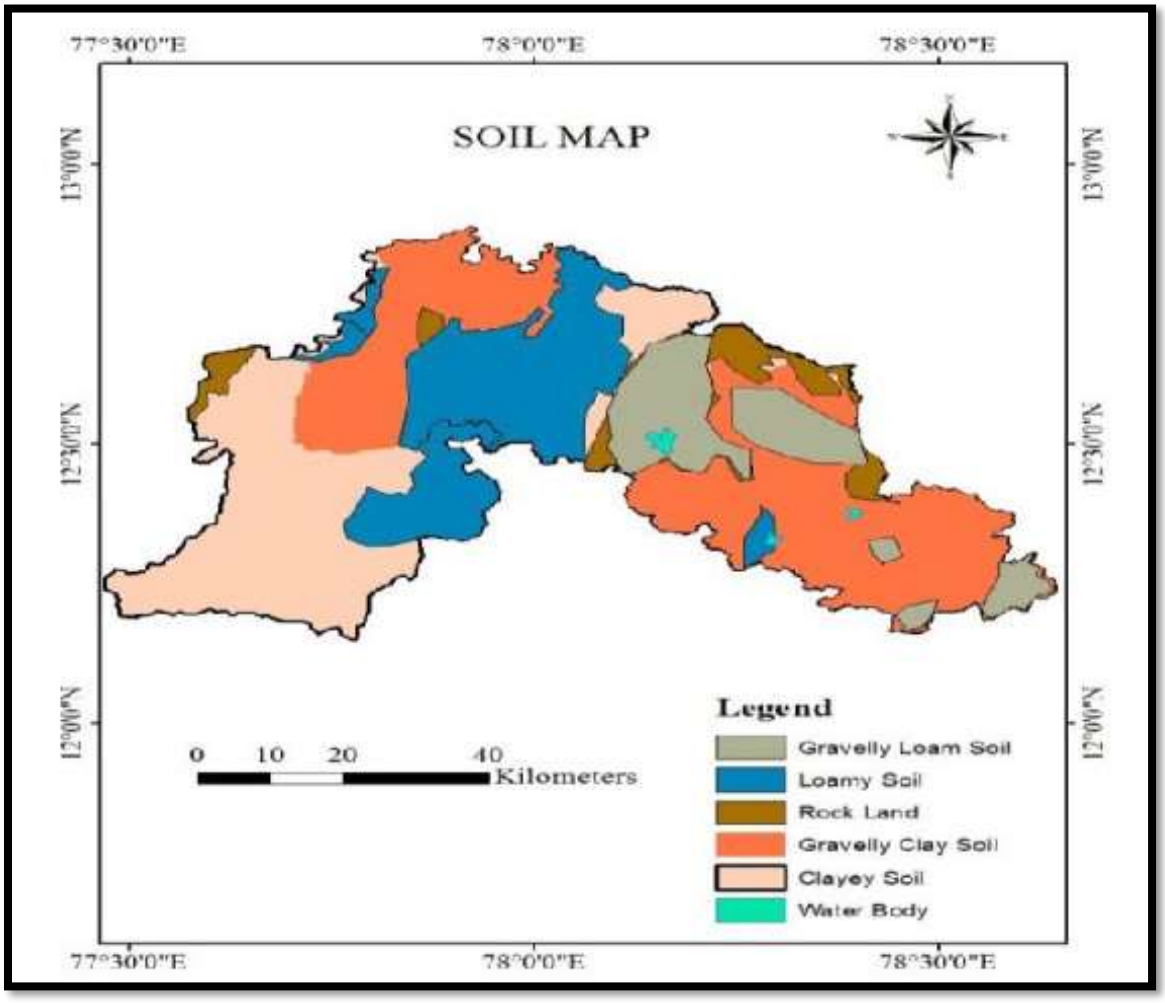
Life of the project is directly linked with condition and quality of soil. The success or failure of a pavement is more often dependent upon the underlying subgrade strength upon which the pavement structure is constructed. Soil formation is a typical process, influenced by several factors: climate, organisms, relief, parent materials and time. It plays an important role in the regulation of vegetation cover, therefore, changes in the soil types, texture and properties, and is one of the causes for gradual variation in the forest types and composition along the belt.

In Tamil Nadu, soils are classified into 6 orders, 12 sub-orders, 20 great groups, 44 subgroups and 94 soil families in the hierarchy. The six orders are Entisols, Inceptisols, Alfisols, Mollisols, Ultisols, Vertisols. Inceptisols cover about 50% of the State's total geographical area followed by Alfisols (30%), Vertisols (7%), Entisols (6%), Ultisols (1%) and negligible area by Mollisols. About 5% of the areas are miscellaneous land types, which includes rocklands, marshes, urban areas and water bodies.

Different types of the soils such as black or mixed loamy, red and gravel are found in the district Krishnagiri. The Black of rigor loam is very fertile due to its moisture absorbing character. Red soils are observed in Hosur, Shoolagiri, Thally and Kelamangalam. In general, the soil in the district is quite loose and fresh with its colour from red to dark brown. The soil has low nitrogen and phosphate content with marked variation between different taluks.

Coarse textured red sandy loam (Typic Ustorthent)	80 per cent
Laterite	10 per cent
Black and other soil types	10 per cent

There are six types of soil series in the Project district, which is provided in **Figure 3.9.**



Source: CRIDA, Central Research Institute for dryland agriculture

Figure 3.9: Soils Map of Krishnagiri District

As observed from **Figure 3.9** the soil along the proposed alignment of NH948A is of alfisols category comprising of mainly red loamy soil.

3.3.5.1 Soil Quality

For studying soil quality, sampling locations ware selected to assess the existing soil conditions in and around the project area representing various land use conditions. The samples were collected by ramming a core-cutter into the soil. The details of soil sampling locations are provided in **Table 3.4** and presented in **Map Soil Sampling Location**. The collected samples were analyzed for physical and chemical characteristics. Field photographs taken during soil sample collection are provided in **Figures 3.10 and Figure 3.11.**

Table 3-4: Description of Soil Sampling Locations

S. No.	Sample Code	Sampling Location	GPS Coordinates	Sensitivity indicator	Type of Source
1	SQ1	km. 158.500 near to Thorapalli Agraharam Village	12°41'1632.2762"N 77°8853'1326.4798 "E	Ponniyyar River	Agriculture
2	SQ2	km.171.500 near to Attur village	12°48'9.98"N 77°54'20.28"E	Village near project site	Agriculture

Figure 3.10: Field photographs taken during soil sample collection in Thorapalli Agraharam Village

Figure 3.11: Field photographs taken during soil sample collection in Attur Village

3.3.5.2 Analysis Methodology

The samples of Soil were collected in the month of July 2018 in the study period. The physical and chemical characteristics of the soil of the study area have been assessed by analysing various parameters as per the methods described in "Soil Chemical Analysis" (M.L Jackson) and Department of Agriculture and Cooperation. Standard classification of Soil as per Indian Council of Agriculture Research, New Delhi is presented in **Table 3.5.**

Table 3-5: Standard Classification of Soil

Sl. No.	Soil Test	Classification
1	pH	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.0 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline 9.01 very strongly alkaline
2	Salinity Electrical Conductivity (mmhos/cm) (1 ppm = 640 mmho/cm)	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)
3	Organic Carbon	Upto 0.2: very less 0.21-0.4: less 0.41-0.5 medium, 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient
4	Nitrogen (Kg/ha)	Upto 50 very less 51-100 less 101-150 good 151-300 Better >300 sufficient
5	Phosphorus (Kg/ha)	Upto 15 very less 16-30 less 31-50 medium, 51-65 on an average sufficient 66-80 sufficient >80 more than sufficient
6	Potash (Kg/ha)	0 -120 very less 120-180 less 181-240 medium 241-300 average 301-360 better >360 more than sufficient

3.3.5.3 Results Analysis:

The analytical results for both the locations are provided in **Table 3.6**. As evident from the results the pH values of soils are in the range of 7.10 to 8.13. The soil type varies from loamy to silty loam. The nutrient status of soil is also a key element in agriculture. Above results also show that the soils of the study area have good amount of primary nutrients i.e., Nitrogen (N), Phosphorus (P) and Potassium (K) content. From the results, it can be observed that the soil in the project area is fertile with high agricultural productivity with appropriate use of fertilizer.

Table 3-6: Analytical results of Soil sampling of the study area

S. No	Parameters	Unit	SQ1	SQ2
	pH	-	8.13	7.10
	Electrical Conductivity	µs/cm	169.6	61.6
	Sand	Percent	68.96	68.96

S. No	Parameters	Unit	SQ1	SQ2
	Silt	Percent	17.28	19.28
	Clay	Percent	13.76	11.76
	Texture	-	Sandy Loam	Sandy Loam
	Moisture Retention Capacity	Percent	23.99	24.55
	Moisture Content	Percent	9.72	2.60
	Organic Matter	Percent	0.62	0.82
	Available Nitrogen	kg/ha	242.69	252.69
	Available Potassium	kg/ha	62.72	67.2
	Available Phosphorus	kg/ha	123.72	164.96
	Sulphate	mg/100gm	10.48	23.29
	Sodium Sulphate as NA	mg/100gm	2.29	2.06
	Calcium	meq/L	25.9	10.3
	Oil & Grease	mg/kg	BDL	BDL
	Magnesium	meq/L	1.3	1.3
	Sodium Absorption Ratio	-	0.27	0.37

Source: Baseline data collected by consultant

3.3.6 Air Environment

Ambient air quality is the most significant parameter that is required to quantify the impact on the natural and biophysical environment. The air quality of the project area is influenced by emissions from stationery sources like domestic sources from various settlements, agricultural activities, and industrial activities and from mobile sources such as vehicles plying on the road. The prime objective of baseline air quality survey was to assess the existing air quality of the area. This will also be useful for assessing the conformity to the standards of the ambient air quality. Degradation of ambient air quality is the most commonly identified adverse impact on the natural and biophysical environment during the construction and operation of the road projects. As a part of the Environmental Assessment (EA), climatic component has been studied to establish the benchmarks to understand air quality in the project influence area.

3.3.6.1 Meteorology and Climate

a) Climate

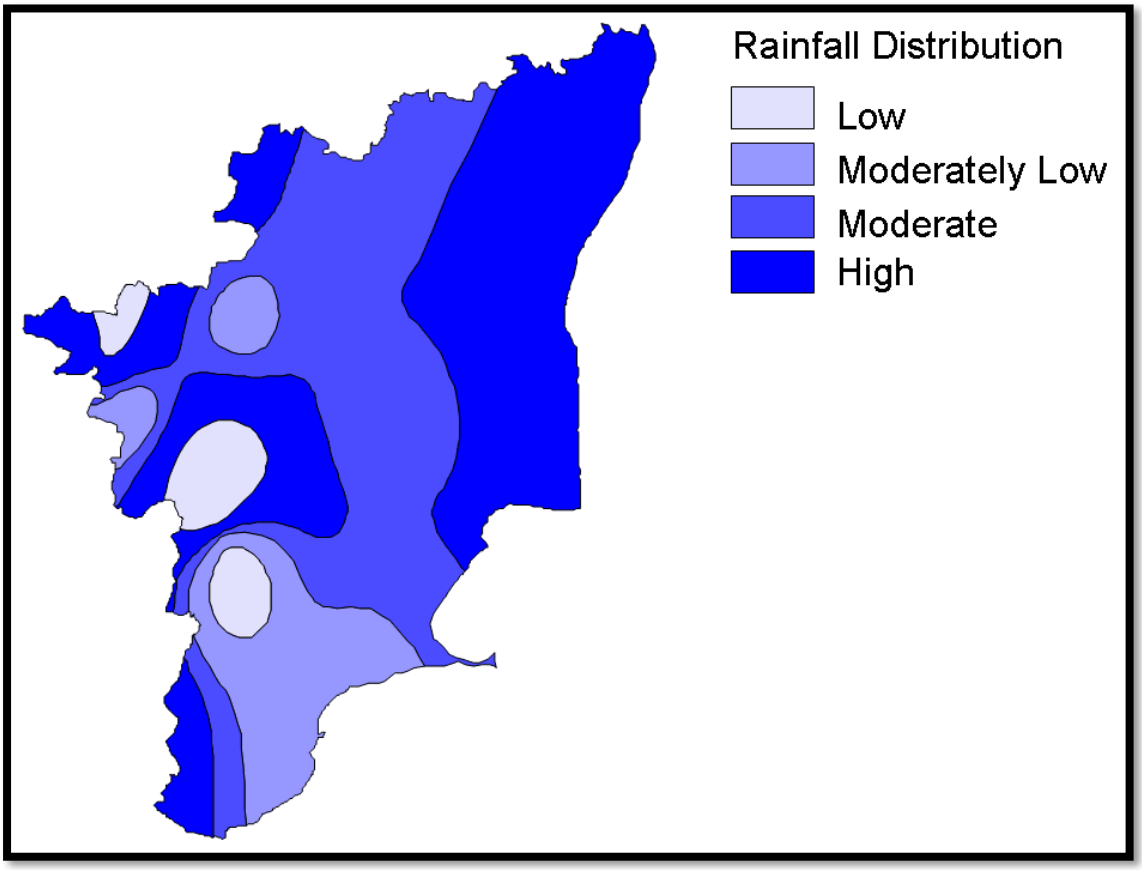
Among all other physical factors, Climate is the most important factor-influencing environment because it plays a vital role in determining the evolution of landforms (erosion, soil characteristics), types of flora and fauna (ecological diversity), the productivity of ecosystems as well it has an influence on the pollution loads on the environment. Rainfall, temperature, and winds are the principal climatic components that serve to transport and disperse various forms of pollution into the atmosphere and on the ground.

The climate of the project influence area (PIA) is tropical, with distinct wet and dry seasons. The climate may be classified into four distinct seasons: winter (January – February), summer (March – May), southwest monsoons (June – September) and northeast monsoon (October – December).

The various climatic factors such as rainfall, temperature, and humidity in the project area have been discussed in detail in the following sections.

b) Rainfall

In the State of Tamil Nadu, the project region is located in moderate to moderately low rainfall receiving region. The rainfall distribution map for the State of Tamil Nadu presented in **Figure 3.12** highlights this aspect very clearly.



Source: http://mapsof.net

Figure 3.12: Rainfall Distribution in the State of Tamil Nadu

The district receives the rain under the influence of both Southwest and Northeast monsoons. July - November is Rainy Season and between December - February winter prevails. The annual rainfall over the district varies from about 750 to about 900 mm. It is the minimum around Hosur (767.7 mm) and Rayakottai (768 mm) in the northern and central parts of the district. It gradually increases towards west and east and is the maximum around Denkanikotai (910.7 mm) in the western part.

The actual rainfall in Krishnagiri district for the last five years (2013-17) as provided by the Hydro-met division of the India Meteorological Department is given in **Table 3.7.**

Table 3-7: Rainfall for Krishnagiri District (mm) for last five years (2013-17)

Month	Rainfall for Krishnagiri District				
	2013	**2014**	**2015**	**2016**	**2017**
January	0	0	-	0.2	5.7
February	7.2	1.7	-	0	0
March	1.2	7.7	-	1.9	48.7
April	39.1	6.5	-	3.8	37.9
May	105.1	189.6	-	144.4	198.6
June	47.2	8	-	87	19.1
July	22.4	39.6	-	185.5	24.6
August	95.7	71.1	-	49.1	189.7
September	212.9	84.8	-	5.2	291.7
October	143.6	213.1	-	34.7	219.0
November	83.7	33.5	-	8.5	54.5
December	7.9	32.9	-	76.9	56.2
Total	**766**	**688.5**	**-**	**597.2**	**1145.7**

Source: CRIS, Hydromet Division, Indian Metrological Department

The thirty years (1981 to 2010) actual average rainfall data from Indian Meteorological Department in Krishnagiri are given below in **Table 3.8.** The past thirty-year rainfall depicts that the project area receives rainfall between 910.4 mm. About 76 percent of the total rainfall is concentrated during the months of July to November.

Table 3-8: Actual Average Rainfall in Krishnagiri (1981-2010)

Month	Rainfall (mm)
	Krishnagiri (Earlier Part of Dharmapuri District)
January	5
February	3.8
March	22.5
April	44.2
May	96.7
June	70
July	75.6
August	105.5
September	170.5
October	181.5
November	93.8
December	41.5
Thirty-year Annual Average	**910.4**

Source: Climatological Normals (1981-2010) published by IMD, Government of India

c) Temperature

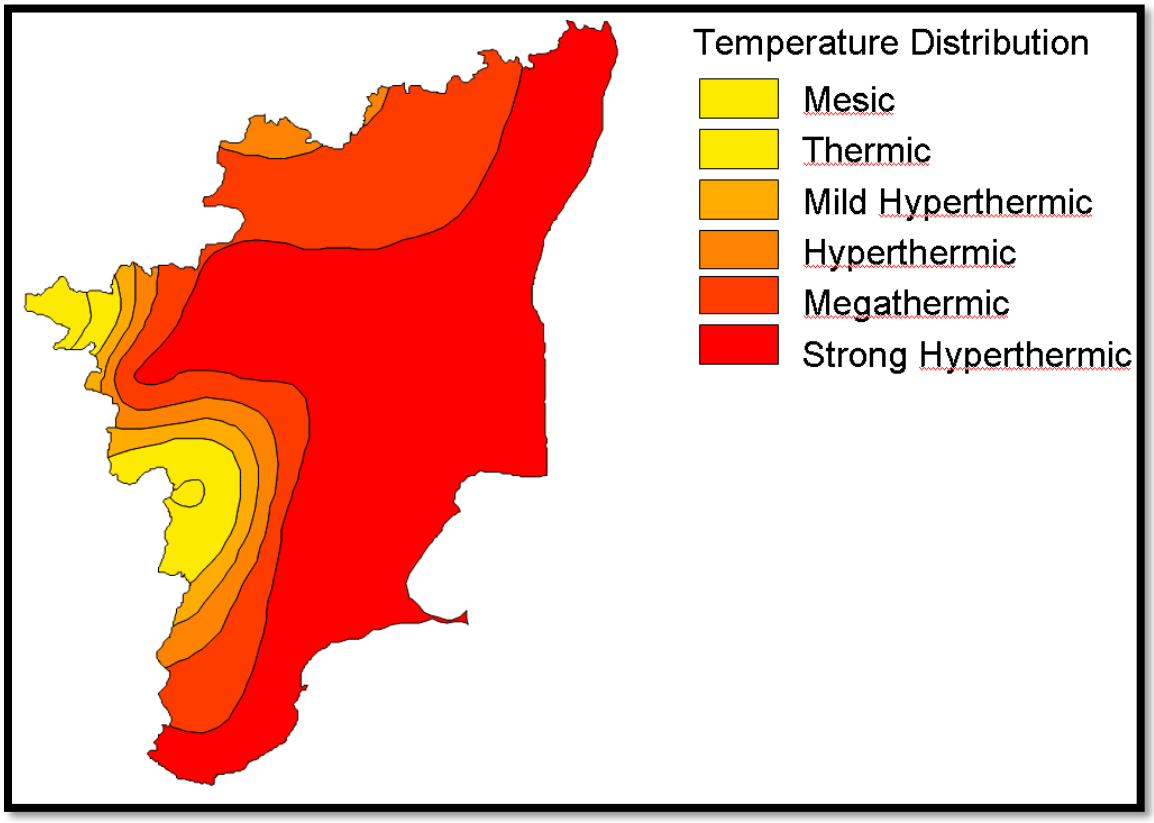
In the state of Tamil Nadu, maximum temperature varies between 25^{0}C to 37 ^{0}C. The minimum temperature in the state varies near 25 ^{0}C to 19 ^{0}C. Krishnagiri district is generally dry. The monthly mean maximum and minimum temperatures of Krishnagiri Observatories (IMD data -1981 to 2010) are presented in **Table 3.9.** The maximum and minimum temperatures were observed in May and January months respectively. In Krishnagiri, during summer season (April to May) the maximum temperature is about 37°C, and the mean daily minimum temperature of about 25°C in the plains. There is a gradual decrease of both day and night temperatures from June onwards till December, when the mean daily maximum temperature is about 30°C and the mean daily min. is about 19°C in plains.. The day temperature increases gradually from January onwards. The lowest temperature is reached in January when the mean daily minimum is about 19°C. However, in higher areas i.e., Hosur, Thally and Krishnagiri taluks day and night temperature are lower by about 2 to 3°C. In these areas weather is comparatively pleasant round the year

Table 3-9: Monthly Mean Maximum and Minimum Temperature in ^{0}C (1981-2010)

Month	Krishnagiri (Earlier Part of Dharmapuri District)	
	Highest in the Month	Lowest in the Month
January	32.3	13.9
February	35.5	14.7
March	38.1	16.7
April	39.4	20.4
May	39.6	21.2
June	37.4	21.6
July	36.7	21.5
August	35.8	21.1
September	35.1	20.6
October	33.3	19.4
November	31.6	16
December	30.6	14.2

Source: Climatological Normals (1981-2010) published by IMD, Government of India

Project alignment falls in hyperthermic to mega thermic zone as per temperature distribution map of Tamil Nadu State **is given in Figure 3.12a.**



Source: http://mapsof.net

Figure 3.12a: Temperature Distribution map of Tamil Nadu State

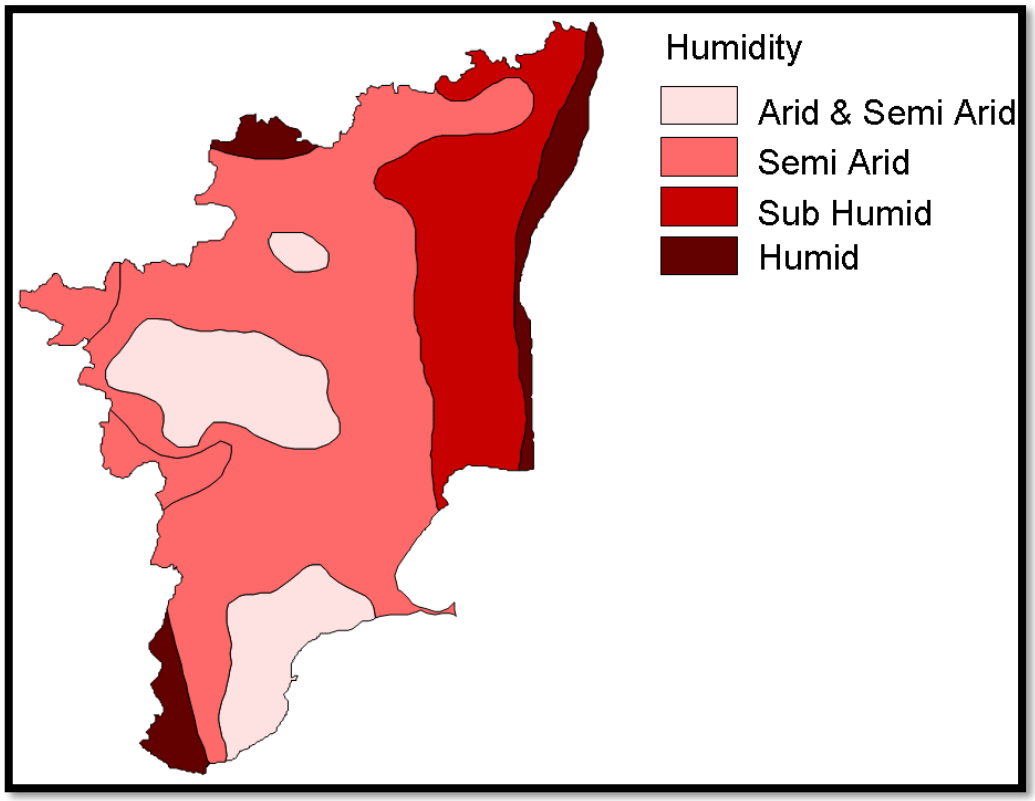
d) Humidity

Based on IMD observations the relative humidity for Krishnagiri district is shown below in **Table 3.10**. It can be observed that project region experiences high humidity during months of October, November and December. Lowest humidity is experienced in the months of March and April. The average relative humidity in Krishnagiri district varies between 48.5% and 73%. Humid to Sub-humid conditions are observed in the project region. Humidity map of Tamil Nadu State is shown in **Figure 3.13.**

Table 3-10: Relative Humidity based on 1981-2010 Observations

Month	Relative Humidity (%)		
	Krishnagiri (Earlier Part of Dharmapuri District)		
	I	II	Average Total
January	78	50	64
February	71	39	55
March	65	32	48.5
April	65	38	51.5
May	64	46	55
June	65	51	58
July	67	54	60.5
August	69	55	62
September	73	60	66.5
October	78	68	73

Month	Relative Humidity (%)		
	Krishnagiri (Earlier Part of Dharmapuri District)		
	I	II	Average Total
November	79	67	73
December	80	60	70
Thirty year Annual Average	**71**	**52**	**61.5**



Source: Climatological Normals (1981-2010) published by IMD, Government of India
Source: http://mapsof.net

Figure 3.13: Humidity map of Tamil Nadu State

e) Wind Speed and Direction

Wind speed and wind directions have a significant role on the dispersion of atmospheric pollutants and therefore, the air quality of the area. Ground level concentrations for the pollutants are inversely proportional to the wind speed in the down wind direction, while in upwind direction no effect will be observed and in cross wind directions partial effect due to the emission sources is observed.

Based on thirty-year climatologically data (1981-2010) the mean wind speed for Krishnagiri district is shown in **Table 3.11.** Mean wind speeds are observed to be highest in the months of June and August at Dharmapuri (7.2 -7.9 Kmph) observatories. The lowest wind speed was observed in the month of October (4.2 Kmph) at Dharmapuri.

Table 3-11: Mean Wind Speed in Krishnagiri district based on 1981-2010 Observations

Month	Mean Wind Speed (Kmph)
	Krishnagiri (Earlier Part of Dharmapuri District)
January	5.7
February	5.3
March	4.9
April	4.8
May	5.8
June	7.9
July	7.6
August	7.2
September	5.1
October	4.2
November	4.7
December	5.5
Thirty year Annual Average	**5.7**

Source: Climatological Normals (1981-2010) published by IMD, Government of India

f) Meteorological data collected at project site

The observations on meteorological parameters were recorded continuously during the month of June 2018 from 11/6/2018 to 28/06/2018. The Meteorological Station was kept free from obstruction to free flow of wind. Meteorological observations on hourly basis were recorded to measure the data of temperature, relative humidity, wind speed, wind direction and rainfall by using meteorological data collection instrument. Summary of primary meteorological data observed at project site are given in **Table 3.12**. The meteorological data procured for environmental impact assessment study for the month of June 2018 is **Appendix 3.2**. Also, the annual wind rose of the project area is shown in figure below, it is clearly evident that predominant wind direction is from west side of the project area.

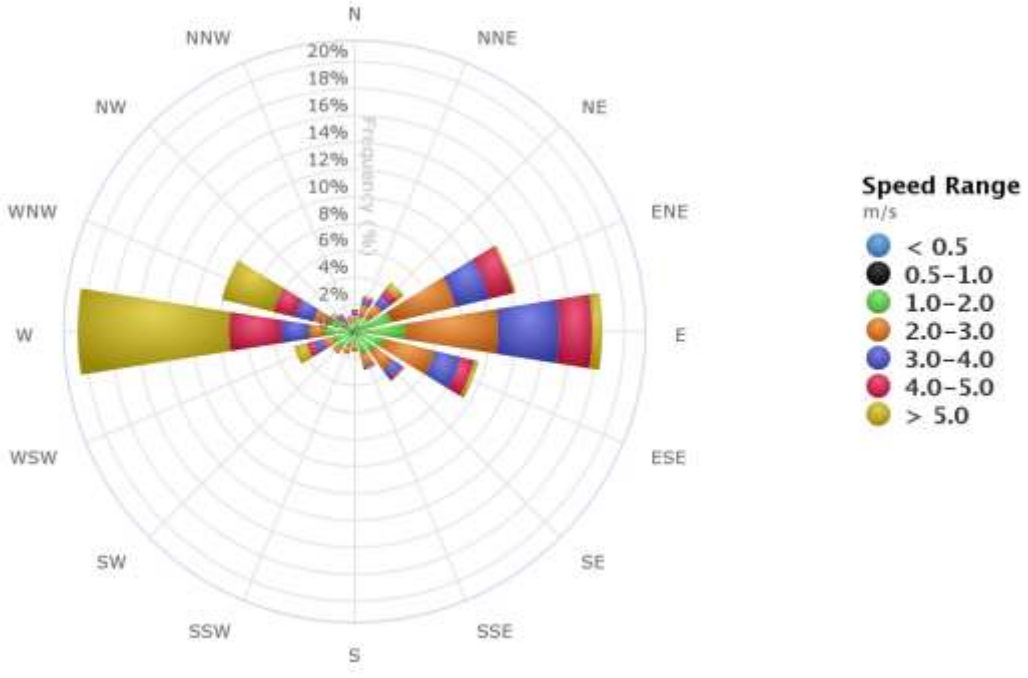


Table 3-12: Summary of Primary Meteorological Data

Location Name	Chainage	Temperature (^{0}C)		Climatic Condition during sampling
		Max.	Min	
Baglur-Berikai Road near Thummanapalli village	174.200	26.0	23.7	Moderate

Source: Primary data collected at site, 2018

3.3.6.2 Ambient Air Quality

Ambient air quality refers to the background air quality levels in a region, characterised by concentrations of various pollutants in the atmosphere. The presence of air pollutants and their concentrations depends on the type of polluting sources, and other factors that influence their flow and dispersion. In most cases vehicular emissions are the predominant source of air pollution. Existing ambient air quality data on various sections of the project corridors was collected to establish a baseline database. The aim was to identify areas that already have high pollution levels or are expected to experience so, because of the proposed road project, and to design adequate mitigation measures, as applicable.

The activities, which modify atmospheric air quality, are transportation (i.e., motor vehicle emissions, which are addressed in this study); industry; domestic and construction. The principal sources of air pollution due to road projects are hot mix plants and machineries used during construction phase and the vehicles that ply over it during the operation phase.

Dispersal of pollutants depends upon factors like prevailing wind direction and other weather conditions, height of the source, and characteristics of roadside plantation and presence of other sinks along the project corridor. The prime objective of baseline air quality survey was to assess the existing air quality of the area. This will also be useful for assessing the conformity to standards of the ambient air quality.

Ambient air quality standards: Govt. of India's Air Pollution Control standards, formulated by MoEF&CC, were set in 1981. The statutory bodies that regulate these standards at the central and state levels are the CPCB and the SPCB, respectively. National Ambient Air Quality Standards (NAAQS) for particulate and gaseous pollutants as laid down by the CPCB in year 2009 are given in **Annexure-NAAQS**

Sample Selection & Monitoring locations

The baseline status of the ambient air quality has been established through a scientifically designed ambient air quality-monitoring network and is based on the following considerations:

- Meteorological conditions prevailing in the area;
- Topography of the study area;
- Representatives of background air quality for obtaining baseline status; and
- Representatives of likely impact areas

Ambient air quality monitoring has been undertaken at five locations with due consideration to the above mentioned points in the months of June 2018. Following parameters have been measured to prepare the baseline condition:

i) Particulate Matter (<PM_{10})

ii) Particulate Matter (<$PM_{2.5}$)

iii) Sulphur dioxide (SO_2)

iv) Nitrogen oxide (NO_x)

v) Carbon monoxide (CO)

The ambient air quality monitoring for winter season (three months) is under progress and the results for the same will be updated on its completion.

Details of the ambient air quality monitoring locations are given in **Table 3.13** and are shown in **Map Ambient Air Quality Monitoring Location**

Table 3-13: Description of Ambient Air Quality Monitoring Locations

Station Code	Location	Project Area/ Study Area	Land Use	Environmental Setting	Co-ordinates of monitoring location
AAQ1	Ch. Km 144+800 at Mathigiri Road (SH-17A) Near Muthuganapalli	Traffic Junction	Buildup area	Residential	12^0 41'54.4"N, 77^0 48' 36.0"E
AAQ2	Ch. Km 152+000 at Attibele-Rayakottai Road (SH-85) Near Agondapalli Village	Residential	Buildup area	Residential	12^0 40' 24.3"N, 77^0 52' 14.3"E
AAQ3	Ch. Km 155+800 at SH-17ANear Omnalvadi Village	Traffic Junction	Buildup area	Commercial	12^0 40' 24.3 "N, 77^0 52' 14.3"E
AAQ4	Ch. Km 161+000 at NH-44(NH-7) Near to the Junction of Moranapallli Village	Junction	Agriculture land	Residential	12^0 43'25.6"N, 77^0 51' 51.9"E
AAQ5	Ch. Km 174+200 at Baglur-Berilai Road Near Thummanapalli Village	Junction	Agriculture land	Residential	12^0 49'17.8"N, 77^0 55' 08.6"E

Monitoring Results

The average on-site twice in a week monitoring results are tabulated in the **Table 3.14**

Table 3-14A: Ambient Air Quality Monitoring
AAQM-1 (Mathigiri Village (SH-17A) Near Mathugunapalli village)

	S.N.	Date	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_2 (µg/m3)	CO (mg/m3)
Week 1	1	16.06.2018	36	6.98	7.04	20.42	0.18
	2	18.06.2018	40	6.98	7.66	18.61	0.22
Week 2	3	19.06.2018	41.6	8.8	7.76	21.27	0.26
	4	20.06.2018	39.6	8.1	7.30	17.63	0.19
Week 3	5	23.06.2018	41.5	10.2	6.97	15.44	0.25
	6	26.06.2018	58.7	11.6	6.55	14.70	0.32
Week 4	7	29.06.2018	56.2	9.7	6.18	16.14	0.31
	8	30.06.2018	51.6	16.3	7.15	15.98	0.40
		Minimum	36	6.98	6.18	14.7	0.18
		Maximum	58.7	16.3	7.76	21.27	0.4
		Average	45.65	9.83	7.08	17.52	0.27
		98 Percentile	58.35	15.64	7.75	21.15	0.39
		NAAQS, 2009	**100**	**60**	**80**	**80**	**2**

Table 3-14B: Ambient Air Quality Monitoring
AAQM-2 (Attibele Rayakotti village Road (SH-85) Near Agondapalli village)

	S.N.	Date	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_2 (µg/m3)	CO (mg/m3)
Week 1	1	16.06.2018	42	13.83	7.51	21.91	0.28
	2	18.06.2018	38.7	10.67	7.56	16.38	0.31
Week 2	3	19.06.2018	52.8	14.5	7.66	22.44	0.32
	4	20.06.2018	44.8	11.5	7.10	15.32	0.27
Week 3	5	23.06.2018	35.2	7.7	7.24	15.05	0.35
	6	26.06.2018	37.5	8.1	6.32	14.61	0.41
Week 4	7	29.06.2018	58.4	11.5	7.75	19.12	0.53
	8	30.06.2018	41.4	7.2	8.72	18.00	0.71
		Minimum	35.20	7.20	6.32	14.61	0.27
		Maximum	58.40	14.50	8.72	22.44	0.71
		Average	43.85	10.63	7.48	17.85	0.40
		98 Percentile	57.62	14.41	8.58	22.37	0.68
		NAAQS, 2009	**100**	**60**	**80**	**80**	**2**

Table 3-14C: Ambient Air Quality Monitoring
AAQM-3 (SH-17 Near Onnalvadi village)

	S.N.	Date	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_2 (µg/m3)	CO (mg/m3)
Week 1	1	16.06.2018	41.6	13.63	8.12	21.06	0.33
	2	18.06.2018	45	11.87	7.92	19.89	0.40
Week 2	3	19.06.2018	67.4	16.7	8.43	22.23	0.50
	4	20.06.2018	48.6	11.8	8.22	16.13	0.46
Week 3	5	23.06.2018	45.2	9.8	8.28	16.08	0.49
	6	26.06.2018	50.8	17.3	7.20	16.37	0.56
Week 4	7	29.06.2018	56.3	13.1	8.03	20.41	0.59
	8	30.06.2018	55.2	8.7	9.00	17.90	0.80
		Minimum	41.6	8.7	7.2	16.08	0.33
		Maximum	67.4	17.3	9	22.23	0.8
		Average	51.26	12.86	8.15	18.76	0.52
		98 Percentile	65.85	17.22	8.92	22.07	0.77
		NAAQS, 2009	**100**	**60**	**80**	**80**	**2**

Table 3-14D: Ambient Air Quality Monitoring
AAQM-4 (NH-44 (NH-7) Near to the junction of Moranapalli village)

	S.N.	Date	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_2 (µg/m3)	CO (mg/m3)
Week 1	1	16.06.2018	57.6	15.33	7.56	20.10	0.42
	2	18.06.2018	51.0	15.03	7.25	16.59	0.35
Week 2	3	19.06.2018	61.2	15.2	7.87	21.91	0.38
	4	20.06.2018	56.7	13.9	7.61	15.12	0.43
Week 3	5	23.06.2018	53.8	12.8	7.40	19.45	0.53
	6	26.06.2018	56.4	14.5	7.47	16.90	0.47
Week 4	7	29.06.2018	65.3	12.1	7.58	15.81	0.62
	8	30.06.2018	68.6	13.1	8.55	18.19	0.59
		Minimum	51	12.1	7.25	15.12	0.35
		Maximum	68.6	15.33	8.55	21.91	0.62
		Average	58.83	14.00	7.66	18.01	0.47
		98 Percentile	68.14	15.31	8.45	21.66	0.62
		NAAQS, 2009	**100**	**60**	**80**	**80**	**2**

Table 3-14E: Ambient Air Quality Monitoring
AAQM-5 (Baglur – Berikai Road Near Thummanapalli village)

	S.N.	Date	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_2 (µg/m3)	CO (mg/m3)
Week 1	1	16.06.2018	54.5	14.80	7.20	22.44	0.23
	2	18.06.2018	58.8	11.93	7.76	20.31	0.37
Week 2	3	19.06.2018	67.1	14.7	7.51	21.59	0.29
	4	20.06.2018	62.6	16.1	8.05	17.18	0.23
Week 3	5	23.06.2018	76.3	20.2	7.93	18.20	0.33
	6	26.06.2018	67.3	19.5	7.10	15.72	0.40
Week 4	7	29.06.2018	69.6	14.6	8.01	17.80	0.37
	8	30.06.2018	63.8	13.2	8.98	17.17	0.30
		Minimum	54.5	11.93	7.1	15.72	0.23
		Maximum	76.3	20.2	8.98	22.44	0.4
		Average	65.00	15.63	7.82	18.80	0.32
		98 Percentile	75.36	20.10	8.85	22.32	0.40
		NAAQS, 2009	**100**	**60**	**80**	**80**	**2**

Source: Baseline data collected by consultant.

Results Analysis

As evident from air quality monitoring result given in **Table-3.14**, the quality of the project area is well with the prescribed limits of CPCB. These low values of air quality parameters near the vicinity of the project is attributed to the no major activity and low traffic volume plying near the project road.

3.3.7 Noise Environment

The baseline assessment of prevailing noise levels in and around the study area is an important parameter in preparation of impact assessment report. Impact of noise sources on environment depend upon the sources, which are generating noise and their respective characteristics. Noise levels are more annoying in the night particularly in the residential area. The environmental impact of noise can have several effects varying from hearing loss to annoyance depending on loudness of noise levels. In the present study, Sound Pressure Level (SPL) was measure by a sophisticated sound level meter (Integrating Sound Level Meter Cygnet, Model 2031A). Since loudness of sound is important by its effects on people, the dependence of loudness upon frequency must take into account in environmental noise assessment. This has achieved by the use of A-weighting filters in the noise-measuring instrument, which gives a direct reading of approximate loudness.

3.3.7.1 Noise levels of Project Area

The Ambient Noise Quality Standards with respect to noise have been stipulated by Govt. of India vide Gazette Notification dated 14.02.2000. **Table 3.15** describes the Ambient Noise Standards.

Table 3-15: Ambient Noise Standards (CPCB)

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

**- Silence zone is defined as an area up to 100 meters around such premises as hospitals, educational institutions and courts. The silence zones are to be declared by the competent authority;*

Sampling Criteria and Locations

Locations for noise monitoring stations along the project corridor are identified based on the same criteria used for air monitoring but the relative importance of each criteria carries a weighting in arriving at the final set of locations.

Hourly noise levels were recorded at four locations identified along project roads using sound level meter C-390 (Data logging Sound level meter C-390). Ambient Noise monitoring locations are presented in **Table 3.16** and shown in **Map Noise Quality Location.** The hourly noise values were used to calculate daytime and night-time equivalent noise levels. In order to arrive at daytime noise levels the logarithmic average of hourly values was taken from 6:00 AM to 10:00 PM. The night-time noise levels were derived by taking logarithmic average of hourly values from 10:00 PM to 06:00 AM. The hours of day and night were considered as specified durations for 'day' and 'night' in Noise Rules published by the MoEF&CC.

Table 3-16: Noise Monitoring Locations

Station Code	Noise Location	Category of Area	Co-ordinates of monitoring location
NQ 1	Ch. Km 144+800 at Mathigiri Road (SH-17A) Near Muthuganapalli	Residential	12^0 37'16.2"N, 77^0 51' 08.3"E
NQ2	Ch.150+600 at Mareamman temple	Sensitive	12^0 39'31.70"N, 77^0 50' 35.49"E
NQ 3	Ch.157+400 at school near Thorapalli Village	Residential	12^0 41' 4.25"N, 77^0 52' 57.88"E
NQ 5	Ch. Km 174+200 at Baglur-Berikai Road Near Thummanapalli Village	Residential	12^0 67'36.35"N, 77^0 57' 28.2"E

Ambient Noise Levels in Study Area

The Ambient Noise Quality Monitoring in Leq (dBA) at various sampling stations are given in **Table 3.17.**

Table 3-17: Ambient Noise Quality Monitoring in Leq (dBA)

Station Code	Location	Leq (dBA) Day	Leq (dBA) Night	Permissible limits as per CPCB standards		Mean Noise Level in (dBA)
				Day (dBA)	Night (dBA)	
NQ 1	Ch. 144+800 at village S. Muthuganapalli near Temple	57.7	48.9	55	45	53.30
NQ 2	Ch.150+600 at Mareamman temple	53.6	44.1	55	45	48.85
NQ 3	Ch.157+400 at school near Thorapalli Village	48.6	41.1	55	45	44.85
NQ 4	Ch. 174+200 junction near Thummanapalli village	55.6	52.6	65	55	54.10

Ch. 144+800 at village S. Muthuganapalli near Temple

Ch.150+600 at Mareamman temple

Ch.157+400 at school near Thorapalli Village

Ch. 174+200 junction near Thummanapalli village

Figure 3.14: Photographs showing Noise Monitoring Locations at Project Site

Results Analysis

As observed from above monitoring results, the daytime noise levels are in the range of 48.6 dBA to 57.7 dBA and the night time noise levels are in the range of 41.1 dBA to 52.60 dBA. The daytime and night time noise levels marginally exceeding the prescribed limits of CPCB at all residential locations. This is due to the heavy traffic at traffic junctions and vehicles plying near to the proposed road. The day and night time noise levels are found to be higher than the CPCB standards at sensitive and residential monitoring locations.

3.3.8 Water Environment

The development of any region is contingent on the availability of sufficient water resources, as developmental activities require water for irrigation, domestic and other purposes.

3.3.8.1 Surface Water Hydrology

Krishnagiri district forms parts of Cauvery and East Coast Minor Rivers basins. Cauvery River forms the south-western boundary of the district. Dodda Halla is the most important tributary of Cauvery draining the rugged terrain in the north-western part of the district. Ponnaiyar is the major river draining the district and is ephemeral in nature. It originates two from Nandhi hills in Karnataka, enters Tamil Nadu west of Bagalur and flows almost in a southeasterly direction until it reaches Manjamedu from where it flows along the district boundary before entering the district, again near Hanuman Tirtham. After flowing for a short distance in an easterly direction, it again follows the district boundary before entering the neighbouring Dharmapuri district. Pambar and Bargur are among the important tributaries

of Ponnaiyar draining part of the district. Drainage map of Tamil Nadu is given in **Figure 3.15.**

Figure 3.15: Drainage Map of Tamil Nadu State

The list of Rivers/Canals Crossing/Abutting the Proposed Alignment are given in **Table 3.18** and list of low-lying areas along the proposed alignment are given in **Table 3.19.**

Table 3.18: List of Rivers/Canals Crossing/Abutting the Proposed Alignment

SrNo.	Type of water bodies	Village name	Crossing Chainage (Km)
Krishnagiri District (Tamil Nadu)			
	Natural stream	Biramangalam	150.950
	Natural stream	Biramangalam	152.000
	Canal Crossing	Thorapalli Agraharam	157.300
	River Crossing	Thorapalli Agraharam (Ponniyar)	158.500
	Canal Crossing	Allur	163.950
	Canal Crossing	Attur (H/o Muthalli)	164.580
	Canal Crossing	Pathamuththali	165.980

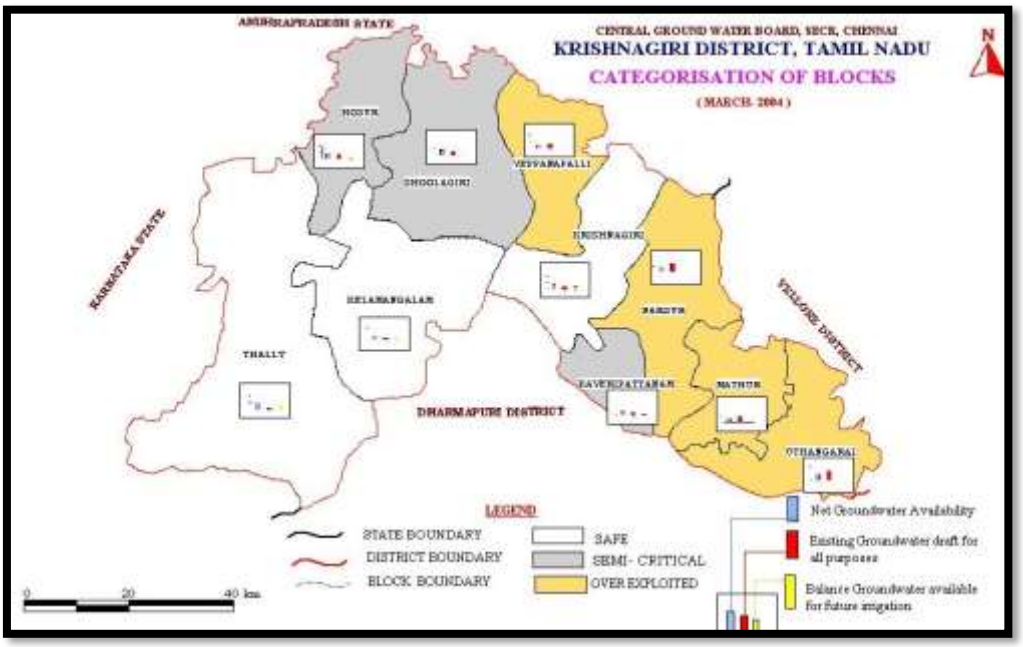
Table 3.19: Details of Low lying area along project road

Sr No	Type of water bodies	Village name	Chainage (Km)
1.	Low Lying Area	Biramangalam	152.600
2.		Biramangalam	153.750

Source: Primary data collected from site

3.3.9 Groundwater Hydrology

As per Central Ground Water Board reports, Krishnagiri district is underlained by Archaean crystalline formations with Recent alluvial deposits of limited areal extent and thickness along the courses of major rivers. The occurrence and movement of ground water are controlled by various factors such as physiography, climate, geology and structural features. Weathered, and fractured crystalline rocks constitute the important aquifer systems in the district. Ground water generally occurs under phreatic conditions in the weathered mantle and under semi-confined conditions in the fractured zones at deeper levels. The thickness of weathered zones in the district ranges from less than a meter to more than 15 m. The yield of large diameter dug wells in the district, tapping the weathered mantle of crystalline rocks ranges from 100 to 500 lpm. These wells normally sustain pumping for 2 to 6 hours per day, depending upon the local topography and characteristics of the weathered mantle. The depth to water level (DTW) during pre-monsoon (May 2006) ranged between 0.5 and 9.9 meter below ground level (mbgl) in the district. In major part of the district, the DTW is more than 5 mbgl. Whereas it ranged between 2 and 9.9 m bgl during post monsoon, in the district and the DTW is in the range of 5 – 10 m bgl in the entire district except a few isolated pockets. The yield of successful exploratory wells drilled in the district ranged from 0.78 lps to 26 lps. As per the studies, the wells drilled in granitic gneiss have higher yields than the wells drilled in charnockites. The specific capacity of the wells ranged from 1.2 to 118.0 lpm/m/dd. The piezo metric head of fracture zones varied between 0.50 and 18.45 m bgl. Hydrogeological map of district Krishnagiri is shown in **Figure 3.16.**



Source: CGWB, Krishnagiri district

Figure 3.16: Groundwater Quality Map of District Krishnagiri

3.3.9.1 Ground Water Resources along the Project Road

Ground water table in the project area varies between 6m to 10m. Main source of water in the nearby villages is groundwater. It was observed during reconnaissance survey and primary field visits that the people of project area mainly use ground water for various purposes

3.3.9.2 Water Quality

To assess the quality of water in the project area, samples were collected from two surface water bodies. The details of sampling locations for surface water sources are presented in **Map Surface Water Quality Location**. These samples were analyzed for all essential characteristics and for most of the desirable characteristics specified in IS 10500:2012 and are analyzed in accordance with the standard methods specified by IS code. The analytical results of surface are given **Table 3.20.**

Field Photographs taken during the sample collection time are shown in **Figure 3.17.**

Table 3.20: Surface Water Sampling Locations

Station Code	Location	Source	Co-ordinates of monitoring location
SWQ1	km158.500 near to Thorapalli Agraharam village	Ponnaiyar River)	12^0 41'22.9''N, 77^0 52' 52.9''E
SWQ2	km171.500 near to Attur village	Surface Water (Lake)	12^0 47'55.32''N 77^0 54' 24.27''E

Figure: 3.17: Photograph Showing Water Quality Sampling at Project Site

Table 3.21: Results of Surface Water Quality Analysis

Sl No	Parameters	Unit	Water Quality Criteria As per CPCB Guidelines					SWQ1	SWQ2	Test Methods
			A	B	C	D	E			
1	pH	-	6.5-8.5					7.85	7.97	APHA 4500H$^+$ B
2	Turbidity	NTU	-		3.69	-	-	2.39	3.69	APHA 2130 B
3	Temperature	^{0}C	-		25	-	-	25	25	APHA 2550B
4	Conductivity	µS/cm	-		340	1000	2250	1234	340	APHA 2510 B
5	Colour	Hazen	10		<1	-	-	<1	<1	IS 3025(Part 4):1983
6	Odour	--	-		Agreeable	-	-	Agreeable	Agreeable	IS 3025(Part 5):1983

Sl No	Parameters	Unit	Water Quality Criteria As per CPCB Guidelines					SWQ1	SWQ2	Test Methods
			A	B	C	D	E			
7	Total Dissolved Solids	mg/L	500		1500	-	2100	820	284	APHA 2540 C
8	Suspended Solids	mg/L	-		-	-	-	10.0	12.0	APHA 2540 D
9	BOD (3 Days@27^{0}C)	mg/L	2		3	-	-	18.0	22.0	APHA 5210 B
10	Chemical Oxygen Demand	mg/L	-		-	-	-	52.0	64.0	APHA 5220 B
11	Dissolved Oxygen	mg/L	6		4	4	-	5.3	4.6	APHA 4500-O
12	Total Kjeldahl Nitrogen	mg/L	-		-	-	-	18.29	2.05	APHA 4500-Norg B
13	Ammonical Nitrogen	mg/L	-		-	-	-	11.94	0.93	APHA 4500- NH_3 B C
14	Total Hardness	mg/L	-		-	-	-	252	104	APHA 2340 C
15	Total Alkalinity	mg/L	-		-	-	-	340	164	APHA 2320 B
16	Sodium	mg/L	-		-	-	-	110	30.0	APHA 3500-Na B
17	Potassium	mg/L	-		-	-	-	4.4	1.6	APHA 3500-K
18	Magnesium	mg/L	-		-	-	-	19.44	8.74	APHA 3500 Mg B
19	Calcium as Ca	mg/L	-		-	-	-	68.8	27.2	APHA 3500-Ca
20	Ammonia	mg/L	-	-	-	1.2	-	10.55	0.03	APHA 4500-NH_3 F
21	Chloride as Cl	mg/L	250	-	600	-	600	162.78	28.78	APHA 4500-Cl B
22	Sulphate as SO_4	mg/L	400	-	400	-	1000	21.15	8.1	APHA 4500-SO_4^2-E
23	Phosphate	mg/L	-	-	-	-	-	6.71	0.11	APHA 4500-P D
24	Nitrate as NO_3	mg/L	20	-	50	-	-	15.08	5.20	APHA 4500-NO_3 E
25	Fluoride as F	mg/L	1.5	1.5	1.5	-	-	0.72	0.62	APHA 4500F D
26	Anionic Detergents	mg/L	-	-	-	-	-	BDL	BDL	APHA 5540 C
27	Total Iron as Fe	mg/L	0.3	-	50	-	-	0.296	0.365	APHA 3500-Fe B
28	Copper as Cu	mg/L	1.5	-	1.5	-	-	0.005	0.004	IS 3025 (Part 2) : 2004 RA 2014
29	Zinc as Zn	mg/L	15	-	15	-	-	0.018	0.015	IS 3025 (Part 2) : 2004 RA 2014
30	Arsenic as As	mg/L	0.05	0.2	0.2	-	-	0.003	BDL	IS 3025 (Part 2): 2004 RA 2014
31	Selenium as Se	mg/L	-	-	-	-	-	BDL	BDL	IS 3025 (Part 2) : 2004 RA 2014
32	Mercury as Hg	mg/L	-	-	-	-	-	BDL	BDL	IS 3025 (Part 48) : 1994 RA 2014
33	Lead as Pb	mg/L	0.1	-	0.1	-	-	0.004	0.003	IS 3025 (Part 2): 2004 RA 2014

Sl No	Parameters	Unit	Water Quality Criteria As per CPCB Guidelines					SWQ1	SWQ2	Test Methods
			A	B	C	D	E			
34	Manganese as Mn	mg/L	-	-	-	-	-	0.181	0.122	IS 3025 (Part 2) : 2004 RA 2014
35	Total Chromium	mg/L	-	-	-	-	-	0.003	0.003	IS 3025 (Part 2) : 2004 RA 2014
36	Phenolic Compounds	mg/L	-	-	-	-	-	BDL	BDL	APHA 5530 C
37	Cadmium as Cd	mg/L	-	-	-	-	-	BDL	BDL	IS 3025 (Part 2): 2004 RA 2014
38	Oil & Grease	mg/L	-	-	-	-	-	BDL	BDL	APHA 5520 B
39	*Total Coliform*	MPN Index /100ml	50	500	5000	-	-	140 x 10^2	170 x10^2	APHA 9221 A, B, C, D, E& F: 2012
40	*Faecal Coliform*	MPN Index /100ml	-	-	-	-	-	21 x 10^2	24x10^2	APHA 9221 A, B, C, D, E& F: 2012

Source: Baseline data collected by consultant

Surface Water - Results Analysis:

Although the rivers are ephemeral in nature, the surface water bears a good concentration (mg/l) of dissolved oxygen. The biological oxygen demand (BOD mg/l) of the surface water varies from 18 to 22, the pH concentration of river water varies from 7.85 to 7.97 and total Coliform (MPN / 100 ml) found to be in the range of 21-24.

It is revealed from the data, that *the E. coli* and total Coliform increases in the river water as the slope wash gets carried away from the entire catchment during Monsoon period. The upper catchment area of Ponniyar and its tributaries hosts a number of villages, from where organic waste is discharged into the river. Due to temperatures and other associated factors, the propagation of faecal Coliform is activated during Monsoon season.

The concentration of all other physicochemical parameters is found to be well within the IS 10500 limits at all monitoring locations of surface water.

The water quality criteria of study area falls in the range of Class B-E water prescribed by CPCB (as per the overall result) and hence recommended for Irrigation, Industrial cooling, Controlled waste Disposal. (Use based classification for Surface Water as per CPCB Guidelines as given in **Table 3.22.**

Table 3-22: Use based classification for Surface Water as per CPCB Guidelines

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days 20C 2mg/l or less
Outdoor bathing (Organised)	B	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less

Designated-Best-Use	Class of water	Criteria
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25C micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l
	Below-E	Not Meeting A, B, C, D & E Criteria

Ground Water - Results Analysis:

As per CGWB, Ground water in the region is colorless, odourless and predominantly alkaline in nature. It is observed that the ground water is suitable for drinking and domestic uses in respect of all the constituents except total hardness, fluoride and nitrate. The incidence of high total hardness is attributed to the composition of litho-units constituting the aquifers in the district, whereas nitrate pollution is most likely due to the use of fertilizers and other improper waste disposal.

Analysis of the ground water level data indicates that there is a long-term fall in a considerable part of the district. Based on the factors mentioned, it is inferred that a major part of the district could be considered vulnerable to water level depletion. Incidence of fluoride in ground water in excess is reported in Thalli and Hosur blocks. The source of Fluoride in ground water is the fluoride bearing minerals present in the granitic gneissic and granites, which underlie the area.

3.3.10 Natural Resources Consumption

A number of sources of natural soil deposits, forum, gravel, sand, GSB and potential quarries for production of crushed rock aggregate to be used in the construction of pavement layers and highway structures had been identified. During the investigations soil borrow areas and quarries for fine and coarse aggregates were identified. 19 borrow areas have been identified along the project roads. The location of the identified borrow areas is as given in **Table 3.23**.

Table 3-23: Location of identified Borrow Areas

Sample No.	Design Chainage	Side (LHS/ RHS/ Both)	Lead from existing Chainage (km)	Approx. Quantity (Cum)	Co-ordinate
BA-1	144.800	RHS	0.170	70000	12°38'8.4" N, 77°47'3.17" E
BA-2	146.600	LHS	5.000	40050	13°14'0.45" N, 77°15'46.56" E
BA-3	148.800	LHS	6.280	62000	12°40'1.1" N, 77°48'13.53" E
BA-4	160.400	LHS	0.000	48000	12°42'19.15" N, 77°53'38.33" E

**Includes Soil, GSB and Morum*

The lead chart of the identified borrow areas along entire NH-948A project (all phases) is as shown in **Figure: 3.18**

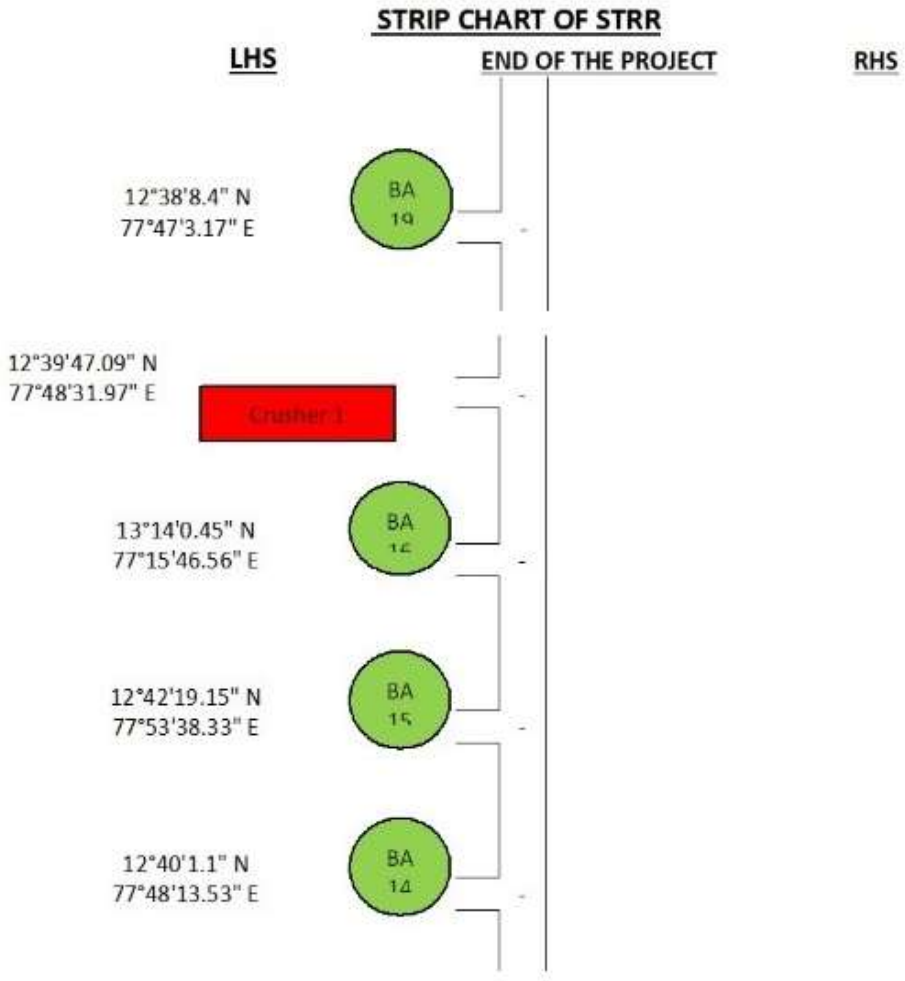


Figure 3.18: Lead Chart of Identified borrow area along NH-948A

3.3.11 Source of Fly Ash

According to the Notification No. S.O. 763(E), dated 14.09.1999 and its amendment on 27.08.2003 and notification S.O. 254(E) dated 25th January 2016 by Ministry of Environment and Forest & Climate Change, it is mandatory to use fly ash within a radius of 300 kilometres of coal or lignite based Thermal Power Plant.

The list of coal or lignite based Thermal Power Plants within radius of 300km from the proposed project is given in **Table 3.24:**

Table 3-24: List of coal or lignite based Thermal Power Plant

Power Plant Name	State	Location	Capacity of Power Plant (MW)	Aerial Distance from Project Road (km)
Ennore Thermal Power Plant	Tamil Nadu	Chennai	660	262
Mettur Thermal Power Plant	Tamil Nadu	Salem	1440	95
Rayalseema Thermal Power Plant	Andhra Pradesh	Kadapa	1230	203

3.3.12 Stone Metal and Sand Quarries

The potentially identified quarries along the entire stretch are provided in **Table 3.25.**

Table 3-25: Quarries Identified for the Project

Sr No	Stone Quarry Name	Coordinates
1.	V.V.Granite	12°39'47.09"N,77°48'31.97" E
2.	Shri Bharat Blue Metals & Enterprises	12°43'37.65" N, 77°54'58.88" E
3.	Trinate Exparts(Eco Sand)	12°57'18.54" N, 77°15'57.67" E
4.	Sri Lakshmi Narayana Swamy	13°17'26.23" N, 77°13'20.74" E
5.	V.V.Granite	12°39'47.09" N, 77°48'31.97" E

3.4 BIOLOGICAL ENVIRONMENT

Biological resources are among the most important resources impacted by the road projects. A detailed baseline study of the ecological resources is essential to estimate the magnitude of potential impacts and to avoid or mitigate any loss caused by the proposed project. In this section baseline, details of the flora and fauna of the project area are presented.

3.4.1 Forest Ecosystem

The Forest Survey of India was mandated to carry out forest cover mapping of the country in the year 1986. Since then, the forest cover mapping has been carried out regularly on a biennial basis. India State of Forest Report 2017 is the fifteenth assessment in this series and the same has been considered to study forest cover in the project states and district (Tamil Nadu).

As per India State of Forest Report, 2017, the recorded forest area in Tamil Nadu is 22,877 km^2, which is 17.59% of the geographical area of the state. Reserved and Protected Forests constitute 88.70% and 7.79% of the total forest area respectively.

The forest cover in the concerned project districts in year 2017 as per Ministry of Environment and Forests, Government of India is given in **Table 3.26** and the forest cover map of Tamil Nadu are shown in **Figure 3.19.**

Table 3-26: Forest Cover in Project District (area in sq.km)

District	Geographical Area	Very dense forest	Mod. Dense forest	Open Forest	Total	% of G.A.
Krishnagiri	5,129	95	843	611	1,549	30.20

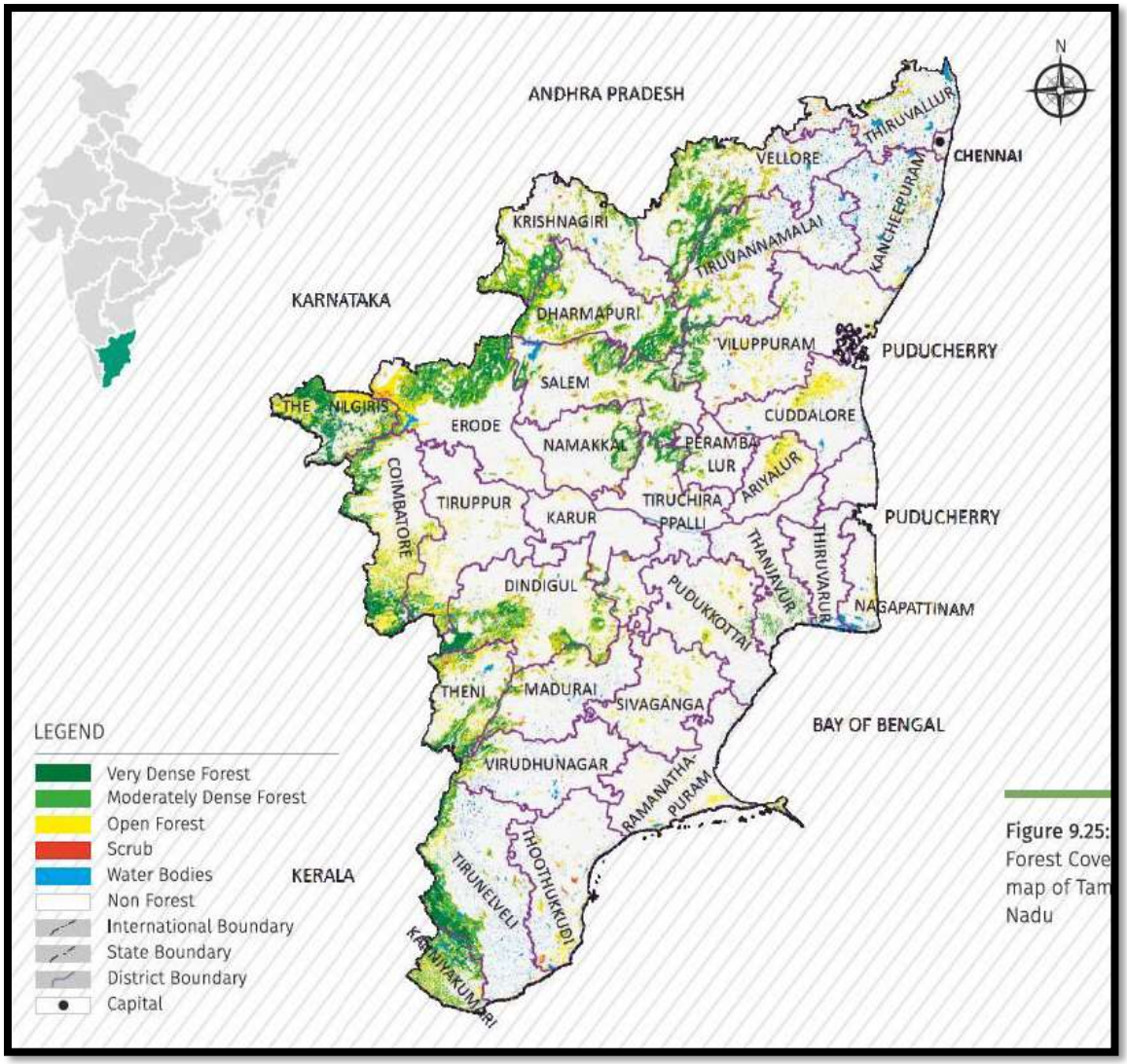


Figure 9.25: Forest Cove map of Tam Nadu

Source: India State of Forest Report, 2017

Figure 3.19: Forest cover map of Tamil Nadu

a) Type of Forest in the study area

As per Forest Department, Government of Tamil Nadu, the state Forest vegetation is divided into 3 major groups according to temperature zones namely Tropical Forests, Montane Subtropical Forests and Montane Temperate Forests, which are sub divided into nine type groups based on moisture and physiognomic variation. They are i) Tropical wet evergreen, ii) Tropical semi evergreen, iii) Tropical moist deciduous, iv) Littoral and swamp, v) Tropical dry deciduous, vi) Tropical thorn, vii) Tropical dry evergreen, viii) Sub-Tropical Broad-leaved hill, ix) Montane wet temperate

Involvement of forestland in project roads

The proposed project does not involve any diversion of forestland.

Protected Areas

There is no protected area (National Park, Wildlife Sanctuary, reserved forest, biosphere reserve, and wetland) within the ROW and 10km on either side of project road.

3.4.1.1 Flora

List of major flora in the region are given in **Table: 3.27**

Table 3-27: List of Common Floral species in the area

Sr No	Botanical name	Common Tamil Name
1	*Acacia nilotica*	Karvela maram
2	*Acacia pennata*	Kattusikkai maram
3	*Acacia suma*	Celai maram
4	*Ailanthus excelsa*	Pee maram
5	*Alangium salvifolium*	Alingi maram
6	*Albizzia lebbeck*	Vagai
7	*Alstonia scholaris*	Palegaruda maram
8	*Anacardium occidentale*	Mundiriparuppu maram
9	*Anogeissus acuminata*	Namai maram
10	*Buchanania lanceolatta*	Mudumalai maram
11	*Butea frondosa*	Elaiporasu maram
12	*Butea monosperma*	
13	*Canthium didynamum*	Nekkini maram
14	*Cassia fistula*	Konnai maram
15	*Dalbergia latifolia*	Itti maram
16	*Dalbergia paniculata*	Porapatchalai maram
17	*Dalbergia sissoides*	Sissoo maram
18	*Diospyros chloroxylon*	Karuvakkanai maram
19	*Dolichandrone falcate*	Klarvalattu maram
20	*Elaeodendron glacum*	Keeri maram
21	*Erythrina indica*	Murukku maram
22	*Eugenia jambolana*	Nagai maram
23	*Euphorbia trigona*	Palkalli maram
24	*Ficus benghalensis*	Ala maram
25	*Ficus religiosa*	Arasu maram
26	*Ficus retusa*	Kalluichi maram
27	*Grewia tiliaefolia*	Thadasu maram
28	*Gyrocarpus jacquinii*	Thanaku maram
29	*Grewia disperma*	Anaikkatti maram
30	*Mangifera indica*	Mamaram
31	*Mundulea suberosa*	Pil avaram maram
32	*Melia composita*	
33	*Melia dubia*	Malai vembu maram
34	*Memecylon edule*	Kasan maram
35	*Millingtonia hortensis*	Maramalli maram
36	*Mimusops elengi*	Magadam maram
37	*Morinda citrifolia*	Nona maram
38	*Moringa concanensis*	Kattu murungai maram
39	*Murraya konigii*	Karuveppilai maram
40	*Phyllanthus polyphyllus*	Kilanelli maram

Sr No	Botanical name	Common Tamil Name
41	*Pistacia oleosia*	kadalmurichi
42	*Pithecolobium dulce*	Kodukapuli maram
43	*Pittosporum floribundum*	Kattu sampangi maram
44	*Pleurostylia wightii*	Karikku vagai maram
45	*Plumeria acutifolia*	Navilla maram
46	*Polyalthia cerasoides*	Kothukala maram
47	*Pongamia glabra*	Punga maram
48	*Randia uliginosa*	Vagatta maram
49	*Santalum album*	Santhana maram
50	*Sapindus emarginatus*	Puvamkottai maram
51	*Shorea talura*	Jalari maram
52	*Streblus asper*	Kuttipilla maram
53	*Tamarindus indica*	Pulia maram
54	*Tectona grandis*	Thekku maram
55	*Terminalia arjuna*	Nirmaddi maram
56	*Terminalia bellerica*	Thani maram
57	*Zizyphus maurtiana*	Elandai maram
58	*Zizyphus xylopyrus*	Mul-kottai maram
59	*Zizyphus trinervia*	Karukava maram

Roadside Trees:

A tree inventory of the existing tree species on the project alignment has been prepared from the Topo Survey report (2018). Giriship, Acacia, Neem, tamarind and thurai, etc are the common species growing in the area of concern. A summary of the tree inventory is given as **Appendix 3.1.**

As observed from atree details, a total of 12111 tress fall within the PRoW of the project road.

3.4.1.2 Fauna

The fauna of the project district is reported to be rich. No habitat fragmentation is likely to take place as a result of the proposed project. The major wild animals include Elephants, Sambar, Spotted Deer, Gaur, Wild boar, Panther etc. The forest area of Denkanikottai Taluk forms the prime elephant habitat with lot of bamboos and this area constitutes the Cauvery elephant reserve. The bird population is also attractive with beautiful bird like Paradise flycatcher. Big lakes in Anchetti and Hosur areas also attract large number of migratory birds like Painted storks, Teals etc. Apart from these birds and mammals, there are variety of butterflies, giant spiders etc.

The class Mammalia in the Division area is represented by at least 35 species belonging to 10 orders including two endangered species – the Dhole and the Asiatic Elephant. The forest of the Krishnagiri are rich in elephants, Leopards, Wild boar, bears and many smaller form of mammalian wildlife. The migratory Elephants from Bannerghatta National Park and North Cauvery Wildlife Sanctuary takes shelter in the forest of Hosur division during the months from October to April. The region reveals a wide avian diversity within the Hosur Forest Division.

The region is also rich in avifauna and herpetofauna. The project location has not been under IBA (Important Bird Area), therefore, it is not a sensitive location for birds too. Common toad, Gunther's toad, Common Tree frog, Painted frog, Indian bullfrog are some of the amphibians. Mysore Day gecko, House gecko, Brook's gecko, Termite hill gecko, Spotted rock gecko. Russel viper, Common cobra, Krait, Indian rock python are found abundantly in the division. A comprehensive list of fauna of the

proposed project area is given in **Table 3.28.**

There is no endangered species (as per IUCN Red list) found in the project area**.**

Table 3-28: List of Common Wild Faunal species of the proposed project area

Local Name	*Zoological Name*
Mammals	
Four-horned antelope	*Tetracerus quadricornis*
Indian gaur	*Bos gaurus*
Spotted deer	*Axis axis*
Wild boar	*Sus scrofa*
Mouse deer	*Moschiola meminna*
Jackal	*Canis aureus*
Jungle cat	*Felis chaus*
Leopard	*Panthera pardus*
Ruddy mongoose	*Herpestes smithii*
Small Indian mongoose	*Herpestes javanicus*
Stripe necked mongoose	*Herpestes vitticollis*
Sloth bear	*Melursus ursinus*
Honey Badger	*Mellivora capensis*
Common palm civet	*Paradoxurus hermaphroditus*
Small Indian civet	*Viverra civettina*
Wild dog	*Cuon alpinus*
Indian flying fox	*Pteropus giganteus*
Indian pipistrelles	*Pipistrellus coromandra*
Black-naped hare	*Lepus nigricollis*
Indian pangolin	*Manis crassicaudata*
Bonnet macaque	*Macaca radiata*
Common langur	*Semnopithecus entellus*
Four-horned antelope	*Tetracerus quadricornis*
Indian gaur	*Bos gaurus*
Spotted deer	*Axis axis*
Wild boar	*Sus scrofa*
Mouse deer	*Moschiola meminna*
Jackal	*Canis aureus*
Jungle cat	*Felis chaus*
Leopard	*Panthera pardus*
Ruddy mongoose	*Herpestes smithii*
Small Indian mongoose	*Herpestes javanicus*
Stripe necked mongoose	*Herpestes vitticollis*
Sloth bear	*Melursus ursinus*
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Indian pipistrelles	*Pipistrellus coromandra*

Local Name	*Zoological Name*
Mammals	
Black-naped hare	*Lepus nigricollis*
Indian pangolin	*Manis crassicaudata*
Bonnet macaque	*Macaca radiata*
Common langur	*Semnopithecus entellus*
Birds	
Grey Francolin	*Francolinus pondicerianus*
Jungle Bush Quail	*Perdicula asiatica*
Painted Bush Quail	*Perdicula erythrorhyncha*
Red Spurfowl	*Galloperdix spadicea*
Grey Junglefowl	*Gallus sonneratii*
Indian Peafowl	*Pavo cristatus*
Lesser Whistling Duck	*Dendrocygna javanica*
Indian Spot-billed Duck	*Anas poecilorhyncha*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acuta*
Snakes	
House gecko	*Hemidactylus frenatus complex*
Mysore day gecko	*Cnemaspis cf. mysorensis*
Brook's gecko	*Hemidactylus brookii complex*
Termite hill gecko	*Hemidactylus triedrus*
Spotted rock gecko	*Hemidactylus maculatus*
Western Ghats worm gecko	*Hemiphyllodactylus aurantiacus*
Unidentified day gecko	*Cnemaspsi sp*
Peninsular rock agama	*Psammophilus dorsalis*
Indian rock agama	*Psammophilus blanfordanus*
Unidentified rock agama	*Psammophilus sp*
Garden lizard	*Calotes versicular*

Source: Working Plan & Field Investigation, Hosur Forest Division, Tamil Nadu

Domesticated animal species

People of the area were found domesticating animals for meat, milk, and companion. A list of major domesticated animals is given in **Table 3.29.**

Table 3-29: List of Domesticated Animal Species in the study area

Scientific Name	**Common name**
Bos indicus	Cow
Bos tauraus	Jersey Cow
Canis familiari.	Domesticated Dog
Capra hircus	Domestic Goat
Felis catus	Cat
Gallus domesticus	Chicken
Bubalis sp.	Buffalo

Source: District Statistical Hand Book and Primary Field Investigation

3.4.1.3 Aquatic Ecology

River Ponnaiyar reverently called 'Little Ganga of the South' is the only major river flowing in the vicinity of the proposed project. It cross the project road section near Km 158+000 distance of the project road section of NH948A. Several tributaries arise from this river and intersect at different point of the proposed road stretch. The river is dry for the most part of the year. Water flows during the monsoon season when it is fed by the south-west monsoon in catchment area and the northeast monsoon in Tamil Nadu. This water flow raises the water table throughout the river basin and feeds numerous reservoirs/tanks. The water current in the river Ponnaiyar is quite low, which ecologically is considered to be normal.

Fish Fauna

Ponnaiyar is the largest River flowing in the vicinity of the project site. Ponnaiyar comprises of 27 species belonging to the families Cyprinidae, Psilorhynchidae, Sisiridae, Garrinae (sub family), Cobitidae, Balitoridae, Channidae, Rosborinae.The fish species observed during field survey in the Ponnaiyar river are - Tor tor, Tor putitora, Labio sp, Barilious sp, Danio sp, Schizotheros sp of Cyprinidae family and Balitora sp of Balitoridae family. The species categorized as endangered (EN) as per available literature (BCPP, 1997)i are Exostomata labiatum, Tor tor and Tor putitora out of the total 27 species of the river Ponnaiyar. The dominant long distant migratory fishes are Mahasheer and Minor carps. The other important fish groups, which undertake short migration, are Voemacheilids, Glyptothoracids, Psilorhynchids. The migratory phenomenon of the fish species is directly related to its life cycle as the fishes move from one habitat to other for spawning. The breeding migration starts with the onset of monsoon.

3.5 SOCIO-ECONOMIC ENVIRONMENT

3.5.1 Socio-Economic Profile of the District Krishnagiri

Krishnagiri, the holy land of wise scholars, men of valour and courage, blessed with the green valleys, hills and hillocks and inhabited by people known for innovative farming was divided, for the formation of Krishnagiri district, carved out of Dharmapuri district as 30th district of Tamil Nadu.

'Krishna' refers to 'black' and 'giri' refers to 'hill'. This district is gifted with black granite hillocks and named as "Krishnagiri".

Krishnagiri district is bounded by Vellore and Thiruvannamalai districts in the East, Karnataka state in the west, State of Andhra Pradesh in the North Dharmapuri District in the south. Its area is 5143 sq km. This district is elevated from 300m to 1400m above the mean sea level. It is located between 11º 12'N to 12º 49'N Latitude, 77º 27'E to 78º 38'E Longitude.

3.5.2 Religion

The villages in the state are comprised of Hindus as the majority community. The presence of Muslims and Christians as the two non-Hindu and minority communities is limited. As per official census 2011 and population data 2018 of Krishnagiri district, Hindu are majority in Krishnagiri state. Total population of Krishnagiri district is 1,879,809 as per census 2011. Hinduism constitutes 91.70% of Krishnagiri population. Religious status of the Krishnagiri District is given in **Table 3.30.**

Table 3.30: Religious Status of the Krishnagiri District

District	Krishnagiri
Population	1879809
Hindu	91.70%
Muslim	6.13%

District	Krishnagiri
Christian	1.91%
Sikh	0.02%
Buddhist	0.01%
Jain	0.02%
Other	0.01%

3.5.3 Language

Three languages namely Tamil, Telugu and Kannada are predominantly spoken in this district. Major religions are Hindu, Islam and Christianity. This district stands as an ideal exhibit of National integration and religious harmony. The society exhibit the confluence of different languages and religions.

3.5.4 Demography

According to the 2011 census, Krishnagiri district has a population of 1,879,809. The district has a population density of 370 inhabitants per square kilometre. The growth of population of the district is 20.41 per cent. Krishnagiri has a sex ratio of 958 females for every 1000 males. Salient demographic features of the district Krishnagiri are given in **Table 3.31.**

Table 3-31: Salient features of the district

S. No.	Particular	Units	Figure
1	Area	In '000 Sq. Km	512
	Administrative Units		
2	Revenue Villages	Number	655
3	655 4 Revenue Talukas	Number	5
4	Gram Panchayats	Number	352
5	Municipalities (incl. Corpns. & NPs)	Number	2
	Population		
6	Total	In Persons	1879809
7	Male	In Persons	960232
8	Female	In Persons	919577
9	Male to Total Population	%	51.08
10	Female to Total Population	%	48.92
11	Sex	Ratio	958
12	Rural	In Persons	1451446
13	Urban	In Persons	42836
14	Rural Population (%)	%	77.21
15	Urbanization	%	22.79
16	Density of Population (per Sq. Km.)	In Persons	367
	Child Population (0 - 6 Years)		
17	Total	In Persons	217323
18	Males	In Persons	112832
19	Females	In Persons	104491
20	Rural	%	166231
21	Urban	%	51092
22	Sex Ratio	(Females per 1000 Males) Ratio	926

S. No.	Particular	Units	Figure
	Literates		
23	Total	In Persons	1187958
24	Males	In Persons	667062
25	Females	In Persons	520896
26	**Literacy Rate**		
27	Total	%	71.46
28	Males	%	78.72
29	Females	%	63.91
	Scheduled Castes Population		
30	Total	In Persons	267386
31	Males	In Persons	135474
32	Females	In Persons	131912
33	Sex Ratio (Females per 1000 Males)	In Persons	974
	Scheduled Tribes Population		
34	Total	Number	22388
35	Males	Number	11419
36	Females	Number	10969
37	Sex Ratio (Females per 1000 Males)	Number	961
	Working Population		
38	Total	Number	877779
39	Males	Number	561634
40	Females	Number	316145

3.5.5 Working Profile

The important crops of Krishnagiri District are Paddy, Maize, Ragi, Banana, Sugarcane, Cotton, Tamarind, Coconut, Mango, Groundnut, Vegetables and Flowers. The district has an excellent scope for agro business. Regional Agricultural Research Centre of Tamil Nadu Agricultural University is functioning efficiently at Paiyur in Kaveripattinam union since 1973. This centre is functioning in 18.5 hectare of land. It helps the peasants to develop and adopt the modern technique of cultivation. It has developed hybrid seeds by research which yields more tonnage and good quality.

3.5.6 Connectivity

This district is connected by Prime Minister's Golden quadrilateral project executed by National Highways Authority of India. This district has a network of National Highways converging.

- NH-7 (Kanyakumari-Kashmir)
- NH-46 (Chennai-Bangalore)
- NH-66 (Pondicherry-Bangalore)
- NH-207 (Sarjapur-Bagalur-Hosur)
- NH-219 (Krishnagiri-Kuppam)

Apart from this, state highways and district highways are linking almost all the towns and villages of the district. Four National highways converge at the Head Quarters of this district is unique.

People of Krishnagiri District belong to various racial groups. People from Kashmir, Maharashtra, Karnataka and Andhra have settled in this District. Hence, it can be rightly called a Cosmopolitan society. Ancient Art & Culture is preserved and maintained by inhabitants. The major entertainment for rural folk form the 'Street Play' (theru koothu) and 'Sevai Attam'.

The following major Highways pass through Krishnagiri District as given in **Table 3.32.**

Table 3-32: Connectivity of the major highways to the Krishnagiri district

S. No.	Start-End Point	NH No.	Length (Km)
1	Kanniyakumari–Varanasi	7	2460
2	Krishnagiri–Ranipet	46	144
3	Pondicherry–Krishnagiri	66	214
4	Krishnagiri–Madanapalli	219	175
5	Sarjapur–Bagalur–Hosur	207	40

Salem, Bangalore Broad gauge line run through Hosur. A railway line between Jolarpet and Hosur (Via) Krishnagiri will pave way for further improvement of industrial growth in Hosur. This will link Chennai city and its port facilities with the growing town of Hosur, which is also a hub for horticulture crops. However, this will take some time for realization. As per new budget report, the proposed new line would take off from Jolarpet Junction, Tirupattur and pass through Kandili, Bargur, Krishnagiri and Shoolagiri a length of 104 km to join at Rayakottai. Another survey was conducted for a new rail link between Krishnagiri and Dharmapuri in 2004-05

3.5.7 Economy

- Krishnagiri district is famous for Mangoes. Krishnagiri district is also famous for the Granite Industry with quarries and processing units spread around the district. Hosur, one of the most industrialized places in the state is located in this district.
- With 40% share, the district is the top producer of Ragi in Tamil Nadu.
- The national fruit of India and of the state of Tamil Nadu is mango. The major crop of Krishnagiri district with 300.17 km² area of cultivation is mango. The district produces 300,000 tonnes annually and in Tamil Nadu Krishnagiri District is the First Place in The Production of Mango. Almost 20% of the mango varieties like 'Thothapuri' and 'Alphonso' that are produced in this district, are processed into pulp. In addition to mango pulp processing, tonnes of mangoes are processed into juice every year in this district. A large-scale mango export zone has been approved for the Krishnagiri district. This will allow growing as well as processing of mangoes thus yielding higher profits for the farmers.

3.5.8 Agriculture

Krishnagiri district is one of the potential districts for cultivation of agricultural and horticultural crops. Total cultivated area of 224767 Hectares, out of which 180902 Ha Net cultivated area against the 5,14,325 Ha. of total geographical area. The total normal area cultivated under all crops is 224767 Hectares out of which 73046 Ha is under irrigated and 151720 ha area under rainfed crops. The major agricultural crops in the district are grown Paddy, Ragi, Redgram, Cowpea, Maize, Cumbu, Groundnut, Horsegram and minor millets. The major cultivated area of agricultural crops occupied by rainfed agriculture. The total number of 2,81,733 famers engaged in agriculture out of which 213023 are Marginal farmers (76%), 45970 are Small farmers (16%), remaining 4615 farmers (8%) are medium and large farmers.

3.5.9 Industry

Approximately 25 industries located in this district process mangoes. Much of the population in this district is employed through mango cultivation directly and other labour class benefit through employment in mango processing units. There are about 150 mango nurseries which produce mango saplings in and around 'Santhur Village'. The district exports mango based products worth over ₹8 billion. Under the horticulture development program, government owned horticulture farms are functioning here. Through these units, about 300,000 fruit saplings are produced and distributed under different schemes. Apart from production and export, Krishnagiri also hosts Mango exhibition every year which is the unique in its kind in line with the annual exhibition held at New Delhi

3.5.10 Tourist Places

Thousands of visitors visit Krishnagiri each year. Majority come from Hosur, Bangalore, Dharmapuri, Vaniyambadi, Ambur and Chennai. The Krishnagiri Dam (Krishnagiri Reservoir Project Dam) is constructed in 1958 during the rule of the then Chief Minister Kamaraj is located near the town. Nearby, Sayed Basha hills has a fort that was the fortress of the ruler, Tippu Sultan. Treks to the nearby hills/mountains as well as farm houses are located in the outskirts. The boat house is situated 8 km from the central bus stand which also houses a children's park. There are a variety of ancient temples in the vicinity of Krishnagiri. Nearby Ramapuram is the site of a 500 year-old Rama Temple that draws many visitors each year.

The presence of museum in this District is known for traditional culture, Art and Architecture, Heritage and Historical Background is a blessing in disguise, to spread the traditional and heritage, culture and art of Tamil Nadu and Krishnagiri District in particular. This museum is functioning since 1993 AD, situated on Gandhi Salai in Krishnagiri. Historical monuments are preserved and exhibited here. It is not only a place of tourism but also a centre of education. This museum collects the monuments, Classifies and preserves them to conduct research on its historical worthiness. The Syed Basha Mountain is very famous for two Sufi martyr saints who had been slain in a battle long ago, every year on 10th of Shawwal (Islamic month) a grand celebration is made Almost thousands gather during this Urs festival with devotion and respect.

3.5.11 Socio-Cultural Properties and Land Acquisition

A total of 182 structures are affected due to the proposed project. List of affected structures is given as **Appendix 3.3**. The land to be acquired for the proposed development is given in **Table 3.33** below:

Table 3-33: Details of Land Acquisition

Area Statement				
Sr. No.	**District.**	**Taluka**	**Chainage**	**Area (Ha)**
1	Krishnagiri	Denkenikottai	140.000 to 142.086 148.956 to 154.883	74.4817
		Hosur	142.086 to 148.956 154.883 to 179.969	276.811
Total				**351.292**

CHAPTER-4: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 ENVIRONMENTAL IMPACTS AND MITIGATION

Previous chapters of this report have dealt about-proposed improvement and existing environmental condition. Following sections summarize impact of proposed improvement on existing environment. The planning of proposed project intervention points towards the impacts in the Design and Pre construction stage, the construction stages and the operation stage. The subsequent sections deal with the prediction of impacts due to the project on the natural environment and socio & cultural environment. **Table 4.1** presents the general environmental impacts expected due to the proposed construction of the new project road. Impacts have been assessed based on the information collected from the screening & scoping of environmental attributes at feasibility stage. The quanta of all the impacts on Natural Environment are discussed in details in subsequent paragraphs.

Prevention or avoidance of impact is better than mitigation of impact. Hence, avoidance and reduction of adverse impacts approaches were adopted during the design stage through continued interaction between the design and environmental teams. This is reflected in the designs of the horizontal & vertical alignment, cross sections adopted, construction methods and construction materials. In-depth site investigations have been carried out so that sensitive environmental resources are effectively avoided, leading to the environmentally best-fit alignment option

Table 4.1: General Impacts on Natural Environment

Project Activity	**Planning and Design Phase**	**Pre-construction Phase**		**Construction Phase**				
Environmental. component Affected	Land acquisition	Removal of Sensitive Receptors	Removal of trees and vegetation	Earth works including quarrying	Laying of pavement	Vehicle & Machine operation & maintenance	Asphalt & crusher plants	Sanitation & Waste (labour camps)
Air		Dust generation during dismantling	Reduced buffering of air and noise pollution, Hotter, drier microclimate	Dust generation	Asphalt odour	Dust and Pollution	Soot, odour, dust and pollution	Odour / smoke
Land	Loss of productivity of Land	Generation of debris	Erosion and loss of top soil	Erosion, loss of top soil and natural fertility	Pressure on Base Area	Contamination by fuel and lubricants Compaction	Contamination Compaction of soil	Contamination from wastes
Water	Loss of water sources	Siltation due to loose earth	Siltation due to loose earth	Alteration of drainage Break in continuity of ditches Siltation, Stagnant water pools in quarries.	Affecting available groundwater source and Reduction of ground water recharge area	Degradation of available water sources nearby the construction zone and Contamination by fuel and lubricants	Contamination by asphalt leakage or fuel	Contamination from wastes Overuse
Noise		Noise Pollution	Noise Generation due to machinery work	Noise Generation due to machinery work	Low Level noise due to working of running equipment	Noise Generation due to machinery work	Noise Generation due to machinery work	
Flora		Loss of Biomass	Loss of Natural affection	Removal of Vegetation Lowered productivity Loss of ground for vegetation		Removal of vegetation	Lower productivity Use as fuel wood	Felling trees for fuel
Fauna			DisturbanceHabitat/Wildlife loss	Disturbance		Disturbance	Disturbance	Poaching

Besides, above-mentioned impact on natural environment there will be socio-economic impacts due to disruptions on the social and economic interactions of communities. This involves effect on both the adjacent communities (mostly direct) as well as the nearby communities (mostly indirect). The various impacts have been detailed as:

- General impacts that apply to the entire project corridor,
- Specific impacts on likely properties and PAPs, within the Corridor of Impact (CoI) of the project corridors. **Table 4.2** presents the general impacts on social and cultural environment.

Table 4.2: General Impacts on Social and Cultural Environment

Project Activity	Planning and Design Phase	Pre-Construction Phase			Construction Phase				
SocialCompo-nentAffected	Design decisions &Implementation policies	Landacquisition	Removal of Structures	Removal of trees & vegetation	Earth worksin-cluding quarrying	Laying of pavement	Vehicle & machine op-eration & maintenance	Asphalt and crusher plants	Labour Camps
Agriculturalland	-	Change in land type and prices	Loss of land economic value	Loss of standing crops	Loss of productive land	Loose top soil fertility	-	Dust on agri-cultural land reduce the productivity	-
Buildings and builtup structures	-	Change in land type and prices	Loss of structures,Debrisgenera-tion, Noise and Air pollution	-	Noise, vi-bration may cause dam-age to structures	-	Noise, vi-bration may cause damage to structures	Dust accu-mulation on building and structure	-
People and Community	Anxiety and fear among community	-	Displacement of peoplePsychological impact on peopleloss of livelihood	Loss of shade & community trees, Loss of fuel wood and fodder, Loss of income	Noise and Air pollution	Odour and dust	Noise and Air pollution, Colli-sion with pedestrians livestock and vehicles	Air and noise pollution and discomfort	Commu-nity clashes with mi-grant la-bour
Cultural Assets	-	-	Displacement loss of structure within ROW	Loss of sa-cred trees.	Noise, vi-bration may cause dam-age to structure	-	Damage from vibration & air pollution	Dust accu-mulation	-

Project Activity	Planning and Design Phase	Pre-Construction Phase			Construction Phase				
Utilities and Amenities	-	-	Interruption in supply	-	-	-	Damage to utility and amenities	Dust accu-mulation on water bodies	Pressure on existing nearby amenities
Labour's Health & Safety	-	-	-	-	Increase of stagnant water and disease	Asphalt odour and dust	Collisions with vehicles, pedestrians & livestock	Impact on health due to dust generation	Increase in com-municable diseases

4.2 PROJECT INTERVENTION

The project intervention necessitates/demands the involvement of following resources, having major direct and indirect impact

- Land acquisition for the development of new road.
- Dismantling of few roadside residential and/or commercial structures (mostly encroachments) for proposed improvements.
- Clearing and grubbing of vegetation & felling of existing trees for construction activity and road safety.
- In addition, project road construction will require 3M i.e. Men, Material and Machinery for execution of construction Work.
- Construction work involves large number of manpower (both local and migrated, contractor staff).
- Construction material includes Borrow Earth, coarse and fine aggregated and water.
- Construction machinery includes Crusher Plant, Bitumen plant, Batching Plant and Pavers, Graders, road rollers and dumpers etc.

The provisional quantification of each of the above mentioned resources, required for project intervention, is tabulated in **Table 4.3**.

Table 4.3: Potential Impacts and Requirement of Man, Materials & Machinery

Sl. No	Description	Unit	Quantity	Remarks
1.	Land Acquisition	Ha	348.29	Irreversible Impact
2.	Dismantling of Structures	Nos.	219	Irreversible Impact
3.	Removal of trees	Nos.	12111	Irreversible Impact
Man, Material and Machinery Requirement for Construction Activity				
4.	Aggregate	cum	13.88 Lakh	Identified Quarries
5.	Earth	cum	63.82 Lakh	Identified Borrow Areas
6.	Sand	Aggregate/ Metal cum	4.75 Lakh	Identified Sand Quarries
7.	Cement	Tonnes	1.17 Lakh	Identified nearest Cement Factory
8.	Bitumen	Tonnes	0.22 Lakh	Approved Refinery
9.	Steel	Tonnes	0.29	Identified Steel Plants
10.	Water	Kilolitre	130(Approx.)	All construction activities and for worker use.

A desperate endeavour has been made by the consultant, during the design process, to minimize the impact and use of resources**.**

4.2.1 Land Acquisition

The major impacts during pre-construction and designing phase are related with the land acquisition. The new alignment needs land area throughout the corridor. The RoW considered for the new alignment is generally 70m. It is proposed to further increase the ROW for the toll plaza and interchanges throughout the stretch as per IRC specification. In such case, loss of productive agricultural land, and private properties is anticipated. The major land-use along the project road is agriculture, so the major share of land acquisition shall be from agriculture land. No forestland needs to be acquired. Total **351.30** ha land is required to be acquired for then proposed project.

4.2.2 Removal of Pavement

Since it is a greenfield project, there are no pavement required to be removed, hence no impact.

4.2.3 Removal of Roadside Structures

Roadside dwelling and business unit would also be impacted, and their impact may not be transformed rather need mitigation measures. Engineering Design team in consultation with environmental and social team has finalized the alignment to minimize/ restrict the impact on built-up areas. Even after such engineering efforts, some of these residential and/or commercial units are required to be dismantled (partially or fully). **Appendix 3.4** gives details of road side structure removal.

Strategies will be adopted for the reuse of these materials so that impact of disposal of these materials could be minimized.

4.2.4 Construction Material

The **Table 2.13 in Chapter-2** presents the details of construction material required for construction of new project road. The quarries for these aggregates and borrow earth are locally available hence No significant direct impact is envisaged, however strict guidelines have been prepared to minimize the adverse impact; some of these guidelines are as follows.

- Top soil will be excavated and preserved and reapplied for vegetation growth.
- The contractor shall prepare redevelopment plan for the quarry site and get it approved by the EMU, before the commencement of any quarry activity.
- Contractor will be responsible for adhering to the condition laid by the Director of Geology and Mining at the time of issue of quarrying permit or quarrying lease.
- The contractor shall restore all haul roads to their original state.
- Contractor will be responsible for enforcing all safety measures/guidelines detailed time to time by EMU.

4.2.5 Machinery and plant for construction activity

Vehicles & machinery like Dumpers, Excavators, Road Rollers, Pavers etc. will be required for project intervention and will have an impact on their influence area. These machinery will have its bearing on surrounding environment especially on air quality subject to emission level of machinery and Noise Environment, however strict guidelines have been prepared to minimize the adverse impact, some of these guidelines are as follows:

- Construction equipment and Machineries deployed for construction will be regularly maintained and not older than 3 years.
- Vehicles/ equipment will be regularly subjected for emission tests and will have valid “Pollution under Control” certificate.
- All vehicles deployed for material haulage will be spill proof.
- Water tankers with suitable sprinkling system will be deployed along the haulage roads and in the work site.

4.2.6 Manpower for Construction Activity

Contractor will be encouraged for hiring/ engaging more and more local labours.

- Contractor is responsible to adhere to the safety measures indicated in the **Appendix 4.6 Workers Safety During Construction Activities.**
- Contractor is responsible to ensure proper medical, hygiene, Sanitation and shelter facilities.
- Contractor will encourage/ facilitate HIV/AIDS prevention awareness programs in construction Camp/s.

4.3 AIR ENVIRONMENT

Motor vehicles have emerged as one of the major sources of air pollution especially in urban areas. Due to the proposed road construction the number of vehicles on these roads will be increased over time, so impacts on ambient air environment may be significant, which needs detailed analysis.

4.3.1 Meteorological factors and climate

Impacts: Due to the construction and operation of the project, no impacts are expected to contribute to the micro-climatic and meteorological conditions of the project-affected region. The project will have a comprehensive afforestation program and avenue plantation that includes shrub plantation in the median and RoW edge. This could provide shade and canopy to larger areas. This could reverse if any minor or negligible impacts do exists due to the construction of the project road.

Mitigation: As indicated in previous chapter, there will not be any micro-climatic effect/impact due to increased traffic emission on the project road during construction and operation phase, if any minor impact do exists due to construction of project road, will be counter by compensatory and additional afforestation plan and avenue plantation.

4.3.2 Air Quality Emissions

4.3.2.1 Preconstruction Phase

Impacts The preconstruction stage activities include site clearance, shifting of utilities, removal of trees present in the corridor of impact, transportation of man and material, construction of accommodations, construction of stockyards, installation of construction plants and construction of office buildings. Dust generation during such activities would be the predominant polluting activity during pre-construction stage and particularly so if pre-construction tasks are performed during dry weather. The impacts due to the pre construction activity are temporary and location specific and the width of the impacts is limited. Impacts at the pre construction stage are temporary as these are localized and fugitive in nature.

Mitigation: As indicated in previous chapter, the dust generation due to preconstruction activities is very temporary and localized, and will be efficiently countered by sprinkling of water.

4.3.2.2 Construction Phase

Impacts: During the construction phase, dust emissions in unpopulated areas will be emitted and deposited on the leaves of trees and other vegetation which may affect the growth of the trees and other vegetation. Certain amount of dust and gaseous emissions will be generated during the construction phase from excavation machine and road construction machines. Pollutants of primary concern include particulate matters i.e. PM10 and PM2.5. However, suspended dust particles matter may be coarse and will be settled within a short distance of construction area. Therefore, impact will be temporary and restricted within the closed vicinity of the construction activities only.

Gaseous emissions include carbon monoxide (CO), unburned hydrocarbons, sulfur dioxide (SO_2), nitrogen oxides (NOx), volatile organic compounds (VOC's) etc. from the DG set/ vehicles involved in transportation of materials during road construction.

Generation of dust and particulates is from:

- Site clearance and use of heavy vehicles and machinery etc.
- Transport of raw materials, borrow and quarry material to construction sites;
- Earthworks;
- 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 in quarries, borrow areas and stone crushing units. This is a direct adverse impact, which will last almost throughout the construction stage along the project road.

Generation of Exhaust Gases

Generation of exhaust gases is likely due to movement of heavy machinery for clearance of the PROW for construction. Toxic gases are released through the heating process during bitumen production. Although the impact will be much localized, it can spread downwind direction depending upon the wind speeds. The health effects of inhaling particulate matter have been widely studied in humans and animals and include asthma; lung cancer, cardiovascular issues, and premature death and are given in **Table 4.4.**

Table 4.4: Emission and their Impacts (Prediction of Impact on Ambient Air Quality)

Emission	Impact	
	Human	**Vegetation**
Hydrocarbons	Prolonged exposure to hydrocarbons contributes to asthma, liver disease, lung disease, and cancer. Inhaling formaldehyde can cause irritation. It is a major contributor to eye and respiratory irritation, which is caused by photochemical smog.	Ethylene causes injury to the leaves of sensitive plants. Effects are epinasty, chlorosis, curling, and abscission and growth retardation
CO	Reduces the ability of haemoglobin to carry oxygen to the body tissues.	-
NOx	Nitrogen dioxide damages the cell membranes in the lung tissues and constriction of the lung passages. Edema or a filling of the intercellular spaces with fluid. Eye and nasal irritation and pulmonary discomfort are also common.	Nitrogen dioxide causes growth retardation.
CO_2	Asphyxiation, caused by the release of carbon dioxide in a confined or unventilated area. Kidney damage or coma. .	Elevated atmospheric carbon dioxide and reduces plant growth
Ozone. .	Ozone causes an irritant action in the respiratory tract, cough chest pain, eye irritation, headaches and asthma attacks. Chronic effects include losses in immune system functions, accelerated aging and increased susceptibility to other infections	Ozone concentrations cause flecks on the upper surfaces, premature aging and suppressed growth, leaf bleaching, necrosis
SO_2	The health problems related to the mucous membrane and respiratory tract are due to sulfate aerosols. Chronic effects of SO2 include increased probabilities of bronchitis, "colds" of long duration and suppression of immune system.	SOx produce injury on leaves and plants which is characterized by the killing of marginal or intervention areas of the leaf.

Emission	Impact	
	Human	Vegetation
Fugitive Dust	Irritation to the eyes, nose and throat. Respiratory distress, including coughing, difficulty in breathing and chest tightness. Increased severity of bronchitis, asthma and emphysema.	Reduced photosynthesis due to reduced light penetration through the leaves. This can cause reduced growth rates and plant vigor. Increased incidence of plant pests and diseases.

Mitigation: During the construction stage, there are two major sources: the first one is construction activities at working zones, which cause primarily dust emission and second are from operation of the construction plant, equipment and machinery, which causes gaseous pollutants. The specific measures include:

- Locating Plant at a significant distance from nearest human settlement in the predominant down wind direction.
- Vehicles delivering fine materials like soil and fine aggregates shall be covered to reduce spills on existing roads.
- Water will be sprayed on earthworks, temporary haulage and diversions on a regular basis.
- Batch type hot mix plants fitted with the bag filter / cyclone and scrubber will be installed for the reduction of the air pollution.
- Pollution control systems like water sprinkling and dust extractors and cover on conveyors will be installed for the crushers.
- All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the emission levels conform to the SPCB/CPCB norms.
- Air pollution monitoring plan has been delineated for construction phase separately for checking the effectiveness of the mitigation measures adopted during the construction phase of the contract.

4.3.2.3 Operational Phase

Impacts: During the operational stage air pollutant will be from vehicular movements on road. The severity of impact of gaseous pollutants due to vehicles plying on the highway at any given time will depend upon the traffic volume, emission rates of auto exhausted pollutants and prevailing metrological condition within the project corridor. However, air quality modeling was carried out in order to predict the future air quality near project area. The predications were done based on the future traffic volume forecasted for the proposed road.

Mitigation: As indicated in previous chapter, the air pollutant will be from vehicular movement on road and dust emission by tyres. As such the national and international bodies are quite active in controlling the air pollution through emission limit, auto technology and fuel quality which will counter the increase in air pollution due to increase in traffic during operation phase. Additional measures/proposed are given below:

- Pollution resistant species, which can grow in high pollutant concentrations or even absorb pollutants, can be planted along the roadside.
- Monitoring of air pollution levels at sensitive locations shall be carried out all through the operation stage to check that the pollution levels are within standards prescribed by CPCB. A monitoring plan to this effect has been prepared and is presented in the EMP.

- Other measures such as the reduction of vehicular emissions, ensuring vehicular maintenance and up-keep, educating drivers about driving behaviour / methods that will reduce emissions are beyond the scope of the Project but will be far more effective in reducing the pollutant levels

4.3.2.4 Air Quality Modeling

The emission factors considered for calculation of emission load are referred from CPCB website. The CPCB (exhaust emissions from cpcb website) published emission factor for different type of vehicles like passenger cars, Heavy diesel vehicles and 2/3 Wheelers. The total emission load calculated based on traffic volume and emission factors is given in **Table-4.5.**

Table-4.5: Pollutants emission load

Year	CO Emission (g/s/m2)	NOx Emission (g/s/m2)	HC Emission (g/s/m2)	PM Emission (g/s/m2)
2030	0.00002145	0.00002116	0.00000284	0.00000059
2040	0.00005370	0.00005232	0.00000684	0.00000014
2050	0.00013100	0.00012634	0.00005873	0.00000034

The location Attibele-Rayakottai Road (SH-85) near Agandapalli village was consider for the air quality modeling. This location is junction therefore there will be diversion of traffic at this location. Also, this location is residential area along the road. The AERMOD model was run for CO, NOx HC and particulate matters. The air quality was predicted for year 2030, 2040 and 2050. It is evident from the modeling result of air pollutants concentration of CO, NOx, PM10 and PM2.5 given in **Table 4.6, Table 4.7, Table 4.8 and Table 4.9** respectively is within CPCB limits during operational phase of the project.

Table-4.6: Predicted CO Quality

Parameters	Year	Baseline Concentration	Incremental Concentration	Resultant Concentration	CPCB Standard
CO	2030	460	92.20	552.20	2000 microgram/m3
	2040		230.84	690.84	
	2050		563.13	1023.13	

Table- 4.7: Predicted NOx Quality

Parameters	Year	Baseline Concentration	Incremental Concentration	Resultant Concentration	CPCB Standard
NOx	**2030**	16.13	9.03	22.16	80 microgram/m3
	2040		22.35	38.48	
	2050		51.58	67.71	

Table- 4.8: Predicted PM 10 Quality

Parameters	Year	Baseline Concentration	Incremental Concentration	Resultant Concentration	CPCB Standard
PM 10	2020	48.6	0.25	48.85	100 microgram/m3
	2030		0.61	49.21	
	2040		1.46	50.06	

Table-4.9: Predicted PM 2.5 Quality

Parameters	Year	Baseline Concentration	Incremental Concentration	Resultant Concentration	CPCB Standard
PM 2.5	2030	11.8	0.25	12.05	60 microgram/m3
	2040		0.61	12.41	
	2050		1.46	13.26	

However, air quality parameters are within the CPCB limits during operational phase of the project, also it will be ensured that in future statuary and regulatory compliance requirements with respect to emission limits, auto technology, and vehicular fuel quality would have minimum negative impacts.

4.3.3 Air Quality Monitoring – mitigation

Apart from provision of the mitigation measures, their effectiveness and further improvement in designs to reduce the air pollution with increase in traffic shall be monitored. The monitoring plan shall be functional in construction as well as in operation stages. The frequency, duration locations, and responsibility will be as per the **Table-6.1**, Environmental Monitoring Program (**Chapter 6**). Any value/result not within acceptable limits will be reported to engineer, for remedial measures.

Regular water sprinkling will be done to suppress dust during construction phase. site. Air pollution norms will be enforced. Labourers will be provided masks. Fine materials to be completely covered, during transport & stocking. Plant to be installed in downwind direction from nearby settlement

4.4 LAND ENVIRONMENT

4.4.1 Topography

Impacts: Since it is a green field project and considerable portion of the alignment passes through low lying area, it is proposed to raise the height of the embankment throughout the length of the road. The overall topography of the area is not going to alter much due to these minor changes, rather there will be some positive impacts as follows:

- Raising of embankment leads to no submergence areas, for round the year connectivity.
- More drainage structures will ease/improve the hydrology of the area, relieve the flooding situation.
- Vertical geometrics improvement leads to better sight distance, safer transportation.
- Junction design/ improvement will provide better and efficient traffic movement.
- The embankment will be raised throughout the length of the alignment on an average by 2.5m from the existing level.

Mitigation: As indicated in previous chapter, raising of the embankment is done to relieve the waterlogging in the area. There is no appreciable change in topography. The raising due to submergence and profile improvement is positive impacts on the local environment. The raised sections are located away from habitations. Adequate measures have been taken so that the raising if any in settlement areas should be minimum possible and in no case exceed 0.5 m

4.4.2 Geology

Impacts: Likely impact on the geological resources will occur from the extraction of materials (borrow of earth, granular sub base and aggregates for base courses and bridges). The boulders will be procured from the authorized suppliers and prevalent rules will be followed for borrowing of soil, sand

and aggregates. Hence, the impact on general geology of the region is insignificant. At the construction sites, no blasting is proposed; therefore, there will be no added impact on the geology of the area.

Mitigation: As part of the Project preparation, the sources of quarries for the fine and coarse aggregates have been identified for use in road works and structural works, details of the quarries have been presented in Chapter 5 Environmental Baseline Data. No new quarry has been proposed for the Project requirements. Only existing, live, licensed quarries will be used as sources of coarse and fine aggregates. It will be ensured that the aggregates procured during construction stage will be from the authorized or licensed suppliers only. In case of use of any new quarry by contractor, the instructions/procedure as detailed in **Appendix 4.1**: **Guidelines for Aggregate Quarry Management** will be applicable.

Selected soil borrow areas have been identified during the design stage of the Project. Most of these borrow areas are local borrow areas, and agricultural fields not in productive use, and where farmers want to lower the level of the land (reduction of energy requirement for the watering and reduce loss of water, nutrients, and fertilizer through the seepage). The list of the borrow areas is given in Chapter 5 Environmental Baseline Data. In case of taking earth from any of these, borrow areas the instructions / procedure as detailed in **Appendix 4.2: Guidelines for Borrow Area Management**, will be applicable.

4.4.3 Seismology

Impacts: The construction and operation of the project road will not lead to any adverse impact on seismology settings of the regional environment. The seismic events that could occur on the region can damage the road and structures if not constructed as per the specification recommended for the seismic zone. The proposed design will incorporate earth quake resistant factors. Project road falls under ZONE II as per seismic map of India.

Mitigation: As indicated in previous chapter, there will be no impact on the seismological setting of the region. Rather, as part of the project all the existing structures will be checked and constructed as per the seismological requirements of the region in conformity to the IRC 6, 2000 guidelines.

4.4.4 land

Impacts: One of the major 'local' impacts due to highway project is upon the local land resources required for construction of the project road. It is new alignment, where acquisition of agricultural land has been unavoidable to accommodate the proposed cross-sections

Mitigation: As far as possible, the land acquisition has been kept to the minimum by restricting the geometric improvement within the existing right of way. The same can be seen, as only 351.30 hectare land is required for construction of new project road. However, the land acquisition will be done at sections having width, insufficient to accommodate the approved cross-sections & geometric improvements. Also compensation for land will be provided to the affected persons

4.4.5 Generation of Debris

The major source of debris generation is dismantling of existing cross drainage structures and roadside residential and commercial structures.

Mitigation Due to the removal of structures (Residential and commercial), pavement scarification and cross drainage structures lot of debris will generate, which need to be disposed properly to avoid contamination of land and water. For safe and environmental friendly disposal of waste debris the instruction/procedure specified in **Appendix 4.3: Guidelines for Debris Disposal Sites and Management**, will be applicable

4.4.6 Soil Erosion

Erosion of top-soil can be considered a moderate, direct and long-term negative impact resulting from the construction and maintenance of roads. The potential for soil erosion is high and pervasive during the construction stage. Starting with clearing and grubbing of trees, vegetation is stripped away, exposing raw soil. The construction of new fill slopes for grading and bridge-end fills also exposes large areas to erosion, if protection methods are not implemented. Finally, during the operation or maintenance phase of highway development, erosion can continue to occur in areas not vegetated. Fills are exposed to long-term exposure to water and wind. Although soil erosion occurs sporadically on highway corridors, the sites most affected are generally bridge end fills and over-steep banks

Mitigation: A comprehensive instruction/procedure is prepared in **Appendix 4.4: Guidelines for Site Clearance and Tree Felling.**

a) Road Slopes and Spoils

Erosion problems may occur on newly constructed slopes and fills depending on soil type, angle of slope, height of slope and climatic factors like wind (direction, speed and frequency) and rain (intensity and duration). Since slope protection methods (re-vegetation or stone pitching) form part of good engineering practice, and have been incorporated into the detailed design for the roads, erosion concerns should be minimized. However, failure to maintain soil erosion protection can reduce the security of high road embankments and add siltation to the rivers during the monsoon season.

Mitigation: Adequate measures have been devised for control of the soil erosion from the embankments; the slopes have been restricted to **1 vertical: 2 horizontal** for most of the sections. Soil erosion through embankments is prevented and controlled by following methods:

Grassing of slopes: (for emb. ht. < 3.0m). For this purpose, it is best to use locally growing grasses and bushes, as these are best adapted to the local soil, temperature and rainfall conditions. Plantation is best done just after the first pre-monsoon showers, which gives a time of 2-3 weeks for the grass to take root before the onset of monsoon. Normally, no watering of the grassed slopes is done following the planting. However, watering of the slopes may be provided if the planting is done in the non-monsoon season, or to respond to dry conditions following planting. The above methods of providing vegetation cover on embankment slopes follow provisions in IRC-56-1974, "Recommended Practice for Treatment of Embankment Slopes for Erosion Control".

b) Construction of Bridges and Culverts

Construction of one major bridge, 6 minor bridges and 73 culverts is planned on the proposed road. Construction of new bridges involves excavation of riverbed and banks for the construction of the foundation and piers. If the residual spoil is not properly disposed of, increased sedimentation downstream of the bridge may take place during the monsoon. For details of bridges proposed for construction, refer Table 2.5 - Salient Features of Proposed Project Alignment, and Table 2.7a and 2.7b - List of Minor & Major Bridges in Chapter 2 of this report.

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 roads for haulage of man and machinery. 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 is not adverse and does not warrant mitigation (as the road design itself takes care of cross-pavement drainage). New culverts are being incorporated in the project roads not only to prevent over-topping but also to maintain equal water distribution on either side of the road. In fact, the bridges and culverts, as designed, are an automatic enhancement to the local environment (flooding, stagnation, scour, torrent run-off velocity– all would be reduced as a result of this project).

Mitigation: Contractor will be responsible of removing all the debris/ earth generated due to dismantling of existing structure and excavation of the foundation of cross drainage works, from the water course before the onset of monsoon.

c) **Quarries and Borrow Areas**

The excavation of quarries and borrow pits used for obtaining soil and aggregate materials 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, 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 will be required. Approximate requirement of construction materials to the project corridors are already presented in **Table 4.3**. One of the long-term residual adverse impacts of borrow pits not reclaimed is the spread of malaria. Mosquitoes breeding and multiplying in stagnant water that collects in these pits can affect humans in villages and towns close to the features.

Mitigation: A comprehensive management plan for restoring of quarry and borrow area is prepared. Refer **Appendix 4.1: Guidelines for Aggregate Quarry Management & Appendix 4.2: Borrow Area Management.**

Prior to the start of the relevant construction, the Contractor shall submit to the Engineer for approval, his schedules for carrying out temporary and permanent erosion/sedimentation control works as are applicable for the items of clearing and grubbing, roadway and drainage excavation, embankment/sub-grade construction, bridges and other structures across water courses, pavement courses and shoulders. He shall also submit for approval his proposed method of erosion/sedimentation control on service road and borrow pits and his plan for disposal of waste materials. No construction activity will start prior to approval by engineer, of the measures and method to be adopted by contractor.

4.4.7 Contamination of Soil

Construction Stage: In this project, contamination of the soil may take place, from the following activities at the construction zones, construction labour 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;

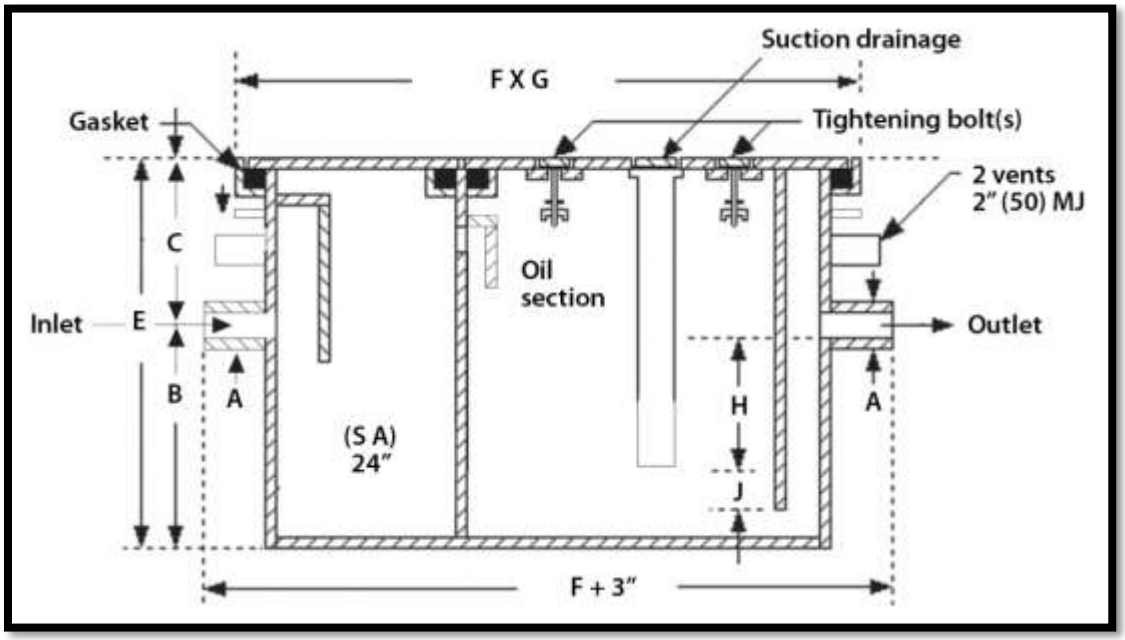
- Scarified bitumen wastes, over production of bituminous product,
- Debris generation due to dismantling of structures,
- Maintenance of the machinery and operation of the diesel generator sets on site,
- Oil spill from the operation of the diesel pumps and diesel storage, during transportation and transfer, parking places, and diesel generator sets,
- Operation of the emulsion sprayer and laying of hot mix,
- Operation of the residential facilities for the labour and officers,
- Storage and stock yards of bitumen and emulsion,
- Excess production of hot mix and rejected materials,

Mitigation: Contamination of soil can spoil the soil and can also contaminate the surface as well as ground water sources. Details of potential impacts due to the contamination of soil and their mitigation are presented in **Table 4.10.**

Table 4.10 Potential impacts due to the contamination of soil and their mitigation

Potential Impact	Mitigation
Scarified bitumen wastes, Excess production of hot mix and rejected materials.	Scarified waste and excess/rejected hot mix, with the consent of village authority, will be used in village roads construction.
Debris generated from dismantling of structures.	A comprehensive list of instructions/procedures has been suggested in **Appendix 4.3: Guidelines for Debris Disposal Sites** and Management**,** for contractor to adhere to for safe and environmental friendly disposal of debris.
Maintenance of the machinery and operation of the diesel generator sets on site	The base of all machinery, generators will be paved and all the waste/spill will be drained to oil interceptor before discharging. Conceptual Plan of oil interceptor is shown in **Figure 4.1.**
Oil Spill from the operation of the diesel pumps and diesel storage, during transportation and transfer, parking places, and diesel generator sets	
Operation of the emulsion sprayer and laying of hot mix	Proper demarcation of the surface to be sprayed /paved will be done to minimize the excessive spread of emulsion/hot mix
Operation of the residential facilities for the labour and officers	The residential facilities will be provided with proper sanitation, and planed setup of construction camp. A comprehensive plan of construction camp is prepared in **Appendix 4.5: Guidelines for Siting & Layout of Construction Camp**
Storage and stock yards of bitumen and emulsion	The base of bitumen/emulsion stock yard will be paved and all the waste/spill will be drained to oil interceptor before discharging.

Oil interceptor: Oil and grease from polluting run-off is another major concern. During construction, discharge of Oil and Grease is most likely from workshops, oil and waste oil storage areas, diesel oil pumps, vehicle parking areas from the construction camps. Vehicle/machinery and equipment maintenance and refuelling will be carried out so that spillage of fuels and lubricants do not contaminate the soil. The source is well defined and restricted. An “oil interceptor” will be provided for wash down and refuelling areas. Fuel storage will be in proper bunded areas. All spills and collected petroleum products will be disposed off in accordance with MoEF&CC and SPCB guidelines. Fuel storage and fueling areas will be located at least 300m from all cross drainage structures and significant water bodies. **Drawing 4.1** provides the conceptual plan of the arrangement for the oil interceptor for the removal of oil and grease.



Drawing No. 4.1: Conceptual plan of Oil Interceptor

Operation Stage: During the operation stage, soil may get contaminated with similar reasons, as mentioned above, during routine and periodical maintenance of the project road. The implications of accidental discharge are potentially disastrous. But, it must be emphasized that the probability of such an accident is quite low, as one of the objectives of the design is the enhancement of road safety.

4.4.8 Soil Quality Monitoring - mitigation

Apart from provision of the mitigation measures, their effectiveness and further improvement in designs to reduce the concentration of pollutants in the soil due to construction activity shall be monitored, as contamination of soil is directly linked with contamination of water. The monitoring plan shall be functional in construction as well as in operation stages. The frequency, locations, duration and responsibility will be as per **Table-6.1 of Chapter 6**: **Environmental Monitoring Program**. Any value/result not within acceptable limits will be reported to engineer, for remedial measures.

4.4.9 Construction and Demolition Waste-Mitigation

The key objectives of the guidelines are intended to:

- Promote an integrated approach, whereby environmental management of construction and demolition waste is given due consideration throughout the duration of the project ;
- Approach has been towards reduction of environmental impacts
- Provide both general and specific guidance in relation to the preparation of satisfactory construction and demolition waste management plans for projects which exceed a specified threshold size

Construction and Demolition waste will be managed as per Construction and Demolition Waste Management Rules, 2016.

Major dust generating sources in C&D at sites are:

a. Loading and unloading activities: waste and C&D products

b. Incoming/outgoing vehicles

c. Due to machinery used in C&D operations

Other pollution abatement measures and safety issues

i. Residual waste deposition

Solid Waste generation/management in C&D waste operations-residues (C&D waste processing facility) will be sent to landfill in consultation with concerned authorities.

ii. Diesel use in equipment/genset/vehicle movement generate emissions: Necessary pollution control measures will be adopted to reduce emissions

C&D Waste Management rules are attached as **Appendix 4.0.**

4.5 NOISE ENVIRONMENT

4.5.1 Impacts

Environmental noise particularly 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 will be of temporary significance locally in the construction phase and slight increase may occur during the operation stages. **Table 4-11** presents the source of noise pollution and the impact categorization. Noise Impact and mitigation measures are presented in **Table 4-12**.

Table 4-11 Source of noise pollution

Sr. No.	Phase	Source of Noise pollution	Impact categorization
1	Pre-construction	• Man, material & machinery movements • establishment of labour camps onsite offices, stock yards and construction plants	• all activities will last for a short duration and also shall be localized in nature
2	Construction Phase	• **Plant Site -** stone crushing, asphalt production plant and batching plants, diesel generators etc • **Work zones -** Community residing near to the work zones	• **Plant Site:** Impact will be significant within 500m. • **Work zones:** Such impacts again will be of temporary nature as the construction site will go on changing with the progress of the works.
3	Operation Phase)	• due to increase in traffic	• will be compensated with the uninterrupted movement of heavy and light vehicles till the facility reaches the level of service

Table 4-12 Impact due to Noise and mitigation measures

Sr. No.	Item	Impact	Impact (Reason)	Mitigation
1.	Sensitive receptors .	Direct impact	The baseline noise is already exceeding the CPCB limits also there will be considerable increase in noise levels in the vicinity of road.	Noise barrier to be provided at locations of road passing through built-up area or residential area. Also traffic calming devises to be used. No Horn Zone sign Post to be displayed.
2a.	Noise Pollution (Pre Construction Stage)	Direct impact, short duration	Man, material & machinery movements. Establishment of labour camps onsite offices, stock yards and construction plants	Area specific and for short duration Machinery to be checked & complied with noise pollution regulations. Camps to be setup away from the settlements, in the down wind direction.
2b.	Noise Pollution (Construction Stage	Marginal Impact	Stone crushing, asphalt production plant and batching plants, diesel generators etc. Community residing near to the work zones	Camps to be setup away from the settlements, in the down wind direction. Noise pollution regulation to be monitored and enforced.
2c.	Noise Pollution (Operation Stage)	Marginal Impact	due to increase in traffic (due to improved facility)	Noise barrier to be provided at locations of road passing through built-up area or residential area. Also traffic calming devises to be used. No Horn Zone sign Post to be displayed.
3.	Noise Pollution Monitoring		Effectiveness / shortfall (if any) Any unforeseen impact	Measures will be revised & improved to mitigate/ enhance environment due to any unforeseen impact.

4.5.2 Noise Modeling

As evident from baseline monitoring data that baseline day & night time noise levels monitored at various locations along the proposed project roads are already higher than permissible limits specified by the MoEF&CC for residential and rural areas, noise is a major area of concern. Therefore, noise quality modeling was carried out using DhawniPro model in order to predict the future noise concentrations of the project area. It is evident from predicted values given in **Table 4.13**, resultant noise levels during operation phase of the project will slightly increase at receptor locations near proposed road which indicates some level of Noise impacts during operation phase of the project. The noise levels in year 2030, 2040 and 2050 are given in **Table 4-13**.

Table 4-13 Future Noise Quality (dB(A)) of the Project area

Location	Year	Baseline Concentration (Leq)	Incremental Concentration (Leq)	Resultant Concentration (Leq)	CPCB Standard
N 1	2030	53.30	56.2	57.99	Daytime 55 dBA and Nighttime 45 dBA for Residential area.
	2040		50.5	55.13	
	2050		59.1	60.11	
N 2	2030	48.85	56.2	56.93	
	2040		50.5	52.76	

Location	Year	Baseline Concentration (Leq)	Incremental Concentration (Leq)	Resultant Concentration (Leq)	CPCB Standard
	2050		59.1	59.49	
N 3	2030	44.85	56.2	56.50	
	2040		50.5	51.54	
	2050		59.1	59.26	
N 4	2030	54.10	56.2	58.28	
	2040		50.5	55.67	
	2050		59.1	60.29	

4.5.3 Mitigation Measures

- Noise standards will be strictly enforced for all vehicles, plants, equipment, and construction machinery. All construction equipment used for an 8-hour shift will conform to a standard of less than 90dB (A). If required, high noise producing generators such as concrete mixers, generators, graders, etc. must be provided with noise shields.
- Machinery and vehicles will be maintained regularly, with particular attention to silencers and mufflers, to keep construction noise levels to minimum.
- Workers in the vicinity of high noise levels will be provided earplugs, helmets and will be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A) per 8 hour shift.
- During construction vibratory compactors will be used sparingly within the urban areas. In case of complaints from roadside residents, the engineer will ask the site engineer to take suitable steps of restricting the work hours even further or use an alternative roller.
- Proposed tree and shrub plantations planned for avenue plantation especially close to settlements, may form an effective sound buffer during the operation stage.
- People will be convinced / educated to prevent sensitive land uses from developing up adjacent to the project corridors.
- Apart from provision of the mitigation measures, their effectiveness and further improvement in designs to reduce the concentration of pollutants in the soil due to construction activity shall be monitored, as contamination of soil is directly linked with contamination of water. The monitoring plan shall be functional in construction as well as in operation stages. The frequency, duration and responsibility will be as per the Environmental Monitoring Program. For location refer **Table 3-17** Ambient Noise Monitoring Locations including one at equipment yards. Any value/result not within acceptable limits will be reported to engineer, for remedial measures

4.6 WATER ENVIRONMENT

4.6.1 Impacts

Due to the proposed project, there will be some direct and indirect long-term impacts on the water resources. **Table 4-14** presents the major adverse impacts on the water resources and the indicators chosen to assess the impacts for the study.

Table 4-14 Impacts on Water Resources due to Construction Activities

Impacts Due to Construction	Indicators
Loss of water bodies	Area of water bodies affected
Loss of other water supply sources	Number of wells affected
Alteration of drainage, run off, flooding	No. of cross drainage channels
Depletion of ground water recharge	Area rendered impervious
Use of water supply for construction	Quantum of water used
Contamination from fuel and lubricants	Nature and quantum of contaminators
Contamination from improper sanitation and Waste disposal in construction camps	Area of camp / disposal site and, proximity to water bodies / channels

Surface Water Bodies: There are total seven Surface water bodies are located along the proposed alignment

Alteration of Cross Drainage: During the construction period, some amount of drainage alteration is anticipated, due to construction of temporary traffic diversions and new bridges and culverts. With these bridging of existing causeways, there will be an improvement in the drainage characteristics of the surrounding area and the alteration will be temporary in nature. All the diversions will be provided with adequate waterway for drainage.

Run-off and Drainage: Sediment accumulation in water bodies decreases the storage capacity for road run-off. To worsen the situation road construction activities can lead to increased run-off both, during the construction and operational stage. This can be considered a high adverse impact.

Sr. No.	Phase	Reason
1	Construction phase	The removal of vegetation and compaction of soil can lead to increased run-off during the monsoon
2	Operational phase	The area of open ground lost and added impervious black top surface increases the amount and rate of run-off.

Overall, there will be an increase in the impervious surface due to road construction. Since soil erosion is associated with concentrated flow of water it is imperative to prevent any increased diversion of run-off into drainage channels.

Water Requirement for the Project

Acquisition and management of water for construction is an issue that must addressed by the contractor. The Contractor expected to obtain water for construction purposes that is of a high-water quality. The total water requirement during construction and operation phase and wastewater generated during project cycle is given in **Table-4.15.**

Table 4.15 Water Requirement and wastewater generated (L/Day)

Sr. No	Water Requirement	Wastewater Generated	Remarks
Construction Phase for construction	1131839	Nil	The water will be used for curing and construction purpose. No wastewater generation.
Construction Phase for Workers and labor camp	157680	126144	Approximately 2628 persons will work during construction phase of the project and use water 60 LPD. The wastewater will be 80% of the total water used.

Sr. No	Water Requirement	Wastewater Generated	Remarks
Opeartion Phase	2760	2208	Approximately 23 persons will be employed for maintenance and use water 120 LPD

Increased Sedimentation: Degradation of water quality due to sediment transport may occur from activities like removal of trees, 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 sandy loam to clay loam.

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 supporting aquatic life. 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.

Contamination of Water during Construction Stage: The degradation of the surface and to a much less extent ground water quality can occur from pavement construction works, bridge 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
- 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 the operation of the diesel pumps and diesel storage, transportation and transfer, parking places, and diesel generators.
- Operation of the emulsion sprayer and laying of hot mix.
- Operation of the residential facilities for the labour and officers.
- Storage and stockyards of bitumen and emulsion.

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

Contamination of Water during Operation Stage: During the operation stage, water may get contaminated with similar reasons, as mentioned above, during routine and periodical maintenance of the project road. The implications of accidental discharge are potentially disastrous. But, it must be emphasized that the probability of such an accident is quite low, as one of the objectives of the design is the enhancement of road safety.

4.6.2 Mitigation Measures

Table 4-16 shows the details surface water bodies along the project alignment with the proposed mitigation measures. **Table 2.11** shows the details of ponds along the project alignment. For the conservation of the existing ponds, proper mitigation measure has been enhanced for the existing water bodies. Efforts had been made to minimize the piers by increasing span arrangement. Necessary mitigation measures shall be made to balance the affected area in water bodies due to proposed bridges.

Table 4-16 Surface Water Bodies-Mitigation

Sr No	Type of water bodies	Village name	Crossing Chainage (Km)	Impact	Mitigation/ Enhancement
1.	Natural stream	Biramangalam	150.950	Direct	Provision of CD structures
2.	Natural stream	Biramangalam	152.000	Direct	Provision of CD structures
3.	Canal Crossing	Thorapalli Agraharam	157.300	Direct	Provision of CD structures
4.	River Crossing	Thorapalli Agraharam (Ponniyar)	158.500	Direct	Provision of CD structures
5.	Canal Crossing	Allur	163.950	Direct	Provision of CD structures
6.	Canal Crossing	Attur (H/o Muthalli)	164.580	Direct	Provision of CD structures
7.	Canal Crossing	Pathamuththali	165.980	Direct	Provision of CD structures

Table 4-17 List of Ponds along the project road

S.No.	Taluka	Village	Design Chainage	Survey Number	Affected Area
1.	Denkanikottai	Biramangalam	150+700	842	3.5908
2.		Madhagondapalli	140+800	273	0.3778
3.		Peddamadhagondapalli	138+850	179/1	0.2490
4.				179/2	0.5431
5.	Hosur	Moranapalli	161+200	655/1	1.6583
6.				767	0.6250
7.				768/2	0.0700
8.		Nandhimangalam	169+400	201 & 202	1.0615
9.		S. Mudhuganapalli	145+000	54	0.1684

Ground water resources: Loss of other water supply sources includes removal of private and community ground water sources like bore wells, tube wells and open wells. These losses have been covered under the utility relocation process in the pre-construction phase of the DPR. Compensatory water supply sources will be set up before the start of construction activities. Impacted Ground water resources present along the project road and its mitigation measures are presented in **Table 4-18**.

Table 4-18 Ground water Sources-mitigation

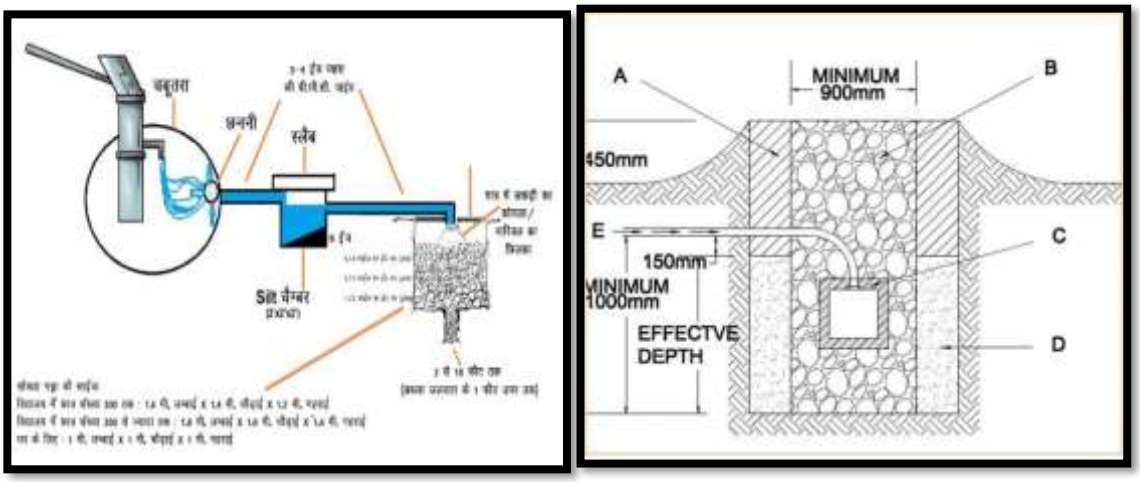
Sl. No.	Chainage (Km.)	Name of Common Property	Location (Left / Right)	Impact	Mitigation/Enhancement
1	148.000-149.000	Well	RHS	Direct	To be compensated
2	162.000-163.000	Well	RHS	Direct	To be compensated

Any source of community water (potable or otherwise) such as open wells, ponds, tube-wells and bore wells, accidentally lost will be compensated immediately. The typical layout of the soak pit is presented below in **Drawing No. 4.2.**

Alteration of cross drainage

- All cross drainage structures have been designed to handle a 50-year peak flood level. A detailed hydrological study will be carried out to calculate the design discharge.

- Pipe drainages will be provided for diversion roads constructed for the construction of new bridges and culverts.
- Storm water from all longitudinal and cross drainage works will be connected to the natural drainage courses.
- The contractor will remove obstructions that may cause temporary flooding of local drainage channels, during the construction phase.
- Contractor will be responsible for removal of debris generated due to the dismantling of structure and earth generated due to the excavation of foundation, from the water course before the onset of monsoon.



Drawing No. 4.2: Conceptual plan of Soak Pit for Hand Pump

Runoff and drainage

- Continuous Drain (lined/unlined) will be provided throughout the project road for efficient drainage of storm water.
- Lined drain is provided at built-up sections for quick drainage of storm water.
- The increased runoff due to increased impervious (Bituminous Top) surface will be countered with increased pervious surface area through soak pits, at hand pump locations.
- The local bodies need to discourage/stop the filling of private water bodies, ponds etc. to develop commercial places and shops due to the improved roads and improved connectivity.

Water Requirement for Project

The measures for water conservation are as follow:

- Contractor needs to obtain approvals for taking adequate quantities of water from surface and ground water sources. This is required to avoid depletion of water resources.
- Contractor is required to minimise wastage of water.
- Water conservation methods to adopt during construction process to make optimum use of water, as limited water sources are available along the proposed alignment.
- The septic tanks will be constructed at site during construction and operation phase of the project. The wastewater will be collected from site on regular basis and treated in nearby common effluent treatment plant. If water will be discharged outside, the Use based classification for Surface Water as per CPCB Guidelines given in **Appendix-4.3.**

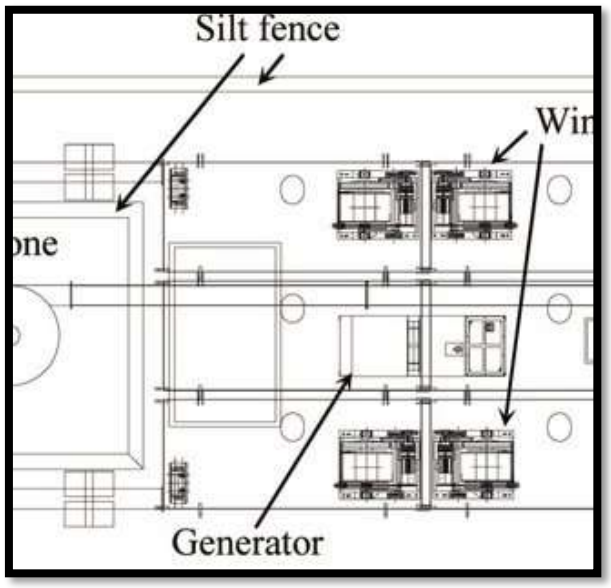
Increased sedimentation

- Silt fencing will be provided
- Desilting will be done for the existing ponds/Tanks, if any.
- Desilting of the waste water will be ensured before the discharge of drain water into natural stream
- Instructions given in **Appendix 4.9: Guidelines for Soil Erosion and Sediment Control** to be enforced.

Table 4-19 gives the list of silt fencing locations and **Drawing 4.3** presents the conceptual plan of Silt Fencing.

Table 4-19 List of silt fencing locations

S. No.	Location	Length (approximate)	Remark
1	Top soil storage	300m	Around the periphery of dumping yard
2	Borrow area site	100m	Along the length of borrow area in down slope direction
3	Surface Water bodies.	200m	Equals to diameter/length or as instructed by engineer
4	Plant Site	100m	In down slope direction of fine material



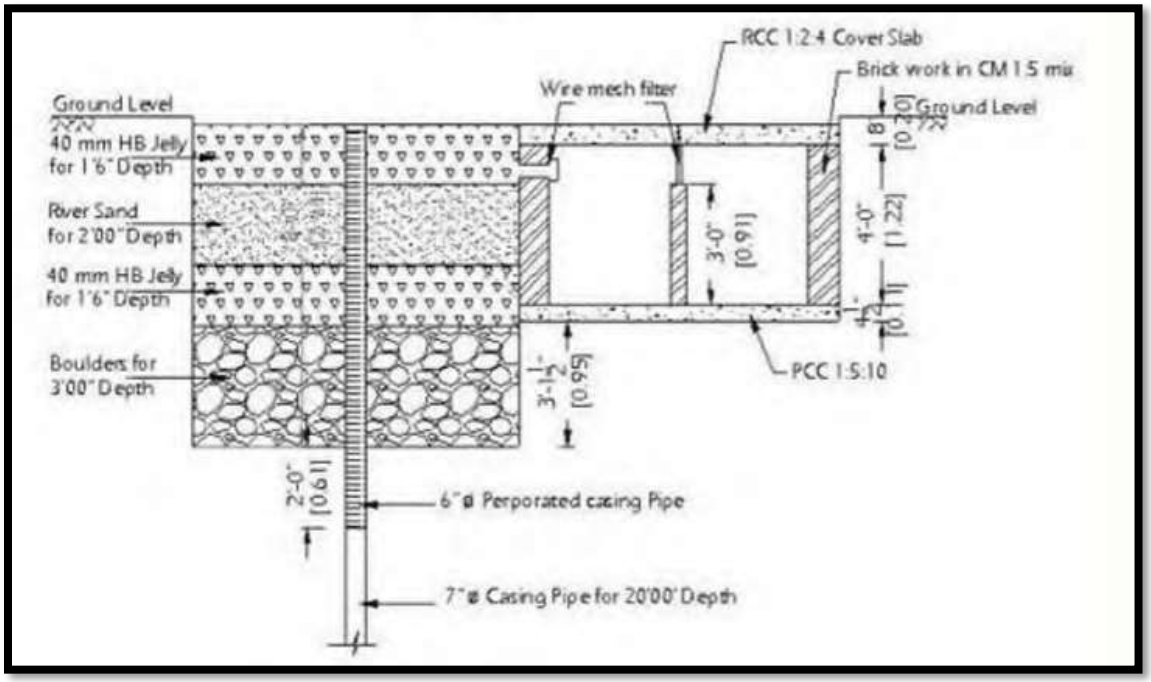
Drawing No. 4.3 Conceptual plan of silt fencing.

Rain Water Harvesting: This is s green field alignment project. The proposed project will increase of surface run-off due to more paved road surface. It will have adverse impact on ground water recharging if measures are not taken during the design. Therefore, compensation is required to recharge ground water.

Mitigation Measures

- Detailed hydrological survey will be conducted and adequate drainage facilities provided to discharge the run-off to existing catchments area.

- Provision of recharge pits, in the design to recharge ground water, in the urban area.
- Longitudinal road-side drains on both sides of the road and out fall should be nearby culverts/ bridges on nalas/ rivers/ drains.
- All the construction preparatory activities for culverts, bridges and other structures will be carried out during dry seasons.
- Water for construction will be arranged by the contractor from the existing sources.
- Minimum use of water from existing sources for construction purpose will be ensured promoted at construction site/camps to minimize likely impacts on other users.
- Rainwater harvesting structures shall be provided at every 500m on alternate sides of the road throughout the proposed alignment. The prototype drawing of Water harvesting Structure is given in **Drawing 4-4**



Drawing No. 4.4 Typical Rain Water Harvesting Structure

Contamination of Water

- Oil interceptor will be provided at plant site and truck lay byes.
- Construction work close to the streams or water bodies will be avoided during monsoon.
- The discharge standards promulgated under the Environmental Protection Act, 1986 will be strictly adhered to. All wastes arising from the project will be disposed off in a manner that is acceptable to the State Pollution Control Board (SPCB).
- All relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996 will be adhered to.
- Construction labourers' camps will be located at least 1000m away from the nearest habitation.

- All approach roads to rivers and other surface water bodies need to be closed permanently to avoid vehicle washing and to avoid major pollution sources. This is applicable to all areas including the secondary construction sites.
- Automotive service centres will be discouraged from establishing along the corridors without installing preventive measures against petroleum and oil contamination.

Water Quality Monitoring

Apart from provision of the mitigation measures, their effectiveness and further improvement in designs to reduce the concentration of pollutants in the soil due to construction activity shall be monitored, as contamination of soil is directly linked with contamination of water. The monitoring plan shall be functional in construction as well as in operation stages. The frequency, duration and responsibility will be as per the **Chapter 6: Environmental Monitoring Program.** For location, refer Table 3.20: Water Quality Monitoring Locations plus one at construction site. And standard/acceptable values are given in Table 3.21: Use based classification for Surface Water as per CPCB Guidelines. Any value/result not within acceptable limits will be reported to engineer, for remedial measures.

4.7 ECOLOGY

The construction of new project road can have a substantial impact on the degradation and loss of natural ecosystems, especially in less developed areas. Although the actual areas converted to highways may cover only a small proportion of the region, but the fragmentation of habitats caused by highway development is often severe. The scale of both the habitat conversion and habitat fragmentation effects caused by highway development varies with the size of the project. The impacts of projects also vary according to the environmental setting, especially the degree of naturalness in the local and regional ecosystems.

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 4-20** below presents the major adverse impacts on the flora & fauna and the indicators chosen to assess the impacts for this study.

Table 4-20 Impacts on flora & fauna due to construction activities

Impacts due to Construction	Indicators
Tree felling	No. of trees to be fell
vegetation	Area of vegetation loss
Cattle Grazing	Ground Area and location of grazing ground

4.7.1 Forest Area

No forest area exists within the corridor of impact. Therefore no direct impact on forest

4.7.2 Wild Life

The project is not falling near any protected area and its eco-sensitive zone therefore no wildlife clearance is required. As there is no notified wildlife area and wildlife movement in the project area, however there is elephant movement corridor in other project nearby, therefore it was advised by MOEF&CC to prepare a cumulative impact assessment for wildlife management. The cumulative impact assessment is prepared for the wildlife and given in section 6.11.

No endangered species as per IUCN red list is found in the project area

4.7.3 Tree Cutting

Impacts: Trees located within the toe line (bottom of formation) need to be removed for efficient construction workmanship and more importantly to prevent collision with the trees, in case of accident. 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. There will be a significant, direct impact on cutting of the roadside trees, it includes

The loss of shade

- Loss of tree products.
- 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 this trees act as noise barrier, dust absorption, air purifier etc.

A detailed tree inventory is being carried out of all the existing trees within the corridor of impact. Due care has been given in alignment design to reduce/minimize the loss of flora. As a result, a total of about 1367 trees are required to be cut for the proposed project. About 809 trees on the left side and 558 trees on the right side are being affected due to the proposed construction. The major trees affected are Thumma, Neem, kangua, Agipulla, Raavi, Giriship, Tamarand, etc.No tree will be cut beyond the proposed toe line. Cutting of trees for fuel by workers, especially near their camps is of major concern. Therefore adequate training of the workers and availability of their fuel requirements are to be ensured by the contractor.

Mitigation: The mitigation and enhancement measures taken along the project corridor includes

a) Compensatory Afforestation: to compensate the felling of trees.

b) Avenue Plantation

c) Plantation at enhancement sites, if any

d) Landscaping at Junctions and intersection locations etc.

Compensatory Afforestation: Compensatory afforestation will be taken up as per the Forest (Conservation) Act, 1980. For each tree felled, ten trees will be planted. The **NHAI** will bear the cost of such afforestation. Refer **Appendix 4.10: Arrangement with Forest Department**

- To minimise loss of trees, clearance of only those trees identified from the design will be removed.
- Endangered species, if found during construction, will be transplanted as per **the Appendix 4.12: Guidelines for Transplantation of Trees.**
- No tree will be removed in the zone of construction without the prior approval of the State Forest department, through the supervising engineer.

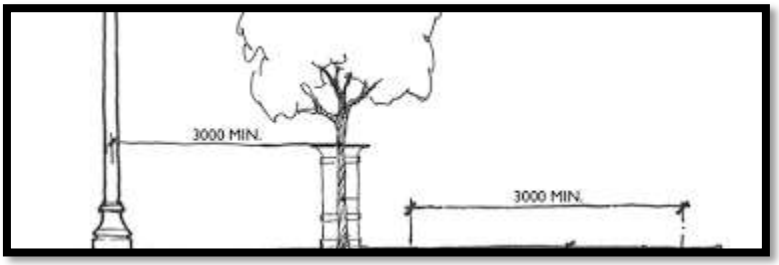
Avenue Plantation: In addition to the compensatory afforestation, trees shall be planted along the project corridors by the NHAI through Department of Forest for this purpose. NHAI should sign a MOU with Department of Forest. Such plantations will be initiated once the construction is complete. The objective behind such plantation is to cover/ re-vegetate the areas within the RoW that are at presently barren. To maintain the present character of strip plantation, similar indigenous trees should be planted. Refer **Appendix 4.11: Guidelines for selection of Tree Species.**

- Considering the combined compensatory afforestation by DoF and the plantation by the NHAI, a total of 1,21,110 saplings will be planted along the corridor. **Drawing 4.5** presents the conceptual plan for Avenue Plantation.

Drawing No. 4.5 Conceptual Plan for Avenue Plantation

Landscaping at Junctions and medians

No trees are planted up to 50m before the intersections so as to achieve clear sight distances for intersections, shrubs will be planted at 1.5m c/c as per the design shown in the Drawing no. 7.5. Beyond this point, only dwarf shrubs are planted. The height of these shrubs should be such that they do not obstruct the view of traffic coming from the intersecting road. The plants recommended for intersections are *Cleodendron, Antirhinnum, Browallia* etc. The intersections where landscaping is proposed is presented in the individual EMPs. The supervision consultant shall ascertain availability of space in the junctions mentioned below and plantation shall be done in the available space. Refer **Appendix 4.11: Guidelines for selection of Tree species. Drawing 4.6** presents the conceptual plan for tree guard.



Drawing No. 4.6 Conceptual Plan for Tree Guard

4.7.4 Removal of Vegetation

Impacts: Clearing and grubbing of the area is the foremost requirement to start the construction activities in accordance with MORTH specifications. 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.

Mitigation:

- Measures will be taken in reducing and curtailing the clearing and grubbing of excess land.
- High embankment will be re-vegetated with local shrubs and grasses to prevent soil erosion from the bare earth, prior to the monsoon.

4.7.5 Cattle Grazing

No cattle grazing grounds have been found along the corridor of Impact.

4.8 SOCIO-ECONOMIC ENVIRONMENT

4.8.1 Impacts

Engineering, environmental and socio-economic surveys, conducted during the design phase, for the generation of the baseline information, give indications of several adverse impacts in the vicinity of the alignment, which are related to common human psychology and general in nature.

4.8.1.1 Fear of uncertainties regarding future

These normally become long lived, given the length of time, which elapses between initial surveys and commencement of construction. Land and property owners are subjected to sufferings regarding uncertainties of the extent of loss and the nature of compensation. These involve:

- uncertainty of the amount of land/property to be acquired,
- time of acquisition and evacuation,
- extent and amount compensation,
- Provision of alternative land or job, etc.

4.8.1.2 Inducement of Land prices

Once the project becomes common knowledge, there may be an incidence of unscrupulous speculators moving in to purchase land at what might seem to be advantageous prices, prior to the commencement of the official procedures. Such impact is more likely to occur in the case of urban fringe areas during the design and pre-construction phase.

4.8.1.3 Inducement of Squatter Influx

Squatters may attempt to occupy land along and adjacent to the proposed alignments, in the hope of receiving compensation or some other inducements to leave when construction commences. Such squatters could cause undue pressure on local resources such as water and firewood, which could result in conflicts with those who are harvesting the resources presently.

4.8.1.4 Loss of utilities and amenities

Site clearance involves removal of various assets, utilities and amenities that are:

- Natural (trees, bushes and grasslands), and
- Physical structures (public or private assets and utilities).
- Relocation of utilities like electricity, water and telephone lines. For people dependent on the above, this constitutes economic loss for some time before these are restored to their previous status.

4.8.1.5 Public health and safety

a) Impacts on Public health and safety may arise during the phases of pre-construction, construction and operation . During the pre-construction and construction phases, dismantling of the structures for CoI clearance and road construction activities may result in the following health hazards:

- Dismantling of properties has psychological impacts on their owners and others associated with them.
- Debris generated on account of the above mentioned activities.

b) Labour Camps during construction period can bring the following problems.

- In the case of non-local labour (if so is arranged by the contractor), labour camps are set up at one or more sites adjacent to the alignment, and at some ancillary sites, like aggregate quarries. These labourers hired from outside can have clashes with the local population on account of cultural and religious differences. The influx of a large work force to an area, already hard pressed for basic services (medical services, power, water supply, etc.), can impose additional stress on these facilities.
- If alternative fuels are not made available to the workforce, there is a likelihood that trees will be cut down for cooking or heating purposes.
- Insanitary conditions in the labour camps might also result in impact on health of labourers as well as the local population. Transmission of diseases is also facilitated by the migration of people. During the construction phase work, crews and their dependants may bring with them a multitude of communicable diseases including sexually transmitted diseases (STDs) like AIDS. This is more so if the nature of the project requires more male-workers, who have migrated from other parts of the state or country.

c) Allied activities during construction period may cause local disruption.

- During road construction allied activities like quarrying and crushing operations, traffic diversions, etc., may cause disruption of social and economic life of the local population of the nearby areas.
- Dust and noise generated in crushing and blasting operations may cause nuisance to the nearby communities.
- Traffic jams and congestion, loss of access and other road accident risks, as a result of diversion of traffic and construction work on road.
- There will be some impact on land during construction, limited mainly to temporary acquisition to cater to road diversion or traffic detours and establishment of labour camps.

d) Accidents and Safety

- Although the design speeds have been kept lower in the major settlement areas, some amount of severance is expected in the rural areas, especially where the residential area is on one side and their agricultural land and other facilities are on the other side of the highway. School children and women carrying pots full of water from the water sources (ponds/wells) also get exposed to this risk.

4.8.1.6 Resettlement of People

People, displaced from their homes and agricultural lands on account of the project, shall induce additional pressures to the local resource base. These include pressure on:

- water resources in areas where availability is low,
- grazing lands and fuel-wood,
- Public services such as schools and medical facilities.

4.8.1.7 Land Use Changes

Land use changes along the road corridors are anticipated. These shall bring about a change in the characteristics of the adjacent lands. There would be succession of land uses and higher return uses would displace the lower return uses. This phenomenon will occur at major intersections and in

settlement areas along the project corridors. The urban fringe areas along the project roads will be subjected to ribbon development.

4.8.2 Mitigation Measures

Table 4-21 General Impacts – Mitigation

S. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
1.	Fear of uncertainties regarding future	Direct, long Impact	Land and property owners are subjected to sufferings regarding uncertainties of the extent of loss and the nature of compensation	Public participation sessions were/will be conducted in different stages of project
2.	Inducement of land prices	Direst impact	Danger of unscrupulous speculators moving in to purchase land	Market Value Assessment Committee will decide the actual cost of land
3.	Inducement of squatter influx	Direct impact	Squatters may attempt to occupy adjacent land in the hope of receiving compensation, undue pressure on local resources	The dates of base-line socioeconomic survey have been considered as cutoff date for identification of project affected people PAP.
4.	Loss of utilities and amenities	Direct Impact	Natural (trees, bushes and grasslands), and Physical structures (public or private assets and utilities).	Relocation of utilities will be completed prior to start of project work. These have been further discussed in details in RAP
5a.	Public Health and Safety	High direct adverse impact	Psychological impacts on their owners and others associated with them. Debris generated	Advance notice as per RAP (4 months before commencement of work) will be given to the owners of the affected properties. Debris, so generated will be disposed to the satisfaction of Engineer. Refer **Appendix 4.3: Guidelines for Debris Disposal Site and Management.** Monitoring of air, water, noise and land during construction and operation phase. Refer Chapter 10: Environmental Monitoring Program. Refer **Appendix 4.7: Guidelines for Environment Friendly construction Methodology**.
5b.	Labour Camps	Direct Impact	Can have clashes with the local population, Pressure on basic facilities like medical services, power, water supply, etc. ,Transmission of communicable diseases including AIDS., sanitary conditions in the labour camps	All contractors will be encouraged to recruit the local people as labourer at least for unskilled and semi-skilled jobs. Hygiene and basic facilities will be ensured at labour camp to prevent the spread of disease. Refer **Appendix 4.5 Guidelines for siting and layout of construction Camps,** and **Appendix 4.6 Workers Safety during construction activities**
5c.	Allied activities	Indirect Impact	Social and economic life of the local population due to	Detailed traffic control plans shall be prepared and submitted to the

S. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
			quarrying and crushing operations, traffic diversions, etc. traffic jams and congestion, loss of access and other road accident risks, temporary land acquisition	engineer for approval 5 days prior to commencement of work on any section of road
5d.	Accidents and Safety	Direct Impact	School children, ladies carrying pots full of water	The contractor will provide, erect and maintain barricades, including signs marking flags lights and flagmen as required by the Engineer
6.	Resettlement of People	Indirect impact	Pressure on civil amenities, water sources, grazing lands, fuel wood, medical facilities etc.	A comprehensive resettlement action plan has been prepared to improve the standard of living of the affected population.
7.	Land Use Changes	Indirect impact	Succession of land uses and higher return uses would displace the lower return uses at major intersections and in settlement areas. Urban fringe areas will be subjected to ribbon development.	The ribbon development is anticipated during operation phase of the project.
8.	Removal of encroachments and squatters	Indirect impact	loss of shelter disturbance to family and community life	Impact will be avoided by implementation of phase-wise resettlement action Program Notice will be served 4 months in advance
9.	Host Community	Indirect Impact	Displaced, resettled families will put pressure on the existing scarce infrastructure and amenities available with the host community	special provision will be made in the comprehensive resettlement action plan for the host community

4.8.2.1 Fear of uncertainties regarding future

It's a green field project with 70m RoW. Land and property owners are subjected to sufferings regarding uncertainties of the extent of loss and the nature of compensation. At places where the community utilities are to be affected a certain amount of anxiety will be among the people in that particular community.

To remove such fear from the people, public participation sessions were/will be conducted in different stages of project, viz. pre-design, design, pre-construction and construction.

In the pre-design stage, a comprehensive socio-economic survey was conducted to prepare base line status of the households squatting or encroached upon the RoW. During the survey each households were contacted/interviewed and they were explained about the purpose of the survey, need of the project and benefits associated with the project etc.

The second stage of public participation was in the form of village meetings, focus group discussion, individual interviews, voluntary and academic institution consultation.

The third stage of participation session will start before pre-construction. The EMU will verify and consult the individual EPs with the help of an NGO for distribution of ID card. At this stage the EPs will be explained about their entitlement and R&R framework.

All people likely to be displaced will be informed in advance through NGO by a time bound Programme about resettlement to remove fear of uncertainty.

During the construction stage, the consultation process will continue to avoid any inconvenience to the community at any point of time.

4.8.2.2 Inducement of Land Prices

As the project becomes common knowledge, the land prices along the corridor will increase. For the construction of highway, 351.30 ha of land will be required; Market Value Assessment Committee (MVAC) will decide the actual cost of such land. The actual cost of land may be different from induced land cost. The MVAC have time bound Program to calculate the actual cost of land. In calculating the actual land, cost individual project affected person (PAP) & NGOs will be involved.

4.8.2.3 Inducement of Squatter Influx

Once the project becomes common knowledge, people may attempt to occupy the land along the corridor in anticipation of compensation. To avoid such, the dates of base-line socio-economic survey have been considered as cutoff date for identification of project-affected people, who are eligible for compensation. The cut off dates will be used to establish whether a person located in the right way qualifies as a PAP for the disbursement of compensation. All the PAPs recorded during socio-economic baseline survey are eligible for compensation after verification by EMU.

4.8.2.4 Loss of utilities and amenities

The site clearance for construction of road may result in loss or relocation of certain utilities and amenities, viz. electricity, water and telephone line etc. People dependent upon these utilities and amenities may experience inconvenience and economic loss. Though such impacts are unavoidable keeping in mind the scale of work, but every care will be taken in co-ordination with concerned departments, to restore the facility within shortest possible time to avoid any prolonged hardship or inconvenience to the community. Similarly other utilities like water source, cattle trough etc. will be constructed or replaced at appropriate place with the consent of community prior to dismantling the existing one.

4.8.2.5 Public Health and Safety

a) During the Pre-construction and Construction Phases dismantling of the structures for CoI clearance and road construction may result in health hazards. To minimise this potential negative impact the following recommendations should be adopted:

- To avoid the psychological impacts due to the demolition of properties on the owners and other tenants. The advance notice as per RAP will be given to the owners of the affected properties. An advance notice will be served at least four months before construction commences. For squatters needing relocation, all R&R activities will be undertaken and entitlements will be completed before construction starts.
- Debris generated from the demolition of properties will be properly disposed of to avoid the health problems. Earth material, if required will be dumped in borrow areas as approved by the engineer. Borrow areas will be filled to avoid health hazards from stagnant water collecting in these areas. The contractor will make all arrangements for dismantling and cleaning up of debris. Implementation will be as per the approval and direction of the engineer.

- Instructions as given in **Appendix 4.7**: **Guidelines for Environment Friendly Construction Methodology**, to be enforced

b) During the construction period the potential negative community impacts arising from imported labour in the labour camps will be avoided as per following: -

- All contractors will be encouraged to recruit the local people as labourer at least for unskilled and semi-skilled jobs. This would automatically reduce the magnitude of impact expected due to outside labour. Wherever the local labourers are not available the contractor should ensure the following provision for imported labour.
- The additional stress on the facilities like medical services, power, water supply due to a labour camp in a local area will be avoided by the contractor providing these facilities for the labourers as per the direction of the Engineer
- In areas where wildlife resources are abundant, construction workers shall be instructed how to protect natural resources, fauna, flora and aquatic life. In such areas hunting and unauthorised fishing are prohibited.
- In the labour camps, all temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing.
- The sewage system for the camp will be properly designed built and operated so that no health hazard occurs. Garbage bins will be provided in the camp and regularly emptied. The collected garbage will be disposed off in a hygienic and approved manner.
- Instructions as given in **Appendix 4.5: Guidelines for Siting and Layout of construction camps**, to be enforced.
- Instructions as given in **Appendix 4.6: Guidelines for Workers Safety during Construction Activities**, to be enforced.
- Instructions as given in **Appendix 4.8: Storage, Handling use and Emergency Response during construction**, to be enforced.

c) Allied activities during construction period may cause local disruption:

In the construction phase, there may be inconvenience to the local people as well as the to the nearby highway passengers due to traffic jams and congestion, loss of access and other road accident risk as a result of construction. Detailed traffic control plans shall be prepared and submitted to the engineer for approval 5 days prior to commencement of work on any section of road. In the preparation of the traffic control plan special consideration shall be given to the safety of pedestrians and workers at night.

d) Accidents and Safety

To avoid the accidents during construction phase, contractor shall take all necessary measures to ensure traffic safety. The contractor will provide, erect and maintain barricades, including signs marking flags lights and flagmen as required by the Engineer. In the operation phase, traffic control measures such as speed breakers and sign boards (including speed limits) will be provided and strictly enforced in residential areas, near schools and water bodies like ponds and wells.

4.8.2.6 Resettlement of People

People displaced from their home and livelihood on account of the proposed activity will be taken care in the project. A comprehensive resettlement action plan will be prepared to improve the standard of living of the affected population if not at least restore their livelihood and regaining their former standard of living (Refer Resettlement Action Plan Report).

4.8.2.7 Land Use Changes

As regards land use changes, it is observed that the impact would be long term negative impact. Since the project is entirely a new Greenfield developmental project, the possibility of major land acquisition is envisaged. In design stage, utmost care has been taken to keep the land acquisition at minimal for road realignment and geometric purpose. The probable impact on road-side business and trees within ROW has been reduced and avoided through design.

Besides mitigation & enhancement, following measures will be taken for safety of the locals:

- Local people will be informed about the schedule of construction activity, so that the local people remain prepared in advance.
- The existing sign boards will not be removed but shifted to appropriate place during construction, so that people don't find problem in identifying the tourist/religious place.
- During construction proper demarcation and sign board, indicators and flag man will be deputed for safe traffic movement.

4.9 HEALTH AND SAFETY

Health and safety are of major concern during the construction as well as operational phases. The impact on health and safety can be envisaged for both workers at site and road users, as well as inhabitants of nearby area to the project sites.

Emission of gaseous pollutants and dusts are major result of various processes like material treatment, stone crushing, and asphalt preparation. This emission effect is only for short term till the construction work is over but the effect may be significant from the point of view that the workers are directly exposed to these emissions. Apart from this, safety risks to road workers, primarily in the areas of storage and handling of hazardous materials, and in operation of heavy machinery close to traffic, slopes, power line and water courses, are also involved during the construction works.

The dust and gaseous pollutant generation in the sections near settlement areas are likely to affect the health of people residing in the close proximity of the proposed alignment. Excavation of borrow pits on both sides of the roads within and outside the proposed ROW can create unhealthy aesthetics and also enhance the risk of water borne diseases. These areas provide ideal breeding zones for flies and insects due to stagnant water in borrow pits enhancing the possibility of spreading of diseases. The vehicles and equipment operations increase the chances of collision with vehicles, pedestrians and livestock.

4.10 SOLID WASTE GENERATION

The road construction activities will generate a number of waste materials such as:

a. Vegetation and demolition waste from site clearance;

b. Excavated materials from earthworks (e.g. cuttings, pile foundations);

c. General construction waste (e.g. wood, scrap metal, concrete);

d. Chemical wastes generated by general site practices (e.g. vehicle and plant maintenance/servicing); and

e. Municipal wastes generated by site workers. It is estimated that 250 grams/day of municipal waste will be generated. The MSW generated during project cycle is given in **Table- 4.22**.

Table 4.22: MSW Generation (Kg/day)

Sr. No	Description	No of Persons	Waste Generation
Construction Phase for Workers and labor camp	Construction Phase for Workers and labor camp	2628	657
Operation Phase	Operation Phase	23	5.75

Impacts

The above-mentioned waste materials have the potential to cause adverse environmental impacts during generation, storage, transport and disposal. The principal adverse effects relate to dust, water quality, general health and safety and visual impacts. Potential hazards associated with the inappropriate handling of chemical wastes include effects on human health (i.e. dermal and toxic effects with respect to site workers), phyto-toxic effects to vegetation, contamination of the soil, ground waters and surface water following spillage, risk of fire or explosions and discharge of chemical wastes to sewer and potential disruption of the sewage treatment works. If not appropriately managed, municipal wastes generated by site workers have a potential to cause impacts in terms of nuisance, insects and vermin. This may give rise to adverse environmental impacts for both site workers and site neighbours, which could include odour nuisance if putrescible material is not collected on a frequent basis, wind-blown material causing litter problems, if it is not well maintained and cleaned regularly. **Table 4-23** presents the waste management methods.

Waste management

The waste materials have the potential to cause adverse environmental impact during generation, storage, transport and disposal. The principal adverse effects relate to dust, water quality, general health, safety, and visual impacts. Potential hazards associated with the inappropriate handling of chemical wastes include effects on human health (i.e. dermal and toxic effects with respect to site workers), phyto-toxic effects to vegetation, contamination of the soil, ground waters and surface water following spillage, risk of fire or explosions and discharge of chemical wastes to sewer and potential disruption of the sewage treatment works. If not appropriately managed, municipal wastes generated by site workers have a potential to cause impacts in terms of nuisance, insects and vermin. This may give rise to adverse environmental impacts for both site workers and site neighbors, which could include odor nuisance if putrescible material is not collect on a frequent basis, wind-blown material causing litter problems, if it is not well maintained and cleaned regularly. **Table 4.23** presents the waste management methods.

Table 4.23: Waste Management

Waste Type	Control Measures Proposed	Disposal Method
General Requirements	• Minimization of waste generation for disposal (via reduction/recycling/re-use) • Segregating waste materials according to type to facilitate re-use and recycling • Separation of inert construction and demolition materials for either re-use on-site or use as material fill • During demolition works, segregating materials at source as far as practical	

Waste Type	Control Measures Proposed	Disposal Method
	• Co-ordinate material deliveries to site in order to minimize storage times on site and the likelihood of causing damage • Training site staff in waste minimization practices • Transport of wastes off site as soon as possible • Maintenance of accurate waste records • Use of re-useable metal hoardings / signboards • No on-site burning will be permitted	
Vegetation from preparatory works	• Segregation of materials to facilitate disposal • In site mulching by contractor to reduce bulk and review of opportunities for possible use within landscaping areas	Re-use / landfill
Demolition waste	• Segregation of materials to facilitate disposal • Appropriate stockpile management	Pre designated disposal site
Excavated materials	• Segregation of materials to facilitate disposal /reuse • Appropriate stockpile management • Re-use of excavated material on or off site (where possible) • Special handling and disposal procedures in the event that contaminated materials are excavated	Re-use of Suitable material on site. Disposal of Unsuitable materials to pre-designated disposal site
Construction waste	• Segregation of materials to facilitate recycling/reuse (within designated area and in appropriate containers/stockpiles) • Appropriate stockpile management • Planning and design considerations to reduce over ordering and waste generation • Recycling and re-use of materials where possible (e.g. metal, wood from hoardings, formwork) • For material which cannot be re-used/recycled, collection should be carried	Public fill for inert wastes. Disposal to landfill for Material unsuitable for public filling

Waste Type	Control Measures Proposed	Disposal Method
	out by an approved waste contractor for landfill disposal • Management of waste as per C&D waste management Rule 2016.	
Chemical waste	• Storage within locked, covered and bunded area • Storage area should not be located adjacent to sensitive receivers e.g. drains • Minimize waste production and recycle oils/solvents where possible • A spill response procedure should be in place and absorption material available for minor spillages • Use appropriate and labelled containers • Educate site workers on site cleanliness/waste management procedures • Collection by a licensed chemical waste collector	Chemical Waste collection by a licensed agency
Municipal waste	• Waste should be stored within a temporary refuse collection facility, in appropriate containers prior to collection and disposal. • Regular, daily collections are required by an approved waste collector and recycler	Landfill

4.11 RISKS AND MITIGATION DURING CONSTRUCTION STAGE

4.11.1 Disruption to the Community

4.11.1.1 Loss of Access

At all times, the Contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from side roads and property accesses connecting the project road. Work that affects the use of side roads and existing accesses will not be undertaken without providing adequate provisions. The works will not interfere unnecessarily or improperly with the convenience of public or the access to, use and occupation of public or private roads, railways and any other access footpaths to or of properties whether public or private.

4.11.1.2 Traffic Jams, Congestion and Safety

Detailed Traffic Control Plans will be prepared prior to commencement of works on any section of road. The traffic control plans will contain details of temporary diversions, details of arrangements for construction under traffic and details of traffic arrangement after cessation of work each day.

Temporary diversion (including scheme of temporary and acquisition) will be constructed with the approval of the Engineer and the EMU. Special consideration will be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night.

The Contractor will ensure that the running surface is always properly maintained, particularly during the monsoon so that no disruption to the traffic flow occurs. The temporary traffic detours will be kept free of dust by frequent application of water, if necessary.

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 may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the highway under improvement.

4.11.2 Safety of the Workers

- Refer **Appendix 4.5: Guidelines for Siting and Layout ff Construction Camp.**
- Refer **Appendix 4.6: Workers Safety During Construction Activities.**
- Refer **Appendix 4.7: Guidelines for Environment Friendly Construction Methodology.**
- Refer **Appendix 4.8: Storage, Handling Use and Emergency response for Hazardous Chemicals**

1.1.1.1 Risk from Operations

The Contractor is required to comply with all the precautions as required for the safety of the workmen as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will supply all necessary safety appliances such as safety goggles, helmets, masks, etc., to the workers and staff. The contractor has to comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.

4.11.2.1 Risk from Electrical Equipment

Adequate precautions will be taken to prevent danger from electrical equipment. No material or any of the sites will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect,

will be kept in good working order, will be regularly inspected and properly maintained as per IS provisions and to the satisfaction of the Engineer.

4.11.2.2 Risk at Hazardous Activity

All workers employed on mixing asphaltic material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles. Workers, who are engaged in welding works would be provided with welder's protective eye-shields. Stone-breakers will be provided with protective goggles and clothing and will be seated at sufficiently safe intervals. The use of any herbicide or other toxic chemical will be strictly in accordance with the manufacturer's instructions. The Engineer will be given at least 6 working days notice of the proposed use of any herbicide or toxic chemical. A register of all herbicides and other toxic chemicals delivered to the site will be kept and maintained up to date by the Contractor. The register will include the trade name, physical properties and characteristics, chemical ingredients, health and safety hazard information, safe handling and storage procedures, and emergency and first aid procedures for the product.

4.11.2.3 Risk of Lead Pollution

No man below the age of 18 years and no woman will be employed on the work of painting with products containing lead in any form. No paint containing lead or lead products will be used except in the form of paste or readymade paint. Face masks will be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.

4.11.2.4 Risk Caused by Force Majeure

All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. All necessary steps will be taken for prompt first aid treatment of all injuries likely to be sustained during the course of work.

4.11.2.5 Risk from Explosives

Except as may be provided in the contract or ordered or authorized by the Engineer, the Contractor will not use explosives. Where the use of explosives is so provided or ordered or authorized, the Contractor will comply with the requirements of the following Sub-Clauses of this Clause besides the law of the land as applicable: (also refer **Appendix 4.8: Storage, Handling Use And Emergency response for Hazardous Chemicals.)**

- The Contractor will at all times take every possible precaution and will comply with appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives and will, at all times when engaged in blasting operations, post sufficient warning flagmen, to the full satisfaction of the Engineer.
- The Contractor will at all times make full liaison with and inform well in advance and obtain such permission as is required from all Government Authorities, public bodies and private parties whatsoever concerned or affected or likely to be concerned or affected by blasting operations.

4.11.2.6 Malarial Risk

The Contractor will, at his own expense, conform to all anti-malarial instructions given to him by the Engineer; including filling up any borrow pits which may have been dug by him. Gravid, blood-laden mosquitoes cannot fly very far, so they generally bite within a kilometer or so of their breeding place. Thus borrow pits and any other water bodies created during the construction process will be situated 1 to 2km away from the human settlements. Pits dug up closer than these will be adequately drained to prevent water logging. Similarly compensatory measures for filling up part of the water bodies situated adjacent to the project corridors will be directed towards deepening of the water bodies concerned. This way the capacity of the water body remains the same, while water surface available for breeding of

mosquitoes is reduced. This will have an additional advantage of decreased evaporation losses, which will be important in water-scarce corridors such as 02, 23 and 28.

4.11.2.7 First Aid

At every workplace, a readily available first aid unit including an adequate supply of sterilized dressing material and appliances will be provided as per the Factory Rules. Workplaces remote and far away from regular hospitals will have indoor heath units with one bed for every 250 workers. Suitable transport will be provided to facilitate take injured or ill person(s) to the nearest applicable hospital. At every workplace an ambulance room containing the prescribed equipment and nursing staff will be provided as prescribed.

4.11.2.8 Potable Water

In every workplace at suitable and easily accessible places a sufficient supply of cold potable water (as per IS) will be provided and maintained. If the drinking water is obtained from an intermittent public water supply then, storage tanks will be provided. All water supply storage will be at a distance of not less than 15m from any latrine, drain or other source of pollution. Where water has to be drawn from an existing well, which is within such proximity of any latrine, drain or any other source of pollution, the well will be properly chlorinated before water is drawn from it for drinking water. All such wells will be entirely closed in and be provided with a trap door, which will be dust proof and waterproof. A reliable pump will be fitted to each covered well. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once a month.

4.11.2.9 Hygiene

The Contractor during the progress of work will provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labor to standards and scales approved by the resident engineer. Refer **Appendix 4.5: Sitting and layout of construction Camp.**

There will be provided within the precincts of every workplace, latrines and urinals in an accessible place, and the accommodation, separately for each for these, as per standards set by the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996. Except in workplaces provided with water-flushed latrines connected with a water borne sewage system, all latrines will be provided with dry-earth system (receptacles) which will be cleaned at least four times daily and at least twice during working hours and kept in a strict sanitary condition. Receptacles will be tarred inside and outside at least once a year. If women are employed, separate latrines and urinals, screened from those for men and marked in the vernacular will be provided. There will be adequate supply of water, close to latrines and urinals.

All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. 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. Compliance with the relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp and regularly emptied and the garbage disposed off in a hygienic manner. Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the work force.

Unless otherwise arranged for by the local sanitary authority, arrangement for proper disposal of excreta by incineration at the workplace will be made by means of a suitable incinerator approved by the local medical health or municipal authorities. Alternatively, excreta may be disposed off by putting a layer of night soils at the bottom of a permanent tank prepared for the purpose and covering it with 15 cm layer of waste or refuse and then covering it with a layer of earth for a fortnight (by then it will turn into manure).

On completion of the works, the whole of such temporary structures will be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the whole of the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer.

4.12 CUMULATIVE IMPACT ASSESSMENT OF STRR

4.12.1 Introduction

Satellite Town Ring Road (STRR) is newly declared National Highway-948A. The alignment of proposed project passes through state of Karnataka and Tamil Nadu and traverses through Bangalore Rural, Ramanagara, and Bangalore Urban district in South-eastern part of Karnataka and Krishnagiri district in Western part of Tamil Nadu.

The proposed project starts from Ch. 0.000 in Dabaspet and ends at Ch. 179.969 near Devarapalli village in Tamil Nadu/Karnataka Border. The project road is entirely a new highway having design length of 179.969km. The project road is falling in two states viz. Karnataka (length 134.942km) and Tamil Nadu (length 45.027km).

This section is for providing the Cumulative Impact Assessment of entire Satellite Town Ring Road (West Side) starting from Ch. 00.000 to Ch. 179.969.

It provide the evaluation of the impact of project on eco-system in the context of the combined effect of all the phases of STRR project i.e. Phase-I, II and III for assessing potential cumulative effects on environmental resources. The Salient features of the proposed project given below:

Salient features of the proposed project given in **Table 4-24.**

Table 4-24 Salient features of the Entire STRR (km 0.00 to km 179.969)

S.No.	Particulars	Proposed (Design)	
Technical Features			
40	State and District	**State** Karnataka Tamil Nadu	**District** Bangalore Rural, Ramanagara, and Bangalore Urban district Krishnagiri
41	Length	179.969 km	
42	No. of affected villages by land acquisition	119 nos	
43	Total Area of Land Acquisition	Approx.2492.52 ha.	
44	Seismic Zone	Zone-II	
45	Proposed Carriageway	6-lane divided carriageway configuration	
46	Proposed ROW	70m (In Bannerghatta National Park area: 28.5m)	
47	Design Speed	100kmph	
48	Embankment	About 3m on existing ground generally	
49	Tunnels (length, seepage, emergency exit, drilling/blasting etc.)	Not applicable. No tunnel involved in the project	
50	Junctions/ Fly Over/Interchange	13 Interchanges	
51	Vehicular Underpasses	95 no (62 VUP, 4 LVUP, 4 LVOP, 2 VOP, 1PUP	
52	ROB	4 no (8.950, 29.250, 71.000,154.540)	
53	RUB	Nil	
54	Major Bridges	5 no (Km 64.580, km 78.380, 90.280, km 92.980, km 158.820)	
55	Minor Bridges	17 nos.	
56	Culverts (Widening/Reconstruction/New)	315 nos	
57	Service Roads/Slip Roads	Slip roads provided in all interchange locations for converging and diverging traffic	
58	CBR adopted for pavement design	8% as per IRC standards	
59	Median	5m provided	

S.No.	Particulars	Proposed (Design)
60	Service Road	Wherever required
61	Slope protection	Turf/ stone pitching
62	Safety Measure	Crash Barriers provided
63	Lighting	Lighting in all proposed Interchanges and toll plaza etc.
64	Horticulture and landscaping	Throughout
65	Total Project Cost	INR 5,690 Cr (as per Feasibility stage estimate)
Environmental Features		
66	Whether passing through Wildlife area/Protected area/CRZ area/Mangroves area/Critically Polluted area	The proposed project road passes through the Reserved Forest of Bannerghatta National Park (BNP). In order to minimize the ecological impacts, the upgradation of existing Bannerghatta/Harohalli - Jigni Road (MDR) alignment from Ch. 114.635 to Ch. 118.431 (Length about 3.796 km) inside core area and ten km on both sides in the eco sensitive zones (ESZ) is proposed so avoid entire National Park with an elevated corridor.
67	Protected Monuments & structures	Nil
68	Land AUse Pattern	The land use by the side of this road predominantly barren and agriculture. The land use pattern along this project road comprises of agricultural, built up, barren, industrial, and forest. • Vegetation/agricultural : 74% • Barren/fallow land : 5% • Forest : 11% • Plantation:4% • Settlement:2% • Water bodies 3% • Others 1%
69	Forest Land Diversion	11 ha. (already applied for the diversion vide MoEF&CC proposal no. *FP/KA/ROAD/36126/2018)* Additional 2.5 ha for construction of ramp on both sides of the elevated corridor.
70	Tree	Approx. 9827 nos.
71	River crossings	Vrishabawathi River crossing (at Design Ch.90.650) and few minor streams Crossing the alignment.
72	Ponds	Nil
73	Terrain	Mix of Plain and rolling
74	Green belt development	As per IRC SP 21:2009 /MORTH Code/Guidelines and Green corridor's terms of reference for plantation by GHD/NHAI
75	Compensatory Plantation	Ten times the trees cut has been propose as Compensatory Plantation (1:10).
76	Mangroves, sand dunes etc.	N/A
77	Environmental Management Cost including Corporate Environmental Responsibility Cost	Approx. 2% of the entire project cost
78	No. of social structures Affected	737 approx. based on Topographic Survey.

4.12.2 ENVIRONMENTAL BASELINE DATA

The brief description of the environment given as follows:

Table 4-25 Brief Description of the Environment (STRR)

S. No.	PARAMETER	DESCRIPTION
1. Physical Environment		
(i)	Topography and Geography	The project road section of NH948A passes mainly through rolling terrain while few stretches passes through plain terrain. The latitudes and longitudes of project road start and end are 13°14'57.00"N & 12°52'16.64"N and 77°18'29.13"E & 77°53'22.8"E respectively. Physiographical, the project area can divided in to rocky upland, plateau and flat-topped hills. The entire corridor length of road is passing through rolling and hilly terrain and in general passing through northern high land to southern low land of district.
(ii)	Geology and Seismicity	The prevailing rock of these districts is a light to dark-gray or whitish biotic granite gneiss, which varies considerably from place to place, in texture, structure and appearance, according to the fitness or coarseness of its constituent grains and the relative abundance or scarcity, and mode of deposition of the darker Ferro-minerals. These complex Gneissic masses have been styled as "Peninsular Gneiss". The project influence area falls under least active to moderate damage risk Zone II
(iii)	Soils	The soils are mainly red loamy and sandy soil. The soils are fertile and support a variety of crops.
(iv)	Borrow Areas	Total 19 borrow areas have been identified for the project.
(vi)	Fly Ash	Fly ash shall collected from the Ennore Thermal Power Plant, Mettur Thermal Power Plant and Rayalseema Thermal Power Plant and it shall use for construction purposes.
(vii)	Land Use Pattern	The terrain along this alignment is predominantly mix of plain and rolling. The land use pattern along this project road comprises of agricultural, built up, barren, industrial, and forest. However, the main land use pattern is agricultural and barren viz. Agriculture (74%), and Barren (5%).
2.	**Meteorology**	The climate of project districts is generally dry throughout the year, except during the southwest monsoon. The winds are predominantly south westerly during the summer monsoon and northeasterly during the winter monsoon.
3.	**Air**	Ambient Air Quality data collected during the month of June 2018 from seventeen (18) locations along the entire STRR Project. The parameters monitored were Particulate Matter (<PM_{10}); Particulate Matter (<$PM_{2.5}$); Sulphur dioxide (SO_2), Nitrogen oxide (NO_x) and Carbon monoxide (CO). The monitoring results reveal that Ambient Air Quality parameters are found to be below the prescribed permissible limits of CPCB.
4. Water		
(i)	Water resources	**<u>Surface Water Resources</u>** Arkavati River and Ponniyar River are two (2) major river in study area crossing NH948A. **<u>Ground Water Resources</u>** Locals use dug wells, hand pumps, bore well and wells for various purposes. The water requirements of rural and urban areas in the district are met either thorough surface water sources or through various mini water supply schemes or integrated water supply schemes utilizing the available ground water resources.

S. No.	PARAMETER	DESCRIPTION
(ii)	Water Quality	**Surface Water Quality** The surface water sample collected from eight (8) locations. The physio-chemical analysis of water samples revealed that the water quality criteria of study area falls in the range of Class B to E water prescribed by CPCB (as per the overall result). **Ground Water Quality** Ground water quality was assess at seven (7) locations along the project area. It is observe that the ground water is suitable for drinking and domestic uses in respect of all the constituents except total hardness.
5.	**Noise**	Ambient Noise levels taken during the month of June 2018 from Seven (7) locations from 6:00 am to 10:00 pm (Day) and from 10:00 pm to 6:00 am (Night).
6.	**Biological Environment**	
(i)	Forest	There is no forest land will be diverted due to proposed project.
(ii)	Flora	The total number of trees falling within 70m PROW of project roads is 12111 . Plantation along the highway shall take up as per Green plantation strategy (as per IRC: SP-21:2009). Shrubs will be planted on the medians.
(iii)	Fauna	No habitat fragmentation is likely to take place because of the proposed project. Also no direst impacts on fauna.
7.	**Socio-economic environment**	Total 182 structures will be affected by the project. Most of the people in affected villages depend on agriculture for their livelihood. The major agricultural crops in the district grown Paddy, Ragi. People also employed in constructions, government jobs, agriculture and household activities.

4.12.3 Cumulative Impact Assessment of STRR

STRR will provide a safe, smooth, efficient, and high-speed transport corridor to Bangalore city with connectivity to National Highways NH 648 (NH 207), NH 48 (NH 4), NH 275, NH 948, NH 209 & NH 75 (Hassan road), and majority of State Highways SH 3, SH 85, & SH 35. This will help in reducing the heavy commercial traffic movement inside Bangalore City. The project has assessed in “with” and “without” scenarios considering the cumulative impact of road development.

Business as Usual Condition

Bangalore is one of the fastest growing city in Asia and the traffic expected to raise due to incredible growth of IT and BT sectors, Education, Research, Defense, Space, Public and Private sector. The high density of traffic, inadequate road capacity and road network are becoming bottleneck for further economic growth to the city.

In absence of a peripheral road, the heavy traffic will continue to move through the Bangalore city thereby mixing with the city traffic and increase the traffic congestion in Bangalore city. This Environmental quality will further deteriorate due to pollution and high emission from slow traffic movement and congestions. With increase in traffic, the pace of degradation of environment will only hasten.

“With” Project Scenario

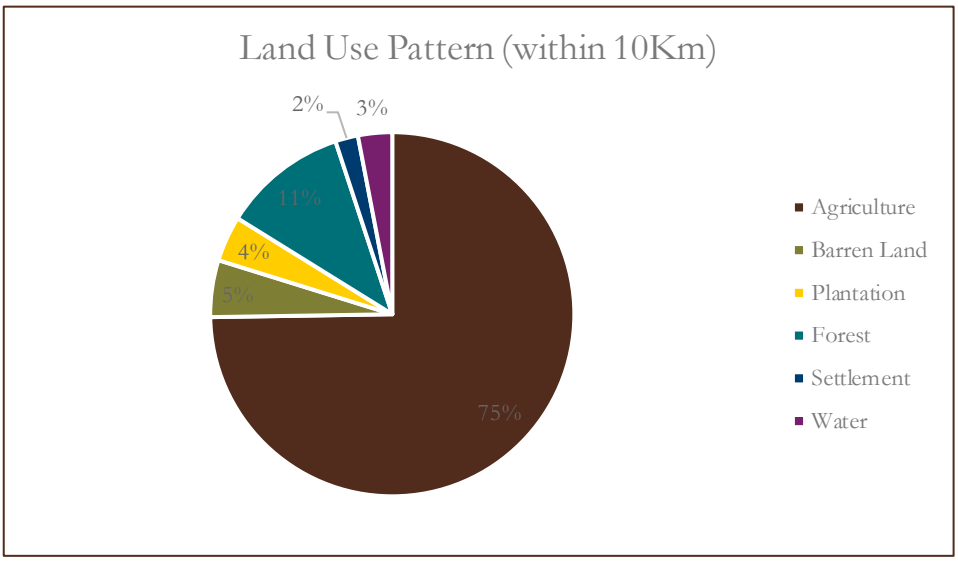
The new road will be capable of ensuring uninterrupted free flow traffic. This will ensure the Bangalore city free from long route trucks that do not need to enter just for passage. Construction of new road will provide better, fast, safe and smooth connectivity for the commuters between the two states of Karnataka and Tamil Nadu as well as in the region. Smooth and fast moving traffic will cause lower

pollutant emissions thereby reducing pollution levels. The environment parameters of the region will significantly improve besides saving in vehicle operating cost.

Overall, the project will significantly enhance social & economic development of the region when compared to the Business as usual scenario. The implementation of the project, therefore, will definitely be beneficial for overall socio-economic environment of the impacted region.

4.12.3.1 Land Use

The land use map for a buffer length of 10 km on either side of the proposed alignment of NH-948A has been prepared as **Figure 4.1**. Land use map shows the main land covers including Agriculture (74%), forest (11%), plantations (4%), settlements (2%), barren-land (5%), water bodies (3%) and other important physical features. **Figure 4.1** shows the percentage breakup of the different land covers within 10km buffer of proposal road.



Source: Survey of India Topo sheet, Government of India

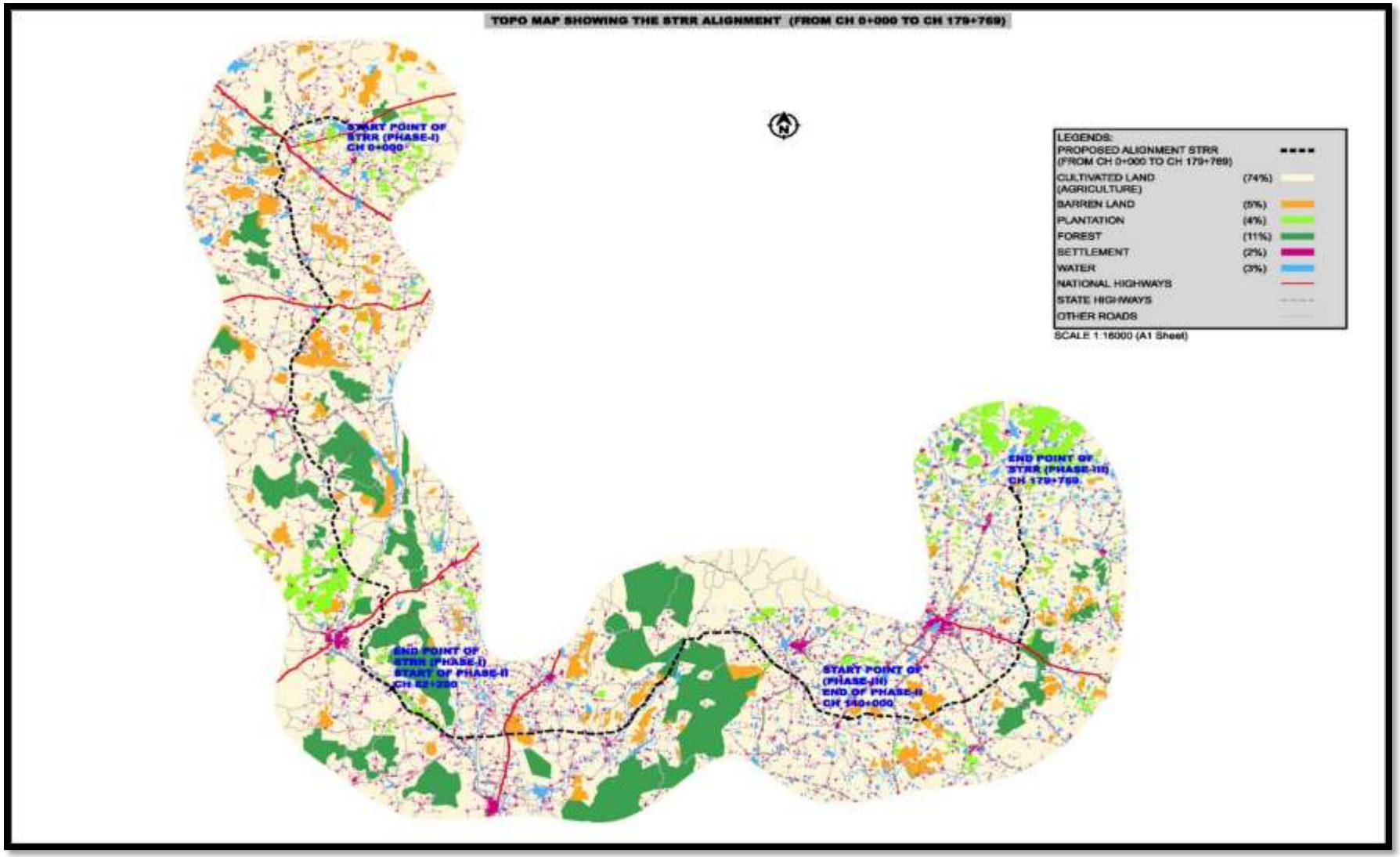


Figure 4.1: Land Use Pattern of STRR (From km 0.00 to km179.969)

4.12.4 Impact Mitigation and Enhancement

Prevention or avoidance of impact is better than mitigation of impact. Hence, avoidance and reduction of adverse impacts approaches adopted during the design stage through continued interaction between the design and environmental teams. This reflected in the designs of the horizontal & vertical alignment, cross sections adopted, construction methods and construction materials. In-depth site investigations have carried out so that sensitive environmental resources effectively avoided, leading to the environmentally best-fit alignment option.

NHAI also proposes to provide structure in order to maintain/elevate the grade of the road allowing passage for fauna below however, for it the location of wildlife is critical, which allow for natural movement of animals and thus be construct at location where the possibility of animal using them is maximum.

In Consideration to the joint inspection with various officials of EAC's Subcommittee, Forest Department, Various viable location considering the engineering aspect of the terrain and seasonal drainage associated in the terrain, Animal crossing/VUPs (25m opening and 5.5m clear height) structures are propose at following locations along STRR. In Bannerghatta National Park, the existing road inside the park is already fragmenting the protected area. This further deteriorate the park conditions in business as usual scenario. Therefore, NHAI proposed to upgrade the existing Bannerghatta/Harohalli-Jigni Road (MDR) with an elevated corridor. The proposed alignment is passing through the core zone of Bannerghatta National Park (BNP) from Km 114.635 to Km 118.431 (length about 3.796km) and Eco sensitive Zone (ESZ) from km 95.525 to km 138.00000.Considering the MOEF&CC guidelines and as discussed with forest officials it is proposed to provide an elevated corridor on single pier in the entire core zone from Km 114.635 to Km 118.431 (length about 3.796km) and ten km length of ESZ on both sides to segregate human and animal conflict. Total length of the proposed elevated corridor will be 6.63km.

This will help in reducing the barrier effect and thereby help in minimizing the ecological impacts

4.12.5 Public Consultations

Informal and formal consultations with communities as well as affected households have been and are being carryout during various stages of the project.

Peoples' Perception about Environment and Social issues gathered during the informal and formal consultations given below.

Table 4-26 Peoples' Perception about Environment and Social issues

S. No.	Environmental Issue discussed	Response Received	Suggestions given by participants	Findings of the public consultation
1	Air quality of the area	Public are of the view that air quality is not an issue in the area as the settlement area are located away from industrial units and air pollution due to vehicular traffic will be a concern during operational stage.	Adequate vegetation cover on either side of the project road would reduce pollutants migrating to village areas	Air quality is not an issue of concern in the project area. With the proposed development there will be no impact on the air quality in the area as majority of the settlements are located away from the main road. It is anticipate that the proposed avenue plantation would be helpful in checking pollutants being disperse to settlements.

S. No.	Environmental Issue discussed	Response Received	Suggestions given by participants	Findings of the public consultation
2	Water quality	Water quality of surface water bodies' i.e. rivers and canals is satisfactory. The surface water sources used mainly for bathing and washing purposes.	Runoff from the project road should be contained appropriately and no run off should find their path to the water resources being used by residents for cultivation as well as to meet their daily chores	Water harvesting structures on either side of the project road is a good proposition to recharge ground as well as to contain pollutants resulting from vehicular traffic.
3	Noise level of the area	Vehicular movement is the prime cause of noise generation	Adequate avenue plantation (multiple rows) would reduce the noise spreading to nearby settlements	Noise is one of the major concern to habitations abutting the highways
4	Drainage	Water logging at few stretches of the alignment because of the rivers and creeks make the land unsuitable for cultivation	Road construction activities should ensure that slope of road is not such that it results in flooding in the nearby settlements.	Adequate measures will incorporated during the design stage so that flooding; waterlogging, marshy situation does not prevail.
5	Removal of large number of tree	Road projects development would result in removal of large number of trees of common occurrence.	These should be adequately compensated with the right mix of species in consultation with the affected communities and forest department	Compensatory afforestation should carried out to make up for the loss incurred due to felling of trees for the proposed activity.
6	Social Issues	Apprehension to become marginalized and jobless	Adequate livelihood support to the affected persons and rearrangements for affected families who are losing residents structures	Design shall be adjusted to avoid impact on built up area and Payment of compensation at market value

4.12.6 Benefits of The Project

The project will give significant economic benefits to the State. Construction of the project road will lead to better connectivity and will play a significant role in changing the socio-economic condition of the people living in the region. The benefit of this new development are as follows:

1. The proposed road facility will able to connect important towns such as Dobbasapete, Magadi, Ramanagara, Kanakapura and Anekal in Karnataka (134.331km) and Hosur in Krishnagiri district (45.331km)
2. Hosur is an automobile industry town located near about 7km away from Karnataka state border. This city generates huge amount of through traffic and currently experiencing massive traffic congestion and this proposed facility will ease traffic in Hosur city.

The economic appraisal of the project carried out comprising costs of developing the project with direct benefits (Vehicle operating cost and time saving) to the road user likely to use the project road. The analysis reveal that the project as a whole is economically viable considering direct benefits. The indirect benefits such as environmental benefit, reduction in accident, reduction in congestion level in the area will overall improve the condition of the region.

4.13 CONCLUSION

From the above discussions, it is clear that the project will have overall positive impacts due to development of project road sections of NH-948A. The major impacts of project include land acquisition (predominately agricultural and barren). Due consideration have been given to environmental and socio-economic issue during designing phase of the project. Some adverse environmental impacts have been identified which are likely to occur during construction phase which are temporary and short lived and can be mitigated effectively by implementing suggested mitigation measures. The project provides scope for environmental enhancement of the area. Green belt development along the new alignment has been incorporated in the project, which will serve screen for air and noise pollution generated due to vehicular traffic, but at the same time, it will also enhance the overall environmental quality of adjacent areas all along the project corridor. In order to ease the passage of locals from one side of project roads to other, sufficient numbers of underpasses have been provided for pedestrian movements as well as for local traffic.

It is required to strictly adopt and implement the Environment Management Plan (EMP) The mitigation measures suggested will minimize the identified impacts to acceptable limits.

CHAPTER-5: ANALYSIS OF ALTERNATIVES

5.1 INTRODUCTION

The Ministry of Road Transport and Highways (MORT&H), Government of India has proposed "Bharat Mala Pariyojana" an Umbrella scheme of road development project through National Highways Authority of India (NHAI), National Highway and Industrial Development Corporation (NHIDC) and state Public Works Departments (PWD) at an estimated cost of INR 5,35,000crores. This focuses on optimizing efficiency of freight and passenger movement across the country by bridging critical infrastructure gaps through effective interventions like development of economic corridors, inter-corridor, national corridors efficiency improvement, border & international connectivity roads, coastal & port connectivity roads and expressways.

In pursuance of the above program, NHAI appointed M/s Louis Berger Consulting Private Limited, New Delhi as Consultants to carry out the Consultancy Services for preparation of DPR for Satellite Ring Road of Bangalore (West Side) including connection to Hosur town. The proposed STRR alignment declared as National Highway with a serial number 462 and new National highway number 948A as per MORT&H Gazette notification no 6, dated 02/01/2018

Bangalore town is densely populated and in order to ensure safe, smooth, efficient, and high-speed transport corridor to this city, it is impetus that the infrastructure of city and adjoining towns anticipated the development. National Highways NH 648 (NH 207), NH 48 (NH 4), NH 275, NH 948, NH 209 & NH 75 (Hassan road), and majority of State Highways SH 3, SH 85, & SH 35 pass through Bangalore city comprising heavy commercial traffic movement. Most of these traffic pass through the Bangalore city and resulting huge traffic jams. In addition, the NICE road currently has only four lanes dual carriageway (2x2) configuration with heavy traffic movement. Further, the toll rates are also exorbitant with 4 times higher in comparison to NHAI toll rates due to private operator.

Therefore, reviving the STRR project (originally conceived in 2006 by Bangalore Metropolitan Road Development Authority (BMRDA) with considering current development in the region including development of STRR west side is absolute necessary on priority basis and thus, it is proposed to consider a 6-lanes dual carriageway (3x3.50m) configuration throughout as minimum requirement. The STRR will function as an alternative route and there is huge potential for the traffic to be diverted from other road network. The STTR will ensure high-speed connectivity primarily to Bangalore International airport and to the proposed Bangalore – Chennai Expressway.

The proposed project start from Ch. 0.000 in Dabaspet in the intersection point in NH 207 at km 131. 220 and ends at Ch. 179.969 near Devarapalli village in Tamil Nadu/Karnataka Border. The total project road length will be 179.969 km. The proposed STRR packaging are further categorised considering the Banneragatta National park's core and its eco sensitive area of 10km radius beyond core area.

The entire corridor is proposed to be taken up in 3 phases namely:

1. Phase-I – Design Ch. 0.000 (Dabaspet) to Ch. 82.200 (near Kailancha Village)
2. Phase-II–Design Ch. 82.200 (near Kailancha Village) to Ch. 140.000 (near Peddamadhagondapalli Village
3. Phase-III - Design Ch. 140.000 (near Peddamadhagondapalli Village) to Ch. 179.969 (near Devarapalli village in Tamil Nadu/Karnataka Border)

Accordingly this report is pertinent to Phase-III, from design Ch. 140.000 (near Peddamadhagondapalli Village) to Ch. 179.969 (near Devarapalli village in Tamil Nadu/Karnataka Border).

5.2 ANALYSIS OF ALTERNATIVES FOR SELECTION OF ALIGNMENT FOR STRETCH

The originally proposed STRR passes through Dobbaspet, Magadi, Ramanagara, Kanakapura and Anekal. It was also envisaged connecting the Hosur city with the proposed STRR alignment as per the meeting held with CGM/NHAI in Bangalore during the Inception study. The city is located in the proximity of only 7km from Karnataka state border. The Industrial town of Hosur is also an automobile hub of Tamil Nadu. Thus, this proposal will enable to disburse the traffic toward further south in a methodical manner. It also further enables a connectivity for Hosur to the proposed Bangalore - Chennai Expressway.

The proposed alignment also discussed with District Commissioner, Krishnagiri and with various stakeholders, district level officers, and NHAI. Four options proposed and all options discussed with its merits and demerits. The details are given in **Figure 5.1.**

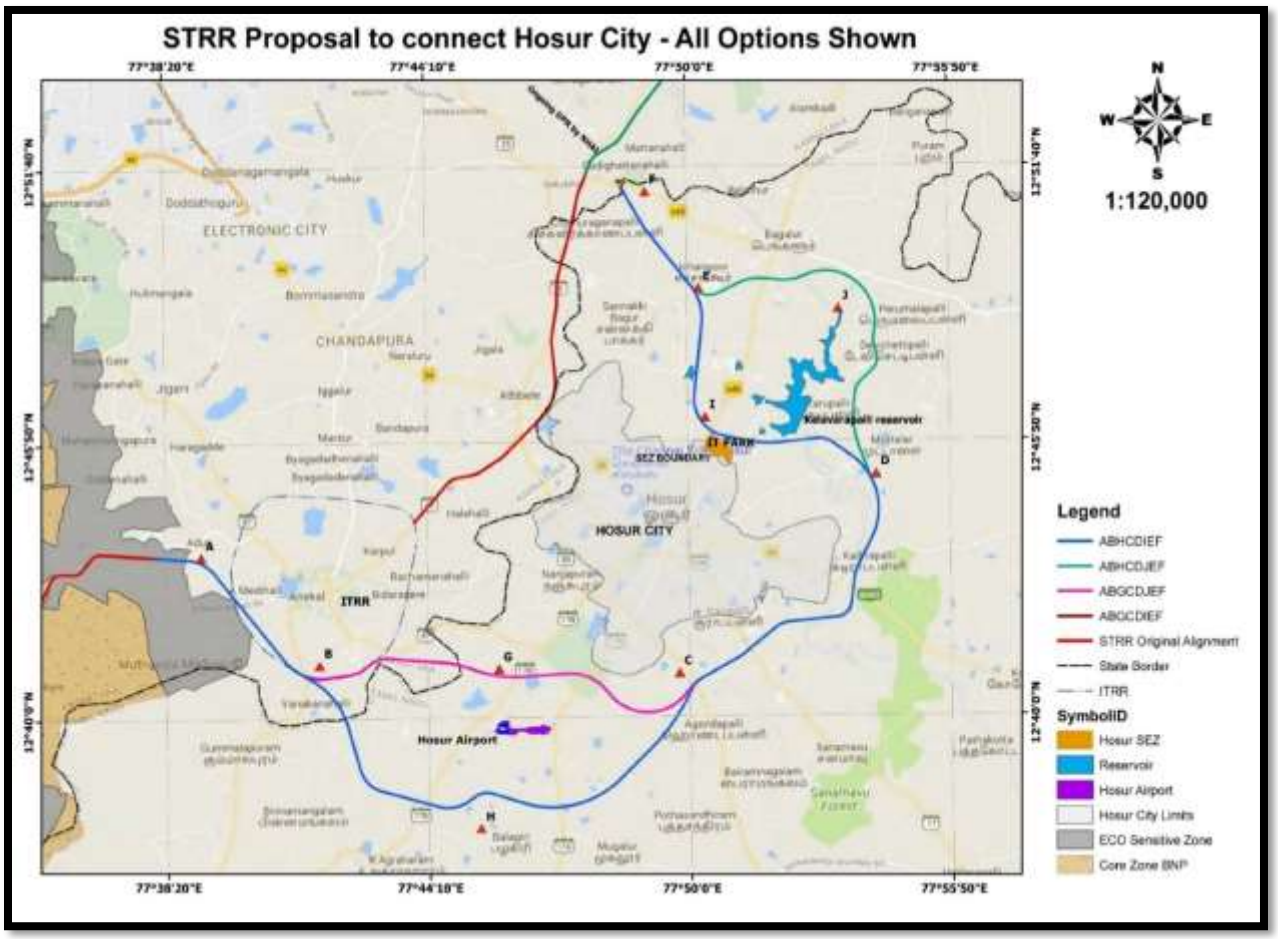


Figure 5.1: STRR proposal connect Hosur city with four options

The comparative statements of all options of proposed Hosur bypass alignment are as below

Table 5.1: Comparative Statement of Proposed Alignment

S. No	Description	Option - 1 (ABHCDIEF)	Option - 2 (ABGCDIEF)	Option - 3 (ABHCDJEF)	Option - 4 (ABGCDJEF)
1.	Starting	139.000	139.000	139.000	140.000
2.	Ending	190.000	190.000	190.000	179.969
3.	Route Alignment side	After Hosur airport & away from Kelavarapalli reservoir area	Before Hosur airport & away from Kelavarapalli reservoir area	After Hosur airport & Close to Kelavarapalli reservoir area	Before Hosur airport & Close to Kelavarapalli reservoir area
5.	Length of existing alignment/ bypassed (km)	nil	nil	nil	nil
6.	Built-up stretch (km)	Few structures	Few structures	Few structures	Few structures
7.	Terrain	Plain	Plain	Plain	Plain
8.	Speed	100 km/h	100 km/h	100 km/h	100 km/h
9.	Geometries	Geometry is good, supports 100 km/h speed. Good sight distance with curves widely spaced.	Geometry is good, supports 100 km/h speed. Good sight distance with curves widely spaced.	Geometry is good, supports 100 km/h speed. Good sight distance with curves widely spaced.	Geometry is good, supports 100 km/h speed. Good sight distance with curves widely spaced.
10.	Intersection developments	7	7	7	4
11.	Existing Land use pattern through proposed alignment	Agricultural Land and barren land	Agricultural Land and barren land	Agricultural Land and barren land	Agricultural Land and barren land
12.	Major Bridge	2	2	2	2
13.	Minor Bridge	3	3	2	2
14.	Approximate Culverts (no)	120	120	130	120
15.	ROB	1	1	1	1
16.	Interchange	7	7	7	7
17.	VUP	nil	nil	nil	nil
18.	PUP	nil	nil	nil	nil
19.	Proposed ROW	90	90	90	90
20.	Existing ROW	0	0	0	0
21.	No of affected Settlements	nil	nil	nil	nil
22.	Alignment passes through villages	Agasa Timanahalli, Patnagere Gollahalli, Muttur, Mattakur, Agraharam, Achettipalli, .Kothur, Peranadapalli, .Attur,	Agasa Timanahalli, Singasandra, KomaranapalliPoonahalli, Achettipalli, Kothur, Peranadapalli, Attur, Pathamuthalli, Avalapalli, Eluvapalli, Nallur,	Agasa Timanahalli, Patnagere Gollahalli, Muttur, Mattakur, Agraharam, Achettipalli, Kothur, Peranadapalli,	Agasa Timanahalli, Singasandra, Komaranapalli, Poonahalli, Achettipalli, Kothur, Peranadapalli, Nandimaglam,

S. No	Description	Option - 1 (ABHCDIEF)	Option - 2 (ABGCDIEF)	Option - 3 (ABHCDJEF)	Option - 4 (ABGCDJEF)
		Pathamuthalli, Avalapalli, Eluvapalli, Nallur, Chikhanathpuram, Kothapalli, Sarjapur	Chikhanathpuram, Kothapalli, Sarjapur	Nandimaglam, Baglur, Kaganur Sarjapura.	Baglur, Kaganur Sarjapur.
23.	Social Impact	Considerable impacts	Considerable impacts	Considerable impacts	Considerable impacts
24.	Environmental Impact	Considerable impacts	Considerable impacts	Considerable impacts	Considerable impacts

The merits and demerits for the Hosur alignment inclusion in STRR are as follow.

Merits

- Enabling new spatial distribution of business/ housing in Hosur city
- Improved road geometry will ensure enhanced traffic safety and reduction in road accident rate.
- Major cross roads intersections will be provisioned with free flow interchanges and will catalysed development of Industrial sited located near to this places
- Will remove through truck traffic from city's main artery
- More local traffic may get encouraged to use a route previously avoided due to heavy truck traffic
- Proactive planning by local authorities will further catalyse industrial development
- Will benefits the town in revenues, real estate, and job opportunities

Demerit

- The overall alignment length will increase and result higher land acquisition and construction costs.

Based on facts presented and as suggested during the stakeholder meeting held under the chairmanship of District Collector, Krishnagiri, the district administration recommended and Option 4 (ABGCDJEF) for consideration.

The alignment was concurred by the Additional Chief Secretary, Government of Tamil Nadu vide his office letter 14787/HV1/2017-2 dated 24/01/2018. The copy of the letter is also enclosed as **Appendix-Approval from NHAI for alignment.**

During the detailed field surveys and land acquisition process, it is note that the alignment at near km 157.800 need some modification as the original alignment pass through in the mid of school. Accordingly, following modifications are suggest. The modifications propose are currently approved by NHAI vide letter NHAI/12012/BM/STRR/DPR/TN/2/2018/PIU BNG (EXP)/765 dated 13/12/2018

5.2.1 Modification in Proposed Alignment

School building near (near km 157.100)

While fixing the boundary stone near km 157.800, it noted that the alignment was passing through the school building. A 100m corridor is notify here also contrary to the requirements of 70m of proposed right of way requirements. Therefore, considering school building and the safety to the children, the alignment shifted away from the school building to the maximum extent possible within the 100m proposed width. It is also pertinent to mention that the proposed shift does not compromise any geometric requirements. The details given in **Figure 5.2**

Figure 5.2: School building (near Ch 157.800)

5.3 ALTERNATIVES FOR CONSTRUCTION TECHNOLOGY

Cold Mix Technology involves cold asphalt which is a high-quality, polymer-modified cold mix asphalt available in batch orders. Hot Mix Technology involves Hot Mix Asphalt (HMA) which is a combination of approximately 95% stone, sand, or gravel bound together by asphalt cement, a product of crude oil. Asphalt cement is heated aggregate, combined, and mixed with the aggregate at an HMA facility. The comparison between the two is given below:

Table 5.2: Analysis of Cold & Hot Mix Technology

Sl. No.	Parameter	Cold Mix	Hot Mix
1	Description	Street Cold Asphalt is a relatively new product developed in 1995 through the introduction of new polymer technology and research into the manipulation of viscosity and material design, of the various components of an asphalt mix - Street Cold Asphalt is soft and sticky out of the bag, but it quickly hardens after application and the end result is a pavement patch with better strength but similar properties to hot asphalt.	Hot mix asphalt is used primarily as paving material and consists of a mixture of aggregate and liquid asphalt cement, which are heated and mixed in measured quantities. Hot mix asphalt facilities can be broadly classified as either drum mix plants or batch mix plants, according to the process by which the raw materials are mixed. In a batch mix plant, the aggregate is dried first, then transferred to a mixer where it is mixed with the liquid asphalt. In a drum mix plant, a rotary dryer serves to dry the aggregate and mix it with the liquid asphalt cement.
2	Requirements	Cold patch, also known as cold mix or cold asphalt, was first recognized as a way to make road repairs quickly because it can be applied right from the container without heating. Cold asphalt also doesn't require any special heavy rolling machines or special applicators as it can be shovelled or poured into a pothole or utility cut and tamped down with a hand tool.	Hot mix asphalt concrete (commonly abbreviated as HMAC or HMA) is produced by heating the asphalt binder to decrease its viscosity, and drying the aggregate to remove moisture from it prior to mixing. Mixing is generally performed with the aggregate at about 300 °F (roughly 150 °C) for virgin asphalt and 330 °F (166 °C) for polymer modified asphalt, and the asphalt cement at 302 °F (150 °C). Paving and compaction must be performed while the asphalt is sufficiently hot
3	Use	Cold mix asphalt concrete is produced by emulsifying the asphalt in water with (essentially) soap prior to mixing with the aggregate. While in its emulsified state the asphalt is less viscous and the mixture is easy to work and compact The emulsion will break after enough water evaporates and the cold mix will, ideally, take on the properties of cold HMAC Cold mix is commonly used as a patching material and on lesser trafficked service roads	HMAC is the form of asphalt concrete most commonly used on high traffic pavements such as those on major highways, racetracks and airfields Asphalt concrete has different performance characteristics in terms of surface durability, tire wear, braking efficiency and roadway noise.
4	Merits	Actually less expensive to use over the life of a road repair	Less expensive for new road construction

Sl. No.	Parameter	Cold Mix	Hot Mix
		Completely seals and patches potholes, utility cuts, edge repairs, and even overlays.	
5	Demerits	Less resilient and more vulnerable to cracking	Expensive

5.4 'WITH' AND 'WITHOUT PROJECT' SCENARIO

Considering the possible positive impacts to the economic and social infrastructure of the region, the proposed road development is imperative; however, with such development the impacts on the regional environment are also unavoidable. Hence, to understand the significance of the proposed project better "With" and "Without" Project scenarios compared and presented below in **Table 5.3**.

Table 5.3 Comparison between 'With' and 'Without Project' Scenarios

Component	"With" Project Scenario	"Without" Project Scenario
Carriageway	The carriageway will be construct to 6-lane configuration with paved and earthen shoulders on either side. This will ensure seamless traffic flow	The Freight traffic will traverse through Bangalore City area and further lead to traffic congestion.
Traffic Congestion	The new road will be capable of ensuring uninterrupted free flow traffic. This will ensure the Bangalore city free from long route trucks that do not need to enter just for passage. The environment parameters of the region will significantly improve besides saving in vehicle operating cost.	The heavy traffic will continue to move through the Bangalore city thereby mixing with the city traffic and increase the traffic congestion in Bangalore city
Road Safety	There will be a decrease in the number of road accidents after development of the new highway, as there will be adequate space for plying vehicles to cross and overtake. The city traffic will be separate with through commercial traffic and thereby ensure adequate safety to light city vehicles.	Mix of city traffic with through commercial traffic lead to traffic congestion in all arterial roads. This leads to many road accidents. As per the community consultation, many accidents are taking place on the existing road stretches due to mix traffic. With increase in traffic, the situation may worsen.
Environmental Quality	The free flow of traffic on the new highway will improve the environmental quality, as the emissions from the plying vehicles will reduce due to seamless flow. There will be temporary increase in dust and emissions during the construction phase only and is reversible.	Environmental quality will further deteriorate due to pollution and high emission from slow traffic movement and congestions. With increase in traffic, the pace of degradation of environment will only hasten.
Transportation Facilities	Free flow interchanges, VUPs/LVUPs, and truck lay byes proposed along the project road for convenience of people. Thus, the travel quality will drastically improve on the road conditions.	Bad travel quality.
Economic Development	Economic activities will automatically improve once the new road is developed around the Bangalore city. It will also benefit farmers, as they will be able to sell their	The economic activity will remain static and local and will improve only at a laggard pace.

Component	"With" Project Scenario	"Without" Project Scenario
	produce in distant markets due to improved transportation.	
Employment Opportunities	The proposed construction of project road will require around 50 technical staff, 100 skilled labours and 200 non skilled labours during construction phase.	No such opportunity
Development Potential	There will be higher potential for development in this area due to improvement in access and consequent increase in economic activity. Essential community infrastructures like drainage system, water supply, electricity, transportation etc. will come as consequence of current development.	Development activity will be greatly hampered due to inadequate connectivity.
Environmental and Social Issues	There are considerable Social and Environmental issues in project.	No such issue will arise in case of no project

It can be concluded that "With" project scenario having positive/ beneficial impacts will significantly enhance social & economic development of the region when compared to the "Without" project scenario. Hence, the "With" project scenario with some reversible impacts is a preferred and acceptable option rather than the "Without" project scenario. The implementation of the project, therefore, will definitely be beneficial for overall socio-economic environment of the impacted region.

5.5 CONCLUSION

5.5.1 Final Site

Based on facts presented and as suggested during the stakeholder meeting held under the chairmanship of District Collector, Krishnagiri, the district administration recommended and Option 4 (ABGCDJEF) for consideration. Also the The alignment was concurred by the Additional Chief Secretary, Government of Tamil Nadu vide his office letter 14787/HV1/2017-2 dated 24/01/2018. The copy of the letter is also enclosed.

5.5.2 Technological Option

- Durability and strength equivalent to using hot mix
- Permanent repair compared to traditional cold-mix which is only a temporary fix
- No Priming required
- Works even when water is present
- Works at low ambient temperatures (hot-mix cannot be used in cold weather as the asphalt will cool to much prior to compacting)
- Instantly ready for traffic – and in fact product cures and hardens more quickly with compaction forces. Rapid access over the surface reduces down time where there are time- critical schedules
- Limited mess than other brands – product will not stick to or stain hands or shoes even when bucket is freshly opened
- No bleeding

- No drift of bitumen to the surface requiring surface preparation prior to any further overlay
- Reduced labour time and therefore cost
- No requirement for special equipment
- Environmentally beneficial as it reduces carbon emission and noxious fumes avoid wastage

Cold Mix technology is more suitable for repair of potholes and cracks on roads, bridges, overlays, parking lots, other asphalt and concrete surfaces. Cold Mix is fast, permanent, easy to use and environmentally preferable cold asphalt product. However, for constructing new roads hot mix technology is better suited. Contractor/Concessionaire shall utilise the same where ever suitable.

CHAPTER-6: ENVIRONMENTAL MONITORING PROGRAM

6.1 ENVIRONMENTAL MONITORING PROGRAM

Monitoring of environmental quality during construction and operation stages reflects the success of implementation of the mitigation measures. In addition, it provides a means to review the suggested measure and improve upon the measures. To ensure the effective implementation of the Environmental Management Plan (EMP), it is essential that an effective environmental monitoring program be designed and carried out.

6.2 MONITORING PROGRAMME OBJECTIVES

The broad objectives are:

- To evaluate the adequacy of Environmental Assessment.
- To suggest ongoing improvements in management plan based on the monitoring.
- To enhance environmental quality through proper implementation of suggested mitigation measures
- To satisfy the requirements of environmental regulatory framework and community obligations.

6.2.1 Performance Indicators

The physical, biological and social components, which are significant in affecting the environment at critical locations, have been suggested as Performance Indicators. The following specific environmental parameters can be qualitatively measured and compared over a period of time and therefore selected as Performance Indicators for monitoring due to their regulatory importance and the availability of standardized procedures and relevant expertise.

- Air quality with respect to PM_{10}, $PM_{2.5}$, NOx, SO_2 and CO at selected locations.
- Water quality with reference to DO, BOD, COD, Suspended Solids, Turbidity, Alkalinity, Oil and Grease at selected water bodies.
- Noise level at selective /sensitive locations (Institutions, Hospitals, Religious places)
- Survival rates of trees planted as compensatory afforestation to compensate for removal of trees the proposed Greenfield alignment.

6.2.2 Ambient Air Quality (AAQ) Monitoring

Ambient air quality parameters which are recommended for monitoring of construction of highway projects are Particulate Matter (Size less than 10m or PM_{10} μg /m^3), Particulate Matter (Size less than 2.5m or PM $_{2.5}$ μg /m^3), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_x) and Carbon Monoxide (CO). These parameters are to be monitored at selected locations such as plant and machinery sites, crusher sites, excavation works, etc. starting from the commencement of construction activity. Data should be generated at the selected monitoring locations as per the frequency given in **Table 6.1** in accordance with National Ambient Air Quality (NAAQ) Standards 2009 since these are applicable from 18th November 2009 onwards

6.2.3 Ambient Noise Monitoring

The measurement for monitoring the noise levels to be carried out at selective locations and at construction sites along the along the proposed alignment in accordance to the Ambient Noise Standards formulated by Central Pollution Control Board. Sound pressure level would be monitored on

twenty-four hour basis. Noise shall be recorded at "A" weighted frequency using digitized noise monitoring instrument.

6.2.4 Water Quality

Water quality of local water resources that is used by local community shall be monitored. The physical and chemical parameters recommended for analysis of water quality relevant to road project are pH, total solids, total suspended solids, total dissolved solids, COD, BOD, DO, Oil and Grease, Chloride, Iron, etc. The monitoring of the water quality will be carried out at all locations identified along the proposed alignment during construction and operation phase. Monitoring parameters will be as per IS-**10500: 2012** for ground water quality and for surface water quality as per CPCB Guidelines for used based surface water classification**.**

6.2.5 Tree Survival Rate

Roadside plantation of trees and their management will be an important environmental activity for the management group. These activities will include selection of plant species, development of nurseries, protection of plants, interaction with roadside communities for plantation management, and their maintenance, etc.

The construction of the new project road requires felling of within the project road alignment. This loss will be duly compensated by compensatory afforestation. The compensatory afforestation will be done as per Forest (Conservation) Act, 1980 and prevailing policy of Tamil Nadu Forest Department.

To ensure the proper maintenance and monitoring of the compensatory afforestation, a regular maintenance and monitoring of the survival rate of the planted trees is being proposed upto a period of 5 years from the operation of the project. This will be monitored by implementing agency with the help of Forest Department.

6.2.6 Monitoring Plan

The monitoring plan covering various performance indicators, frequency and institutional arrangements of the project in the construction and operation stages is given **in Table 6.1.**

6.3 ENVIRONMENTAL REPORTING SYSTEM

Monitoring and evaluation are important activities in implementation of all projects. Monitoring involves periodic checking to ascertain whether activities are going according to the plans. It provides the necessary feedback for project management to keep the program on schedule.

The reporting system will operate linearly with the Concessionaire, who will report to Independent Engineer (IE), who will in turn report to the Project Implementation Unit (PIU), NHAI. All reporting by the Concessionaire and Independent Engineer shall be on monthly/quarterly/semi-annually/annual basis. The PIU shall be responsible for preparing targets for each of identified EMP activities.

The compliance monitoring and the progress reports on environmental components may be clubbed together and submitted to the PIU regularly during the implementation period. The operation stage monitoring reports may be annual or biennial provided the project Environmental Completion Report shows that the implementation was satisfactory. Otherwise, the operation stage monitoring reports will have to be prepared as specified in the said project Environmental Completion Report.

Table 6.1: Environmental Monitoring Plan

Environment Component	Project Stage	Environmental Monitoring					Institutional Responsibilities			
		Parameters	Standards	Locations	Frequency	Duration	No of Samples	Action Plan in case criteria exceeds	Implementation	Supervision
Air Quality	Construction	PM_{10} µg /m^3, $PM_{2.5}$ µg /m^3, SO_2, NOx, CO	National Ambient Air Quality Standard	Batching Plant, Hot Mix Plant (HMP) and Stone Crusher (3 locations)	Once in a season (excluding the monsoon) for 3 years	Continuous 24 hours	1x3x3x3 =27	Check and modify control device like bag filter/cyclones of hot mix plant	Contractor through approved monitoring agency	IE, NHAI – PIU Bangalore (Expressway)
		PM_{10} µg /m^3, $PM_{2.5}$ µg /m^3, SO_2, NOx, CO		Stretch of the road where construction is in progress. At minimum 6 locations in consultation with IE	Once in a season (excluding the monsoon period) for 3 years	Continuous 24 hours	1x3x3x6= 54	-	Contractor through approved monitoring agency	IE, NHAI – PIU Bangalore (Expressway)
	Operation	PM_{10} µg /m^3, $PM_{2.5}$ µg /m^3, SO_2, NOx, CO		Along the project road at locations of baseline monitoring (6 locations)	Once in a season excluding the monsoon for 2 years	Continuous 24 hours	1x3x2x6= 36	-	Concessionaire through approved monitoring agency	IE, NHAI – PIU Bangalore (Expressway)
Surface Water Quality	Construction	pH, temperature, DO, BOD, COD, Oil & Grease, Total Suspended Solid, TDS, turbidity, Total Hardness, Chlorine, Iron, Total Coliform etc.	Surface Water Quality Standard as per used based classification for Surface Water as per	At identified locations. Minimum 2 locations	Once in a season (excluding the monsoon period) for 3 years	Grab Sampling	1x3x3x2= 18	Check and modify oil interceptors, silt fencing devices	Contractor through approved monitoring agency	IE, NHAI – PIU Bangalore (Expressway)

Environment Component	Project Stage	Environmental Monitoring					Institutional Responsibilities			
		Parameters	Standards	Locations	Frequency	Duration	No of Samples	Action Plan in case criteria exceeds	Implementation	Supervision
	Operation	pH, temperature, DO, BOD, COD, Oil & Grease, Total Suspended Solid, TDS, turbidity, Total Hardness, Chlorine, Iron, Total Coliform	CPCB Guidelines.	At identified locations Minimum 2 locations	Once in a season excluding the monsoon for 2 years	Grab Sampling	1x3x2x2= 12	Check and modify Oil interceptors, silt fencing devices	Concessionaire through approved monitoring agency	IE, NHAI – PIU Bangalore (Expressway)
Ground Water Quality	Construction	pH, Temperature, TSS, Total hardness, Suspended Solid, Chlorine, Iron, Sulphate, Nitrate etc.	Ground Water Quality Standard as per IS-10500: 2012	Plant Construction site and Minimum 2 locations	Once in a season excluding the monsoon for 3 years	Grab Sampling	1x3x3x3= 27	Check and modify oil interceptors, silt fencing devices	Contractor through approved monitoring agency	IE, NHAI – PIU Bangalore (Expressway)
	Operation	pH, Temperature, TSS, Total hardness, Suspended Solid, Chlorine, Iron, Sulphate, Nitrate etc.		At identified locations. Minimum 2 locations	Once in a season excluding monsoon for 2 years	Grab Sampling	1x3x2x2= 12	Check and modify petrol interceptors, silt fencing devices	Concessionaire through approved monitoring agency	IE, NHAI – PIU Bangalore (Expressway)

Environment Component	Project Stage	Environmental Monitoring					Institutional Responsibilities			
		Parameters	Standards	Locations	Frequency	Duration	No of Samples	Action Plan in case criteria exceeds	Implementation	Supervision
Noise Level	Construction	Leq dB (A) (Day and Night) Average and Peak values	National Ambient Noise Standard 2000	At equipment yards and along the project road at 6 locations of baseline monitoring in consultation with IE.	Once in a season (excluding monsoon) for 3 years	Readings to be taken at 60 seconds interval for every hour and then Leq are to be obtained for Day time and Night time	1x3x3x7= 63	Check and modify equipment and devices used to protect noise level	Contractor through approved monitoring agency	IE, NHAI – PIU Bangalore (Expressway)
	Operation	Leq dB (A) (Day and Night) Average and Peak values		At the locations of baseline monitoring. Minimum 6 locations	Once in a season (excluding monsoon) for 2 years	Readings to be taken at 60 seconds interval for every hour and then Leq are to be obtained for Day time and Night time	1x3x2x6= 36	-	Concessionaire through approved monitoring agency	IC, NHAI – PIU Bangalore (Expressway)

Environment Component	Project Stage	Environmental Monitoring					Institutional Responsibilities			
		Parameters	Standards	Locations	Frequency	Duration	No of Samples	Action Plan in case criteria exceeds	Implementation	Supervision
Soil	Construction	Physical Parameter: Texture, Grain Size, Gravel, Sand, Silt, Clay; Chemical Parameter: pH, Conductivity, Calcium, Magnesium, Sodium, Nitrogen, Absorption Ratio	-	Near Construction sites and along the project road at locations of baseline monitoring in consultation with IE. Minimum 2 locations	Once in a season (excluding the monsoon) for 3 years	Composite Sample	1x3x3x2= 18	-	Contractor through approved monitoring agency	IC, NHAI – PIU Bangalore (Expressway)
	Operation	Physical Parameter: Texture, Grain Size, Gravel, Sand, Silt, Clay; Chemical Parameter: pH, Conductivity, Calcium, Magnesium, Sodium, Nitrogen, Absorption Ratio		At the locations of baseline monitoring. Minimum 2 locations	Once in a season (excluding monsoon) for 2 years	Composite Sample	1x3x2x2= 12	-	Concessionaire through approved monitoring agency	IC, NHAI – PIU Bangalore (Expressway)

Environment Component	Project Stage	Environmental Monitoring					Institutional Responsibilities			
		Parameters	Standards	Locations	Frequency	Duration	No of Samples	Action Plan in case criteria exceeds	Implementation	Supervision
Construction Sites and Construction Camps	Construction	Monitoring of: 1. Storage Area 2.Drainage Arrangements 3.Sanitation in Construction Camps	As laid out in the Detailed Design for the project	At Storage area and construction camps	Quarterly in the construction stage.	-	-	-	Concessionaire through approved monitoring agency	IC, NHAI – PIU Bangalore Expressway
Road side plantation	Pre-Construction	Monitoring of felling of trees (It should be ensured that only those trees, which are falling in formation width, are felled)	As laid out in the Detailed Design for the project	All along the corridor	During the felling of trees	-	-	-	Forest Department	Concessionaire. (to assist in co-ordination with the NHAI
	Operation stage	Survival rate of trees Success of re-vegetation The number of trees surviving during monthly visit should be compared with number of saplings planted.	As laid by the concerned department.	All along the corridor	Every year for initial three years during operation phase.	-	-	-	Concessionaire & Forest Department	Concessionaire & Forest Department

6.4 ENVIRONMENTAL MONITORING COST

The environmental monitoring cost is estimated on the basis of the length and existing environmental scenario of the project roads. Environmental monitoring cost of Rupees Eighteen Lakhs Fifty Seven thousand only (**Rs. 18,57,000/-)** has been allocated for construction and operation stages of project road sections of NH-948A. The details are provided in **Table 6.2.**

Table 6.2 Environmental Monitoring Cost

Component	Stages	Particular	Quantity	Unit Rate (Rs.)	Total Cost (Rs.)
Air	Construction	Monitoring near Batching Plant Plant Site, hot mix plant locations and Stone Crusher	At 3 locations for three season in a year for 3 years (1x3x3x3 =27)	8,000/samples	2,16,000/-
		Monitoring at construction sites	At 6 locations for three season in a year for 3 years (1x3x3x6=54)	8,000/samples	4,32,000/-
	Operation	Ambient Air Quality Monitoring	At 6 locations for three season for 2 years (1x3x2x6=36)	8,000/samples	2,88,000/-
Surface Water	Construction	Surface water resources	At 2 locations for three season in a year for 3 years (1x3x3x2=18)	6,000/samples	1,08,000/-
	Operation	Surface water resources	At 2 locations for three season for 2 years (1x3x2x2=12)	6,000/samples	72,000/-
Ground water	Construction	Ground water bodies	At 2 locations for three season in a year for 3 years (1x3x3x3=27)	6,000/samples	1,62,000/-
	Operation	Ground water bodies	At 3 locations for three season for 2 years (1x3x2x2=12)	6,000/samples	1,08,000/-
Noise	Construction	At equipment's yards	At 1 location for three season in a year for 3 years (1x3x3x1=9)	3,000/samples	27,000/-
	Construction	At construction sites identified by IE	At 6 locations for three season in a year for 3 years (1x3x3x6=54)	3,000/samples	1,62,000/-
	Operation	As directed by the Engineer	At 6 locations for three season in a	3,000/samples	1,08,000/-

Component	Stages	Particular	Quantity	Unit Rate (Rs.)	Total Cost (Rs.)
			year for 2 years (1x3x2x6=36)		
Soil	Construction	At productive agricultural lands abutting traffic detours and traffic diversions, to be identified by the Engineer	At 2 locations for three season in a year for 3 years (1x3x3x2=18)	7,000/samples	1,26,000/-
	Operation	At five locations where baseline monitoring has been carried out	At 3 location for three season in a year for2 years (1x3x2x2=12)	7,000/samples	84,000/-
Construction site and construction camps	Construction	Monitoring of: 1. Storage Area 2.Drainage arrangements 3.Sanitation in Construction camps	Quarterly in construction stage till end of construction	-	-
Road Side Plantation		Considered in EMP Budget			
TOTAL ENVIRONMENTAL MONITORING COST (Rs.)					18,57,000/- Say **18.57 Lakh**

CHAPTER-7: ADDITIONAL STUDIES

7.1 PUBLIC CONSULTATION

Public participation and community consultation is taken up as an integral part of social and environmental assessment process of the project. Consultation is used as a tool to inform and educate stakeholders about the proposed action both before and after the development, decisions are made. This assists in identification of the problems associated with the project as well as the needs of the population likely to be impacted. This participatory process is helpful in reducing the public resistance to change and to enable the participation of the local people in the decision-making process. The involvement of the various stakeholders ensures that the affected population and other stakeholders are informed, consulted and allowed to participate at various stages of project preparation.

Initial Public consultations have been carried out in this project during the site surveys with the objectives of minimizing probable adverse impacts of the project through alternate design solutions (alignment and cross-sectional) and to achieve speedy implementation of the project through bringing awareness amongst the community on the benefits of the project. The public/official consultation has been taken up as an integral part of social and environmental assessment process for this project.

7.1.1 Objectives of Public Consultation

Community consultations in the project are undertaken with objectives, which may be grouped into:

- Information sharing.
- Appraisal and assessment of the community needs.
- Assessment of the environmental issues in the region, and
- Development of specific design solutions and enhancement measures. These objectives are discussed below:

7.1.1.1 Information Sharing

- To promote public awareness about the proposed project especially amongst the potentially impacted communities/individuals.
- To educate the individuals/interested groups about the proposed course of action;
- To solicit the views of affected communities/individuals on environmental components and the significance of impacts;
- To serve as an important tool for collecting information about natural and the human environments, much of which would never be accessible through more traditional approaches of data collection;
- To ensure lessening of public resistance to modify the proposed activity, by involving them in the decision making process; and
- To achieve the basis for an Environment Management Plan for the project, with the incorporation of felt needs views and preferences of the people likely to be impacted.

7.1.1.2 Appraisal & Assessment

- To inform Project Affected Communities about the provision of EMP, and to settle their felt need with mutual consent and to assist them during relocation of community property, if any
- Deduce information from the people about the local environmental issues and their dependence upon them.

- Collect peoples' perceptions about the project and how the negative effects of the project should be mitigated.

7.1.1.1 Devising Specific Solutions

- To solicit the views of affected communities/individuals on environmental and social problems.
- Receive suggestions from the affected communities with regard to the preferences and options about the project in general and avoidance measures, mitigation/compensation measures, and benefits being provided, in particular.
- To ensure lessening of public resistance to change by providing them a platform in the decision making process.
- Thus, constructive participation by the affected population can influence not only environmental and social impacts of the project corridor, but also the costs, success and duration of the main investment project itself.

7.1.2 Consultations with Project Authorities and Other Officials

Consultation with the stakeholders and government agencies is an integral component of environmental assessment and project design. Without community consultation, a project will not reflect issues or solutions identified by local residents, and a lack of government agency consultation can result in missed data and a lack of conformity with policy and guidelines, in addition to missed opportunities to share experiences and identify solutions to difficult concerns/issues.

Consultations with government agencies and community consultations have been focused to ensure that complete and accurate data is incorporated into the screening assessment, EIA and SIA Report.

The number of officials from various governmental departments have been consulted to assess the actual environmental as well as social conditions of the region.

7.1.3 Formal Consultations at site

Formal consultations are being carried through structured surveys/interviews and have been detailed in the Social Impact Assessment report.

7.1.3.1 District level Consultation at site

District level public consultation for STRR Phase-3, was conducted on 30th October, 2017 from11.00 hrs, at Titan Jewellery Hall, Hosur with Deputy Commissioner, Krishnagiri District (**Appendix-7.1**). The meeting was chaired by Deputy Commissioner and attended by Project Director NHAI, PIU Bangalore (expressway), officials of Hosur New Town Development Authority (HNTDA), Hosur Industries Association (HIA), other officials, members of the consultant company and general public.

The general public, who attended the meeting welcomed the proposed project as this will bring economic prosperity to the region and request to implement this at the earliest as it will give seamless connectivity to Hosur city besides economic activities being accelerated in the region. Photographs of the public consultation/hearing are shown below:

Site Visit with SDRO, Tehsildar to the project Site

Meeting with government officials

Public Meeting in Madhagondapalli Village attended by (DRO, SDRO, SDM, Local MLA)

NHAI officials meeting with District Collector, Krishnagiri

Figure 7.1: Photographs of District Level Public Consultation

Figure 7.2: Photographs of consultation at site

7.1.4 Continued Consultations and Participation

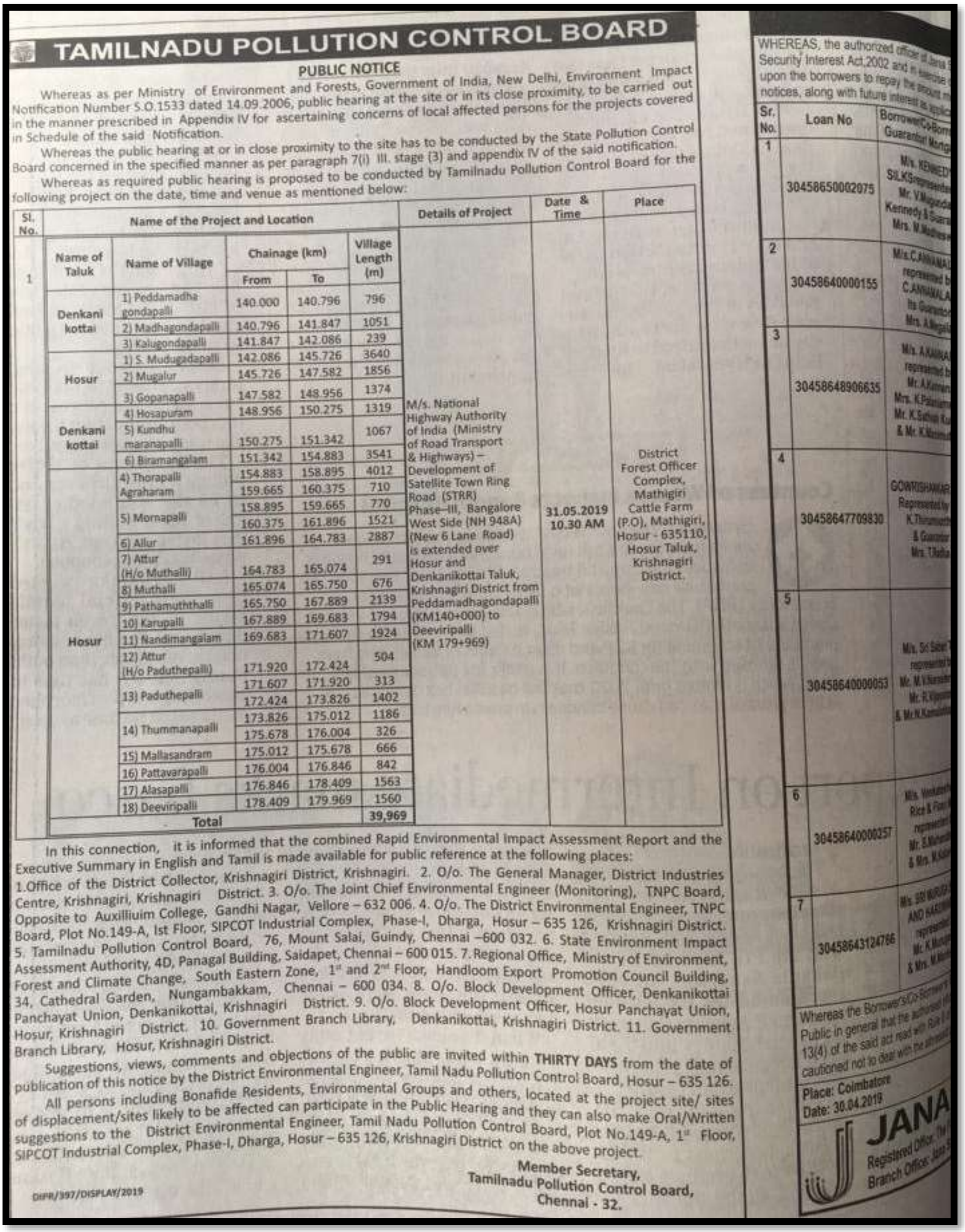
In order that the consultations continue till the implementation of the project, to redress the environmental issues likely to surface during construction and operational phases, a constant communication will be established with the affected communities and the road users. To achieve this, Contractors in consultation with the Supervision Consultant and independent Consultant will organize periodical meetings with the communities before the start of work, during and before the completion of work to inform them about the Construction Activities, Traffic Management Plan, and Siting of Labor Camps etc. and to invite their Suggestions / Grievances.

7.1.5 ENVIRONMENTAL Public Hearing

The public hearing was successfully conducted on 31st May, 2019 at 10:30 a.m in the District Forest Officer Complex, Mathigiri Cattle Farm (P.O),Mathiri ,Hosur Taluk, Krishnagiri District of Tamil Nadu State as per the EIA Notification, 2006 and its subsequent amendments.

Newspaper advertisement, attendance sheet, signed minutes of meeting of Public Hearing and compliance of Public Hearing are enclosed as **Appendix 7.2, Appendix 7.3, Appendix 7.4 and Appendix 7.5.** Some photographs of the Public hearing are also shown below in Figure 7.3

Figure 7.3 Photographs of Public Hearing



TAMILNADU POLLUTION CONTROL BOARD

PUBLIC NOTICE

Whereas as per Ministry of Environment and Forests, Government of India, New Delhi, Environment Impact Notification Number S.O.1533 dated 14.09.2006, public hearing at the site or in its close proximity, to be carried out in the manner prescribed in Appendix IV for ascertaining concerns of local affected persons for the projects covered in Schedule of the said Notification.

Whereas the public hearing at or in close proximity to the site has to be conducted by the State Pollution Control Board concerned in the specified manner as per paragraph 7(i) III. stage (3) and appendix IV of the said notification.

Whereas as required public hearing is proposed to be conducted by Tamilnadu Pollution Control Board for the following project on the date, time and venue as mentioned below:

Sl. No.	Name of the Project and Location					Details of Project	Date & Time	Place
	Name of Taluk	Name of Village	Chainage (km) From	Chainage (km) To	Village Length (m)			
1	Denkani kottai	1) Peddamadha gondapalli	140.000	140.796	796	M/s. National Highway Authority of India (Ministry of Road Transport & Highways) – Development of Satellite Town Ring Road (STRR) Phase–III, Bangalore West Side (NH 948A) (New 6 Lane Road) is extended over Hosur and Denkanikottai Taluk, Krishnagiri District from Peddamadhagondapalli (KM140+000) to Deeviripalli (KM 179+969)	31.05.2019 10.30 AM	District Forest Officer Complex, Mathigiri Cattle Farm (P.O), Mathigiri, Hosur - 635110, Hosur Taluk, Krishnagiri District.
		2) Madhagondapalli	140.796	141.847	1051			
		3) Kalugondapalli	141.847	142.086	239			
	Hosur	1) S. Mudugadapalli	142.086	145.726	3640			
		2) Mugalur	145.726	147.582	1856			
		3) Gopanapalli	147.582	148.956	1374			
	Denkani kottai	4) Hosapuram	148.956	150.275	1319			
		5) Kundhu maranapalli	150.275	151.342	1067			
		6) Biramangalam	151.342	154.883	3541			
	Hosur	4) Thorapalli Agraharam	154.883	158.895	4012			
			159.665	160.375	710			
		5) Mornapalli	158.895	159.665	770			
			160.375	161.896	1521			
		6) Allur	161.896	164.783	2887			
		7) Attur (H/o Muthalli)	164.783	165.074	291			
		8) Muthalli	165.074	165.750	676			
		9) Pathamuththalli	165.750	167.889	2139			
		10) Karupalli	167.889	169.683	1794			
		11) Nandimangalam	169.683	171.607	1924			
		12) Attur (H/o Paduthepalli)	171.920	172.424	504			
		13) Paduthepalli	171.607	171.920	313			
			172.424	173.826	1402			
		14) Thummanapalli	173.826	175.012	1186			
			175.678	176.004	326			
		15) Mallasandram	175.012	175.678	666			
		16) Pattavarapalli	176.004	176.846	842			
		17) Alasapalli	176.846	178.409	1563			
		18) Deeviripalli	178.409	179.969	1560			
	Total				39,969			

In this connection, it is informed that the combined Rapid Environmental Impact Assessment Report and the Executive Summary in English and Tamil is made available for public reference at the following places: 1.Office of the District Collector, Krishnagiri District, Krishnagiri. 2. O/o. The General Manager, District Industries Centre, Krishnagiri, Krishnagiri District. 3. O/o. The Joint Chief Environmental Engineer (Monitoring), TNPC Board, Opposite to Auxilliuim College, Gandhi Nagar, Vellore – 632 006. 4. O/o. The District Environmental Engineer, TNPC Board, Plot No.149-A, Ist Floor, SIPCOT Industrial Complex, Phase-I, Dharga, Hosur – 635 126, Krishnagiri District. 5. Tamilnadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai –600 032. 6. State Environment Impact Assessment Authority, 4D, Panagal Building, Saidapet, Chennai – 600 015. 7. Regional Office, Ministry of Environment, Forest and Climate Change, South Eastern Zone, 1st and 2nd Floor, Handloom Export Promotion Council Building, 34, Cathedral Garden, Nungambakkam, Chennai – 600 034. 8. O/o. Block Development Officer, Denkanikottai Panchayat Union, Denkanikottai, Krishnagiri District. 9. O/o. Block Development Officer, Hosur Panchayat Union, Hosur, Krishnagiri District. 10. Government Branch Library, Denkanikottai, Krishnagiri District. 11. Government Branch Library, Hosur, Krishnagiri District.

Suggestions, views, comments and objections of the public are invited within **THIRTY DAYS** from the date of publication of this notice by the District Environmental Engineer, Tamil Nadu Pollution Control Board, Hosur – 635 126.

All persons including Bonafide Residents, Environmental Groups and others, located at the project site/ sites of displacement/sites likely to be affected can participate in the Public Hearing and they can also make Oral/Written suggestions to the District Environmental Engineer, Tamil Nadu Pollution Control Board, Plot No.149-A, 1st Floor, SIPCOT Industrial Complex, Phase-I, Dharga, Hosur – 635 126, Krishnagiri District on the above project.

Member Secretary,
Tamilnadu Pollution Control Board,
Chennai - 32.

DIPR/397/DISPLAY/2019

Figure 7.4: Newspaper advertisement of Public Hearing

7.1.6 Future Considerations

The initial screening and preliminary Environmental Assessment reveals that the project implementation will result in appreciable social and economic benefits to the people in the project affected area in terms of easy access to the schools, hospitals, government offices, markets etc., increase in land value; reduced travel time

& cost and traffic congestion. The proposed road would act as the prime artery for the economic flow to this region.

7.2 RESETTLEMENT ACTION PLAN AND SOCIAL IMPACT ASSESSMENT

The action plan is based on the primary and secondary data sources. Secondary data source include Gazetteer of project districts, maps and District Census Details, 2011. A questionnaire was used to conduct census and socio-economic survey.

This Resettlement Action Plan (RAP) report has been prepared as per the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, (New LARR 2013 Act), National Highways Act (NH Act), 1956 and is based on data collected from field survey. The primary purpose for preparing SIA (Social Impact Assessment and Resettlement Action Plan (RAP) is to assess the socio-economic condition of the Project Affected Persons (PAPs) in order to minimise and provide mitigative measures. Since the displacement is indispensable, rehabilitation shall be done in such a manner so that the standard of living of PAPs is restored. Special attention will be paid to the vulnerable groups. RAP has provisions to ensure that PAPs are compensated at replacement value for the assets lost and to enable them to regain or improve their socio-economic status enjoyed prior to the project. The RAP is a live document and will be updated as and when necessary. Implementation of the RAP will be done on data so modified.

7.2.1 Objective of the study

The objective of social screening is to create a baseline database containing the features and populace in the immediate vicinity of proposed roads as well as the structures likely to be affected by the roads widening/Improvement process. Social screening during the feasibility stage helps to avoid, reduce or mitigate likely negative impacts of project action and enhance positive impacts, sustainability and development benefits. The report aims to highlight the social problems and suggests general and typical mitigation measures to alleviate social problems that the project-affected people may face such as loss of livelihood, displacement and loss of access to community facilities through construction of service roads, underpasses and other facilities.

7.2.2 Scope of the Study

Carry out Structure Verification Survey of the structures likely to be affected and Socio-Economic Survey of the Project Affected Persons (PAPs) to get the base line information about the level of impact and to get the base line socio economic status of the PAPs.

Preparation of Strip Plan showing existing structures likely to be affected along the project roads.

Conducting Social Impact Assessment including Rehabilitation and Resettlement (R&R) studies

Preparation of detailed Land Acquisition (LA) Plans with the help of Village Revenue Maps (RVMs) to undertake the land acquisition along the proposed project corridors.

Preparation of Land Plan Schedules(LPS) of ownership thereof and costs as per revenue authorities and also based on realistic rates.

Preparation of Social Impact Assessment (SIA) report and Resettlement Action Plan (RAP) for the selected roads.

7.2.3 Social and Rehabilitation Issues

Most of the infrastructure improvements planned for the Urban/Rural areas will take place within the existing Right of Way (RoW) except at some of the congested settlements and densely builtup areas where bypasses/change in alignment/grade separation are proposed and at locations where minor improvements are required for accommodating road safety measures. Since, along the existing National Highways lot of

settlements/habitations are developed and further Land Acquisition will result in displacement of affect persons to reduce the negative imapact of public and to reduce the displacement, the option of Green field alignment were being studied where, displacement will be less. Social screening surveys need to be conducted in the DPR stage. It was obvious that in majority sections of the project roads, ROW is limited and not enough to accommodate/fit in design standards. Further, it has been identified that RoW is not fully free from encumbrances and at many places it is encroached and squatted upon by the people for various purposes mainly, near habitations and in market places. These issues may compound leading to delay of project and escalation of project cost. Hence, in order to face or overcome these consequences, a preliminary idea of Social and Rehabilitation issues need to be acquired and should be considered while selection of corridors. The key social issues considered would be as below.

Loss of fertile agricultural land;

Loss of structures used for residential, commercial and other purposes and associated loss of livelihood i.e., loss of livelihood due to impacts on sources of earning;

Loss of other properties and assets such as boundary walls, hand pumps, bore wells, dug wells, ponds etc.;

Disruption of livelihood due to clearing of RoW particularly, petty shop owners;

Loss of common property resources such as religious places, Samadhi, graveyard, cremation places, water resources, village gates, passenger shelters, etc;

Likelihood of increased accidents due to road widening;

Land use along the Project Road

The preliminary social assessment was carried out, considering Proposed Right of Way of 70M (35M on either side of the proposed PCL) all along the project roads except at the proposed facilities such as Interchanges, RoBs, Bridges etc. Most of the land use categories along this section are of either Agricultiral land or Barren land and various activities are being carried out by the local residents. The proposed project road passes through Denkanikottai and Hosur taluks of Krishnagiri district in the state of Tamilnadu. The proposed alignment is passing where some pucca, semi pucca and kutcha structures are found at some locations along the proposed alignment mainly at proposed Interchanges and other Way Side Amenities. These settlements are like as private, government and community assets. The major portion is predominantly either agricultural or barren land. In general, the inhabitants occupying lands for different activities along the proposed road have land titles. This has implications on the design of the Entitlement Matrix and mitigative measures. Common Property Resources along the sections of the project road include some religious structures, community/village bushy land, grazing lands, water resources, etc.

7.2.4 Negative Social Impact

As the proposed project roads are passing through around 21 villages in Denkanikottai and Hosur taluks of Krishnagiri district of Tamilnadu state consists of high impact zones are the settlements (where the Interchanges are proposed) through which the proposed alignment is passing where some pucca, semi pucca and kutcha structures are found. As the proposed alignment is a Green Field alignment for a total length of 35.489 Kms. In Phase-III (Total STRR project Road Length is 179.969 Kms), acquisition is required for laying of the proposed 4/6-laning with paved shoulder all along the proposed road. As per the social impact assessment and base line verification survey, 206 number of structures (including Compound Walls/Fencing) are either partially/completely affected. The estimated land required for the laying/improvement of other road safety improvements such as creation of strengthening of footpaths, to provide proper drain, RoBs, flyovers, etc all along the project road is approximately about 318.179 Ha. The land required by the project for the construction of proposed project road falls under two classifications. (1) Public land owned by the State Government and administered by other departments such as Revenue Department etc; and (2) Private Land.

7.2.5 Preparation of Land Acquisition Report/Plan

As part of preparation of Land Acquisition (LA) Report/Plan, firstly after identifying the villages along all the project roads, latest available Village maps were collected from the respective District Survey offices/Village Offices. After collecting the same reference points were collected along the project roads at common identifiable locations (both On Village revenue Maps as well as on ground).

During the process of identifying the Survey Numbers in which the land to be acquired where the improvement/widening is proposed, the Village Revenue Maps were scanned and attached as per the topographical data and as per the common reference points collected all along the project roads.

As part of the preparation of Land Plan Schedules (LPS), after identifying the Survey Numbers in which the addition land to be acquired for proposed improvements, for each survey number details such as sub-division numbers, type of land, nature of land and other relevant data was collected from the respective Village offices.

7.2.6 Identification of Structures

Census of all the structures lying within 70m has been undertaken from the topographical survey data to assess the project impact on the population for displacement, resettlement and rehabilitation. The structures existing within the proposed RoW belong to encroachers as well as title and non-title holders. The total number of structures within proposed RoW to be impacted is around 206 (which includes Residential, Commercial, Cattle Sheds, small Religious Structures etc.).

Of the total likely to be affected structures, significant number (190) of private properties comprising Residential, Commercial and Cattle Sheds structure of various types (Pucca/Semi-Pucca/Kutcha) are existing along the project road followed by community/panchayat structures (12 Nos.) (Religious/Tombs) and Government (4 Nos.) are affected.

7.2.7 Ownership of the Affected Structures

The estimated number of structures identified and verified of which are affected completely or partially along STRR Road (Phase-III) is about 206 structures including compound walls. Of the total affected structures, 190 (92.23%) are private, 4 (1.94%) are owned by the government and 12 (5.83%) are owned by the Community in the form of religious and other properties are affected in this project road. Ownership wise details of likely affected structures are presented in below **Table 7.1.**

Table 7.1: Ownership Status of the Affected Structures

Sl. No.	Ownership	No	% to total
1	Private	190	92.23
2	Government	4	1.94
3	Community	12	5.83
4	Panchayat/MC	0	0.00
Total		206	100.00

7.2.8 Impact on Private Properties

The estimated land requirements are resulting in complete or partial displacement of about 206 private structures. Of the total affected private structures, 44 (23.16%) are used for residential purpose, 43 (22.63%) are used for commercial purposes and 5 (2.63%) used for both residential cum commercial purposes are affected. A considerable number 98 (51.58%) of affected structures are found to be compound walls, toilets, basements, sheds, cattle sheds etc. Most of the commercial establishments are provisional (kirana) shops. The usage wise details of all private structures likely to be affected are presented in below **Table 7.2**.

Table 7.2: Usage of the Private Properties Affected

Sl. No.	Usage	No	% to total
1	Residential	44	23.16
2	Commercial	43	22.63
3	Residential + Commercial	5	2.63
4	Others (incl. Toilets, Sheds, , Petty Shops, School etc.)	98	51.58
Total		190	100.00

7.2.9 Impact on Common Property Resources

A total of 16 common properties are affected across the project road. Of which 3 (18,75%) are Religious structures in the form of small temples. About 9 (56.25%) of other religious structure in the form of grave yard/tomb are affected in this project road. In addition, around 4 (25%) other structures such as Bus Stops, Compound Walls etc owned by the government/community are affected. No other structures owned by the community/government are affected along the project road. Details of the usage of these common properties such as religious places and other structures are given in **table 7.3** below.

Table 7.3: Common Properties Affected

Sl. No.	Usage	No	% to total
1	Religious Places (Temples)	3	18.75
2	Grave Yard/Tomb	9	56.25
3	Government Buildings	2	12.50
4	Others (Market, Arch, Statue, Shopping Complex, Bus Stops, Compound Walls Etc.)	2	12.50
Total		16	100.00

7.2.10 Other Assets and Minor Structures Affected

In addition to the above listed properties other minor assets which includes well, bore well, water tanks, taps, Hand pumps and Overhead Tanks etc. around a total of 93 minor assets are affected in this road. Details are given in the **table 7.4** below.

Table 7.4: Details of Other Minor Assets Affected

Sl. No.	Usage	No	% to total
1	Well	9	9.68
2	Bore Wells	10	10.75
3	Water Tanks	14	15.05
4	Pump House	5	5.38
5	Hand Pumps	0	0.00
5	Others (Over Head tanks, Pits, Sump, Taps etc.)	55	59.14
Total		93	100.00

7.2.11 Type and Area of the Affected Structures

Of the total 206 structures affected under both private and government/common property resources a majority 100 (48.54%) are Semi-Pucca and of the remaining, 91 (44.17%) structures are Pucca and 12 (5.83%) are

Kutcha in nature. The total area affected excluding Compound Walls Length is about 17038.45 square meters. Details are presented in **table 7.5** below.

Table 7.5: Type and Area of Structures Affected along Project

Sl. No	Type	Total Structures Affected		Total Area affected (Sq.mts)	
		No	%	No	%
1	Pucca	91	44.17	4946.55	29.03
2	Semi pucca	100	48.54	9288.84	54.52
3	Kutcha	12	5.83	463.02	2.72
4	Movable	3	1.46	2340.03	13.73
Total		206	100.00	17038.44	100.00
Area affected is excluding affected compound walls area.					

7.2.12 Usage with type of total affected structures

Observed across the type and usage of the total affected structures, majority of the residential, commercial, structures used for other purposes and compound walls are Semi-Pucca in nature. Details of usage with type of likely affected structures including compound walls are presented in **table 7.6** below.

Table 7.6: Usage with Type of Total Affected Structures

Sl. No.	Usage	Type of affected property (%)		
		Pucca	Semi-Pucca	Kutcha
1	Residential	12	28	4
2	Commercial	14	26	3
3	Res+Commercial	3	2	0
4	Others (Incl. Common Property Resources, CWs etc.)	62	44	8

Extent of Loss by Usage

Table 7.7 below presents the percentage of loss for the total affected properties by their usage. From the table below it is seen that out of the total area of 21318.64 square meters the affected area is 17038.44 square meters thus resulting in a loss of 73.48% of the total area excluding the affected length 1976.84 Metres of Compound walls.

Table 7.7: Percentage of loss by Usage

Sl. No	Type of usage	Total		
		Total Area	Affected area	% of loss
1	Residential	3130.63	2980.92	95.22
2	Commercial	13363.77	10051.78	75.22
3	Res+Commercial	1609.51	1296.19	80.53
4	Others (incl. Common property resources)	3214.73	2709.55	84.29
5	Compound Walls (Length in Mtrs)	1976.84		
Total		21318.64	17038.44	79.92

7.2.13 Affected Mobile Vendors and Road Side Kiosks

In addition to the affected structures discussed above some roadside Kiosks and mobile vendors are also affected mainly near the proposed Interchanges where the proposed project road crosses existing State

Highways and National Highways. As per the verification approximately a total number of 62 kiosks and local mobile vendors are affected. A majority of them are into these businesses from the last 5 to 10 years are found to earn about 350 to 400 rupees per day. Of the total 55 kiosks and local mobile vendors who are temporarily affected due to the widening of the existing road are into the business of Coconut vendors, Flower vendors, fruit vendors etc. are affected.

7.2.14 Project Impacted PAPs

The acquisition of private land and the affected structures by the project are indicators of impact on the social environment. To estimate the exact number of impacted persons at this stage is not possible. Generally, the impact of project is evaluated on magnitude of land loss and other immovable assets/ structures.

Here, the impacted persons are calculated on the basis of affected structures in project road. The affected persons can be derived by multiplying the average members of household in the project influence districts into likely to be affected structures. The district average of the family size is considered as the base. According to the estimation, approx. 410 project-affected persons of 102 households are likely to be impacted directly or indirectly by the widening of the project road.

7.2.15 Profile of Structure Affected Population

As part of the social assessment survey the demographic and socio-economic particulars of the occupants of the above discussed affected properties is collected. The total number of project-affected households who will be losing their privately owned structures including compound walls is 102. Of the total households, the survey was conducted in around 26 households who are losing their privately owned structures either partially or fully (approximately a sample of 25% of the total households losing their properties). To avoid the non-response cases the survey was conducted in more than the required sample and all are completed. The following analysis is presented for some of the useful indicators at the household level. The analysis tables presenting not available response cases for some of these indicators are mostly due to the respondent being an absentee or not allowed to provide the details.

7.2.16 Socio-Cultural profile of the Project Road

Of the total surveyed households a total of 149 persons are affected due to acquisition of houses and other assets of which 83 (55.7%) constitute Male and 66 (44.3%) constitute female. **Table 7.8** on the analysis of Socio-Cultural profile of the surveyed households shows that along the project corridor, there were households belonging to only two religions viz Hindus (96.15%) and Muslims (3.85%). Social group-wise most of the affected people represents the Backward caste (73.08%) and of the remaining 19.23 percent are General castes. The incidence of Scheduled Castes is around 7.69% along the project road. Observed across the family pattern majority (50%) of the affected households are joint families and of the remaining 46.15 percent of the affected households live as nuclear families.

Most of the households are staying along the roadside from a long time where in nearly 42.31% of them are living since more than 10 years. About 26.92% of them are found to have settled in the last 2-6 years. Details are presented in table below. Analysis on literacy level of head of the affected households shows that around 61.54 percent of them are literates. During the survey, some of the owners/occupants of the structures are not available and the respondent is not in a position to give the details of the concerned head of the Household.

Table 7.8: Socio-Cultural Characteristics of Structure Affected Population

Item	Description	No	% of total
Population	Male	83	55.70
	Female	66	44.30
	Total	149	100.00
Religious Group	Hindu	25	96.15
	Muslim	1	3.85
	Christian	0	0.00
	Others	0	0.00
	Total	26	100.00
Social Group	General	5	19.23
	BC	19	73.08
	SC	2	7.69
	ST	0	0.00
	Total	26	100.00
Family Type	Joint	13	50.00
	Nuclear	12	46.15
	Individual	1	3.85
	Total	26	100.00
Years of stay	Up to 1 year	5	19.23
	2 to 4 years	3	11.54
	5 to 6 years	4	15.38
	7 to 9 years	3	11.54
	10 and above years	11	42.31
	Total	26	100.00
Education level of HH	Illiterate	10	38.46
	1-5 class	1	3.85
	6-7 Class	2	7.69
	8-9 Class	2	7.69
	SSC	7	26.92
	Inter	1	3.85
	Degree	1	3.85
	PG	1	3.85
	Technical	1	3.85
	Professional	0	0.00
	Total	26	100.00

7.2.17 Economic Profile along the Project Road

Occupation wise, most of them are engaged into agriculture activity (57.69%) followed by commercial activity of petty shop keeping (19.23%), non-agricultural labour, Trade/Business (3.85%) and other occupations such as retired pensioners, auto drivers, depend on fixed deposits, Dhobis etc. Details are presented in **Table 7.9** below.

The income levels of all the surveyed households fall under lower and middle income families who are earning less than Rs. 300000 per annum. Details are given in below **Table 7.9**

Table 7.9: Economic Profile of Structure Affected Population

Item	Description	Number of HH	% of total
Occupation of HH	Agriculture	15	57.69
	Trade/Business	1	3.85
	Petty shop keeping	5	19.23
	Agri labour	0	0.00
	Non-Agri labour	1	3.85
	HH Industries/Artisan activity	1	3.85
	Govt service	0	0.00
	Pvt.service	0	0.00
	Professional	0	0.00
	Self employed	1	3.85
	Others (Pensioner)	2	7.69
	Total	26	100.00
Annual income (Rs)	Up to 50000	0	0.00
	>50000 to100000	10	38.46
	>100000 to 300000	16	61.54
	>300000 to 500000	0	0.00
	>500000	0	0.00
	Total	26	100.00

The expenditure pattern for the affected households shows that a majority of them are having an average monthly expenditure less than Rs. 10000 per month. Details are given in **Table 7.10.** Majority of the affected persons (96.15%) reportedly hold the ration cards given for Below Poverty Level (BPL) families.

Table 7.10: Monthly Expenditure and Others for Structure Affected Households

	Description	No. of HHs	% of HH
Monthly Expenditure (Rs)	<4000	0	0.00
	4000 to 10000	18	69.23
	10000 to 15000	3	11.54
	>15000	5	19.23
	Total	26	100.00
Ration Card	White (BPL)	1	3.85
	Pink (APL)	25	96.15
	Total	26	100.00

7.2.18 Details of Indebtedness

The indebtedness pattern for the affected households shows that, of the total households surveyed, around 30.76 percent of the households have some outstanding loans taken for different needs. Of these households reported having outstanding loans, around 50% of them are having an outstanding loan upto Rs. 400000 and of the remaining households around 37.5 percent have an outstanding loan ranging between Rs. 400000 to Rs.600000. Details are given in **Table 7.11**.

Table 7.11: Details of Outstanding Loans of Structure Affected Households

	Amount	No. of HHs	% to Total
Oustanding Loans	Up to 100000	2	25.00
	>200000 to 400000	2	25.00
	>400000 to 600000	3	37.50
	>600000 to 1000000	0	0.00
	>1000000	1	12.50
	Total	8	100.00

7.2.19 Details of Major Health problems

Health is a major development challenge in any infrastructure development project in India. Given the epidemic nature of the problem, it may reverse country's achievements in health and development. The major health issues of the affected households along the project road shows that, of the total households surveyed, in 11.54 percent of the households, the household members are suffering with some major health problems. Details are given in **Table 7.12**.

Table 7.12: Major Health Problems of Structure Affected Households

	Description	No. of HHs	% of HH
Major Health Problem	Diabetes & BP	2	66.67
	Heart Problem	1	33.33
	Total	3	100.00

7.2.20 LEGAL POLICY FRAME WORK & ENTITLEMENT MATRIX

All strategic interventions on human development, spread across all social issues, need directives of policies and legal support to operationalize the appropriate actions. These policies and legislations help to overcome the constraints and support administrator, implementer, community and individual in delivery of justice. This section includes the World Bank as well as National policies and Acts applicable to the proposed Project are detailed under in subsequent stages:

The main objective of the Legal and Entitlement Policy Framework is to appropriately identify, address and mitigate all adverse socio-economic impacts accrued to the communities, families or people due to the implementation of the Project within the purview of the existing law and regulations of the country and state those are applicable to the proposed project.

Road up-gradation/widening projects often result in acquisition of land, particularly in case when the existing ROW is not adequate to accommodate the proposed up-gradation/widening. In order to protect their interests, administrative, policy and legal frameworks are present. National Acts and policies applicable to this project include:

National Highways Act (NH Act), 1956;

Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, (New LARR 2013 Act)

The following provisions from the above mentioned policies are likely to applicable for the project.

7.2.21 Land Acquisition

Land acquisition in India refers to the process by which the Central or any State government, excepting the Government of Jammu & Kashmir, in India acquires private land for the purpose of industrialization, development of infrastructural facilities or urbanization of the private land, and provides compensation to the affected land owners and their rehabilitation and resettlement.

Land acquisition in India is now governed by the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLARR) and which came into force from 1 January 2014. The land acquisition in Jammu and Kashmir is governed by the Jammu and Kashmir Land Acquisition Act 1934.

In case where a State Government through any Act or Gazette Notification or as approved by any authority of State Government (duly authorized for the purpose) as per their approved procedure has fixed a rate for compensation of land and is higher than the provisions under the RCFTLARR Act 2013, the same may be adopted by the Competent Authority in determining the compensation for land.

Similarly, in case where a State Government through any Act or Gazette Notification or as approved by any authority of State Government (duly authorized for the purpose) as per their approved procedure has fixed a rate for resettlement and rehabilitation assistance and is higher than the provisions under the RCFTLARR 2013, the same may be adopted by the Executing Authority.

7.2.22 Institutional Arrangement

The action plan provides a detailed mechanism for the appropriate organisation and implementation of the plan. A social cell will be created which will be responsible for the implementation of the action plan. There will be a Resettlement and Rehabilitation (R & R) Officer and a Land Acquisition Officer, who will be supported by R & R Manager. In addition Non-government Organisations (NGOs), which have relevant experience in implementation of R & R projects, will be contracted to provide assistance to Implementing Authority as well as affected persons. The district level committees will be set up to facilitate the finalization of replacement value and all grievances of the people.

7.2.23 Implementation Arrangements And Schedule

It is envisaged that the land acquisition and the R & R activities will be completed before initiating the civil works. Details of implementation arrangement are discussed separately.

7.2.24 Compensation for Land

The total land need to be acquired for the proposed project is 318.179 Ha. For development of proposed project road. The agricultural land price has been calculated as an average of the Circle/Guidance Value in the respective villages. While calculating the cost irrespective of type and usage, we considered the cost of all structures/buildings and other assets to avoid any further issues in future. The details of village wise Land Rates as per the prevailing Circle/Guidance rate derived from Department of Stamps and Registration, Government of Tamilnadu.

Since the proposed alignment passes through all types of lands being used for various purposes and mainly for agricultural purposes the compensation for land is derived by considering the average Circle/Guidance rate of Agricultural lands in that particular villages irrespective of their type and calculated as per the RFCTLARR Act 2013. According to circle rate, the total amount of towards the acquisition of land stands at Rs. 236.23 Crores needs to be compensated.

7.2.25 Compensation for Structures

The replacement cost of structure is estimated based upon the average of prevailing market value collected from local public during site visits. Most of the existing structures are either pucca or semi-pucca. As per topographical data a total number of 206 structures including 190 private structures are estimated for the social budget. Maximum numbers of the structures which are likely to be impacted are Semi-Pucca (48.54%) followed by pucca (44.17%) and Kutcha/Movable (7.29%). However, while calculating compensation for structures we considered all structures as pucca in nature irrespective of their usage. Apart from private structures; religious and govt. structures are also considered for R&R compensation. The solatium of 100 percent of the Circle/Guidance rate of affected structures is included for final compensation. The estimated budget calculation details are appended in below **Table 7.13**

Table 7.13: Impact on Structures along STRR (Phase-III) Section of NH-948A

Sl. No.	Typology	No. of Structures	Approx. Affected Area of the Structure		Avg. Unit Rate Rs./(Sq. Ft.)	Total Structure Cost (Rs.)	Compensation as per RFCTLARR Act 2013
			Sq. Mtrs	Sq. Feet			
1	Pucca	91	4946.55	52433.43	2500	131,083,575	262,167,150
2	Semi Pucca	100	9288.85	98461.81		246,154,525	492,309,050
3	Kutcha	15	2803.05	29712.33		74,280,825	148,561,650
TOTAL		**206**	**17038.45**	**180607.57**		**451,518,925**	**903,037,850**

7.2.26 Compensation for Other Minor Assets

The replacement cost of other minor assets is estimated based upon the actual cost incurred by the affected persons which was collected from the public during site visits. As per topographical data and estimation a total number of 93 other minor assetsare likely to be affected which includes Wells, Bore Wells, Hand Pumps, Pump Houses, Sump, Pits, Taps etc. The estimated budget calculation details are appended in below **Table 7.14**

Table 7.14: Impact oTn Other Mnor Asstes along STRR (Phase-III) Section of NH-948A

Sl. No.	Type of Asset	Number Affected	Unit Cost (Rs.)	Total Cost (Rs.)
1	Well	9	800,000	7,200,000
2	Bore Wells	10	200,000	2,000,000
3	Water Tanks	14	75,000	1,050,000
4	Pump House (Incl. Connection)	5	100,000	500,000
5	Overhead Tanks	8	75,000	600,000
6	Sump	5	100,000	500,000
7	Pits	30	20,000	600,000
8	Taps (Incl. Connection)	12	10,000	120,000
TOTAL		**93**		**12,570,000**

A total of Rs. 236.23 Crores has been estimated for compemsation towards Land, structures and other minor assets which are likely to be affected due to proposed project road. The NHAI guidelines recommend that the compensation for the lost land and structures be paid through the competent authority. For structures valuation, the concerned government department may be requested to assess the value. The details of estimated LA budget is presented in below **Table 7.15.**

Table 7.15: Estimated LA Cost and R & R Budget

Sl. No	Item	Unit	Quantity	Total Land / Structure Cost (Rs.)	Compensation as per RFCTLARR Act 2013
A. Compensation for Land					
1	Compensation for Land	Acre	785.89	640,253,777	1,434,168,461
B. Compensation for Structures					
1	Compensation for Structures and Other Assets	Number	206	451,518,925	903,037,850
C. Expenditure for Project Implementation					
1	Hiring of NGO for Resettlement Plan Implementation (If Necessary)	Number	1	500,000	500,000
2	Printing of Policy and ID Card	Lumpsum		300,000	300,000
3	Updating of Survey Data	Lumpsum		1,000,000	1,000,000
Sub Total (A+ B+ C)					2,339,006,311
D. Contingency					
1	Contingency at 1 % of the Sub Total				23,390,063
TOTAL (A+B+C+D)					2,362,396,374

For loss of structures, all PAPs will be compensated for their affected structures at replacement cost, for which provision has been kept in the Entitlement Matrix. All the squatters with structures and only vulnerable encroachers will be eligible for assistance for loss of their structures.

7.3 RISK ASSESSMENT & MITIGATION PROCEDURES

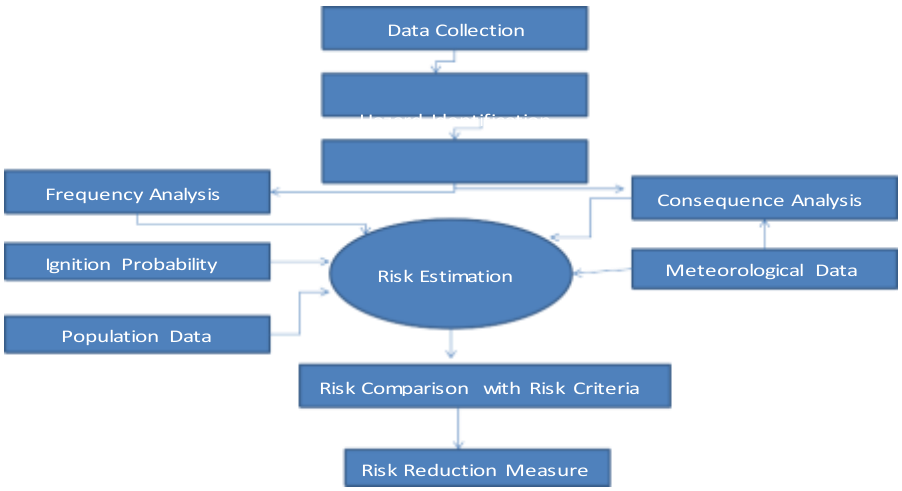
Risk assessment is a process that seeks to estimate the likelihood of occurrence of adverse effects as a result of major road mishaps, gas tanker explosions, fire hazards, floods, cyclones, earth quakes *etc*. at Highway projects. Fatality rate on Indian highways is very high mainly due to road accidents. The other adverse impacts due to gas tanker explosions, fire hazards, floods, cyclones, earth quakes *etc*. are nominal. Elimination of the risk (avoidance of accidents) is given prime importance and NHAI has introduced road safety provisions during the design of highway with the help of Road Safety Manual. Some of these are listed below:

- Safety barriers/delineators hard shoulders on main roads
- Traffic signs and pavement markings
- Underpasses and other grade separators at congested junctions
- Removal of junctions and direct access points on main roads
- Improved median openings with stacking lanes
- Separate provisions and direct access point
- Service roads in towns and villages for segregating local and highways traffic.

Contractor shall conduct Risk Assessment for all works to decide on priorities and to set objectives for eliminating hazards and reducing risks.

7.3.1 The Risk Assessment

A critical observation/study of the structure/process/site under consideration by the risk assessment team is an essential part of hazard identification as is consultation with the relevant section of the workforce. It is important that unsafe conditions are not confused with hazards, during hazard identification.



7.3.2 Person(s) at Risk

On a construction/ plant area, the persons at risk could be site operatives, supervisors, transport drivers, other visitors and the general public. The risk assessment must include any additional controls required due to mitigate vulnerability of any of these groups, perhaps caused by inexperience or disability.

7.3.3 Risk Control Measures and Hierarchy of Risk Control

The next stage in the risk assessment is the control of the risk. When assessing the adequacy of existing controls or introducing new controls, a hierarchy of risk controls should be considered. The principles are:

- Avoiding risks.
- Evaluating the risks which cannot be avoided.
- Combating the risks at source.

Adapting the work to the individual, especially as regards the design of the workplace, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work rate and to reducing their effects on health.

7.3.4 Adapting to technical progress

Replacing the dangerous by the non-dangerous or the less dangerous. Developing a coherent overall prevention policy which covers technology, organization of work, working conditions, social relationships and the influence of factors relating to the working environment.

Giving collective protective measures priority over individual protective measures and giving appropriate instruction to employees.

In addition to the above the following principles shall also to be employed:

- Eliminating;
- Substitution;
- Applying engineering controls (e.g. isolation, insulation and ventilation);
- Reduced or limited time exposure;
- Good housekeeping;
- Safe systems of work, Method Statement, Permit to work,
- Training and information;
- Personal protective equipment;
- Welfare;
- Monitoring and supervision;
- Review

The purpose of the risk assessment, therefore, is to reduce the remaining risk after taking into consideration of risks already addressed. This is called the residual risk.

The goal of risk assessment is to reduce all residual risks to as low as reasonably practicable (ALARP).

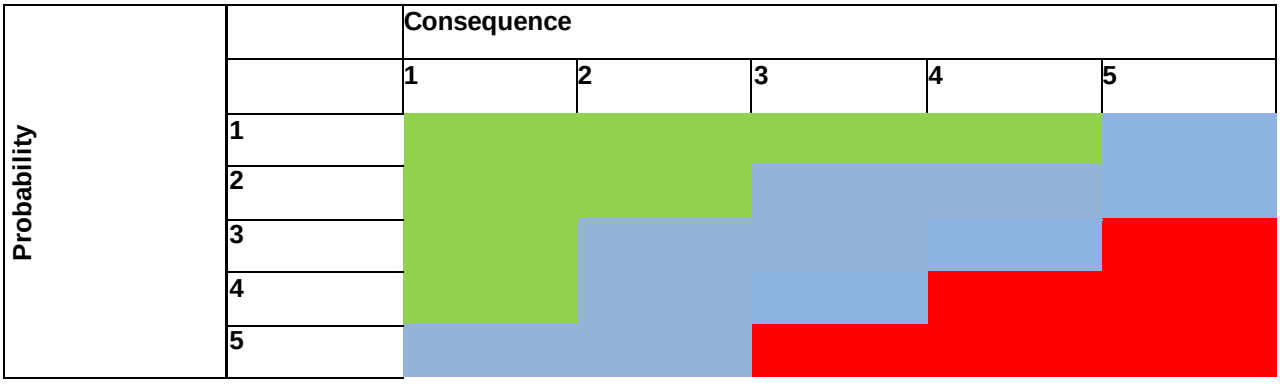
In a relatively complex workplace, this will take time so that a system of ranking risk is required the higher the risk level the sooner it must be addressed and controlled. For most situations, an alliterative risk assessment will be perfectly adequate.

For all high-risk activities, a quantitative risk assessment shall be conducted to quantify the risk level in terms of the likelihood of an incident and its subsequent severity. Clearly the higher the likelihood and severity, the higher the risk will be. The likelihood depends on such factors as the control measures in place, the frequency the exposure to the hazard and the category of person exposed to the hazard.

The severity will depend on the magnitude of the hazard (e.g. voltage, toxicity *etc*.). A simple matrix shall be used to determine risk levels at Construction / erecting sites as given in the Project EHS manual.

7.3.5 Matrix for Risk Assessment

Table 7.16: Consultations with Community / Primary Stakeholders



7.3.6 Severity of hazard (Consequence)

Severity is the degree or extent of injury or harm caused by the hazards, or as a result of an accident. Severity of hazard is classified as per the table given below

Table 7.17: Consequence Descriptions

Value	Result of Hazard to personnel	Result of Hazard to Assets/Progress
1	Single or multiple fatality	Catastrophic damage, Critical Delay, May result in fatality
2	Serious Injury requiring hospitalization	Major Damage, Serious Delay
3	Lost time Accident	Serious Damage, Moderate Delay
4	Injury requiring medical treatment but not lost time	Moderate Damage, Minor delay
5	First Aid Treatment Only	Minor Damage, No Delay

7.3.7 Likelihood of occurrence (Probability)

Likelihood of occurrence of an accident or incident or ill health is classified as per the table given below.

Table 7.18: Classification of Occurrence of likelihood

Value	Status	Description
5	Inevitable	Happens regularly on this site
4	Most Likely	Known to have occurred on this site in the past
3	Likely	Known to occur on other sites
2	Unlikely	Known to Occur in the industries
1	Most Unlikely	Never known before

7.3.7.1 Hazard Identification Risk Assessment

The procedure for preparing the Hazard Identification Risk Assessment is as follows:

Risk involved in each activity and existing control measures are analyzed and Impact Rating and probability rating are given in Hazard Identification Risk Assessment sheet.

Risk level is identified from the matrix based on the rating given.

Control measures are evolved to bring the risk level to ALARP (as low as reasonably practicable and residual risk is also identified.

If the residual risk is not an acceptable level, then assessment process shall be repeated to bring the residual risk at ALARP.

This activity is done for activities identified as Medium & High Risk.

The lists of control measures for the activities are handed over to the concerned execution engineer for implementation and the HIRA shall be explained to the concerned workmen/supervisors and engineer for implementation

7.3.8 Emergency Response Plan

Concessionaire/Contractor will prepare Emergency Response Plans for all work sites as a part of the Safety procedures. The plan shall integrate the emergency response plans of the contractor and all other sub-contractors.

Each Emergency Response Plan shall detail the procedures, including detailed communications arrangements, for dealing with all emergencies that could affect the site. This include where applicable, injury, sickness, evacuation, fire, chemical spillage, severe weather and rescue. Emergency plans and

Fire Evacuation plans shall be prepared and issued. Mock drills shall be held on a regular basis to ensure the effectiveness of the arrangements and as a part of the programme, the telephone number of the local fire brigade should be prominently displayed near each telephone on site

The Emergency Response Plan is prepared to deal with emergencies arising out of:

7.3.8.1 Fire and Explosion

Fire Safety Procedures will be developed and shall be integrated into Emergency Response Plan.

Road Accident

In case of Road Accident the following contact no should be contacted.

Table 7.19: Emergency Contact Number

Help Line no	Description
100	Police
101	Fire
102	Ambulance
103	Traffic Police
1033	Emergency Relief Centre on National Highways
104	State level helpline for Health
104	Hospital On Wheels
1066	Anti-poison
1070	Central Relief Commissioner for Natural Calamities
1070	Relief Commissioners of Central/State/Union territory
1073	Road Accident
1073	Traffic Help Line
1077	Control room of District Collector/Magistrate
108	Disaster management
1090	Anti-terror Helpline/Alert All India
1091	Women in Distress
1092	Earth-quake Help line service
1096	Natural disaster control room
1099	Central Accident and Trauma Services
1099	Catastrophe & Trauma service
112	General emergency Department of Telecommunications (DoT)
112	All in one Emergency Number
155233	Indian Oil Help Line
1906	LPG emergency helpline number
1910	Blood bank Information
1911	Dial a doctor
1913	Tourist Office (Govt.of India)

7.3.9 Operation Control Procedure For Traffic Management

7.3.9.1 Hazards Due To External Traffic Are As Follows

- Construction workers hit by external vehicles while working.
- Injury to Pedestrians:
- Due to fall in excavated trenches.
- Hit by construction equipment / vehicle.
- As they use carriageway due to blockage / absence of footpath.
- Collision due to improper traffic management.
- Between external vehicle and construction equipment / vehicle.
- Between external vehicles.
- External vehicle with other stationery objects in the side of the road

7.3.9.2 Objectives

- Warn the road user clearly and sufficiently in advance.
- Provide safe and clearly marked lanes for guiding users.
- Provide safe and clearly marked buffer and work zones.
- Provide adequate measures that control driver behaviour through construction zones

7.3.9.3 Traffic Control Plan

This plan gives the detailed guideline for traffic management in most of the common situations at our Projects. Traffic Control Plan for a specific road sections should be prepared based on this general guideline and applying the following variables, which may vary from project to project. The variables are:

- Average Vehicular Traffic Density in peak and non-peak hours.
- Maximum width of lane required for construction during various activities.
- Number and types of junctions in the road.
- Availability of standard footpath and its location and dimensions.
- Change in the lane width if any and its location.
- Regulatory and advisory speed limits *etc*.

7.3.9.4 Traffic Control Devices

Traffic control devices used to regulate the traffic in Road Construction Zones include,

1 Road Signs

2 Delineators

3 Barricades

4 Cones

5 Pylons

6 Pavement markings

7 Flashing lights

Table 7.20: Minimum sightline distance and the minimum size of the signs

Average Speed (Km/h)	Distance of first sign in advance of the first channelizing device (m)	Size of Warning Sign (mm)	Minimum no of signs in advance of the hazard
Under 50	100	600	3
51 – 60	100 – 300	750	3
61 – 80	120 – 300	900	3 or 4
81 – 100	300 – 500	1200	4
Over 100	1000	1200 to 1500	4

7.3.9.5 Cautionary / Warning Signs

In case of divided carriageways, the signs should be provided both adjacent to the shoulder and on the central median so as to be visible from all lanes.

7.3.9.6 Delineators

Delineators are devices or treatment which outlines the roadway or portion thereof. They include Safety Cones, Traffic Cylinders, Tapes, Drums, Painted lines, Raised Pavement Markers, Guide Posts, and Post-mounted Reflectors *etc*. They are used in or adjacent to the roadway to control the flow of traffic. Delineators are basically driving aids and should not be regarded as a substitute for warning signs or barriers for out-of-control vehicles.

7.3.9.7 Guide Post

They are intended to delineate the edges of the midway so as to guide driven about the alignment ahead, particularly where it might be confusing. Guideposts can be of metal, concrete, cut stone, amber or plastic. The posts can be made of Circular, Rectangular or Triangular Cross-section but the side facing traffic should be at least 10 cm wide.

7.3.9.8 Drums

Drums of height 800 mm to 1000 mm high and 300 mm in diameter can be used as either channelizing on warning devices. Both plastic and metallic drums (e.g. Bitumen drums) can be used for this purpose. Drums need to be filled up with earth or sand to increase its stability. Drums should be refectories and painted as shown in the figure.

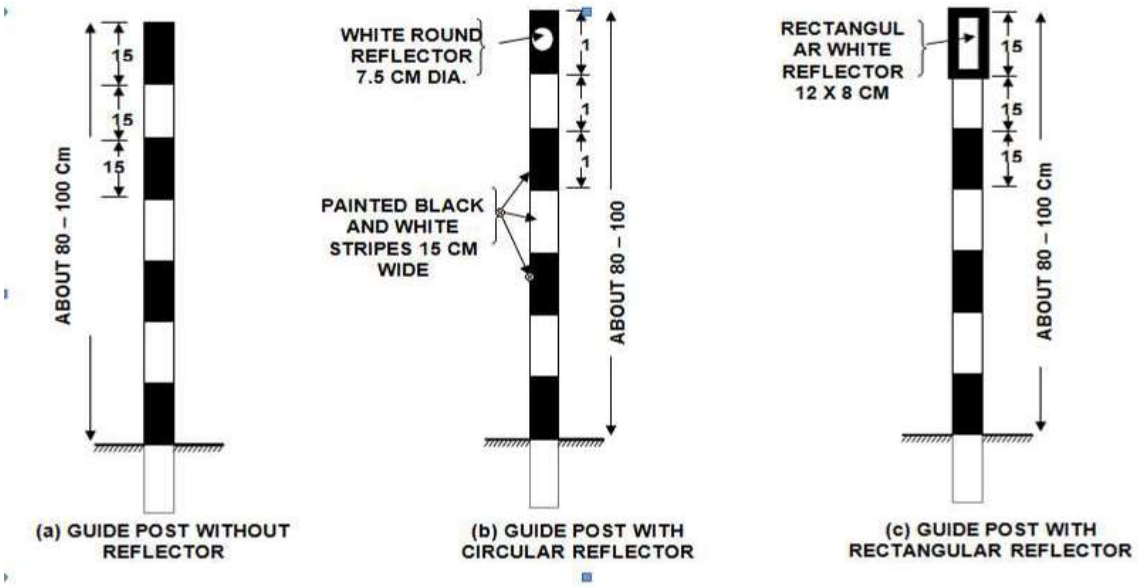


Figure 7.5: Drum Reflections

7.3.9.9 Safety Cones

Safety cones are 500 mm, 750 mm and 1000 mm high and 300 mm to 500 mm in diameter. They are usually made of plastic, rubber, HDPE, PVC and have retro refectories red and white bands. Safety cones would be displaced or blown unless their bases are anchored or loaded with ballast. This can be avoided by, using sand bag rings to provide increased stability. Using heavier weighted cones. Using cones with special weighted bases. Doubling the cones to provide added weight.

7.3.9.10 Barricades

CMRL prescribed standard barricades are used.

7.3.9.11 Flagmen

- An authorised personnel at least average intelligence, be mentally alert and good in physical condition be selected, since flagmen are responsible for public and workmen safety.
- Flagmen should be equipped with yellow helmet with green reflective sticker fixed around and reflective jacket along with hand signalling devices such as flags and sign paddles. The typical specification are given below,
- Flagmen need to maintain the flow of traffic continuous past a work zone at relatively reduced speeds by suitably regulating the traffic. He shall stop the traffic for a short while whenever required (e.g. for entry and exit of construction equipment in to work zone).
- Flagman should be positioned in a place where he is clearly visible to approaching traffic and at a sufficient distance to enable the drivers to respond for his flagging instructions. A flagman never leaves his post until properly relieved,
- The standard distance shall be maintained at 60 – 100 m but can be altered depending upon the approach speed and site conditions. In urban areas this distance shall be taken as 20 m to 50 m.

7.3.10 Traffic Management Practices

7.3.10.1 Definitions

Road traffic control involves directing vehicular and pedestrian traffic around a construction zone, accident or other road disruption, thus ensuring the safety of emergency response teams, construction workers and the general public.

7.3.10.2 Working zone:

The Plant Site, construction zone of road *etc*. at which workmen will be working.

7.3.10.3 Working space:

The space around the works area that will require storing tools, excavated material and other equipment. It is also the space to allow workmen, movement and operation of plant, (e.g. swing of jibs, excavator arms) to move around to do the job. Materials and equipment must not be placed in the zone either. Workmen will only need to enter the zone to maintain cones and other road sign.

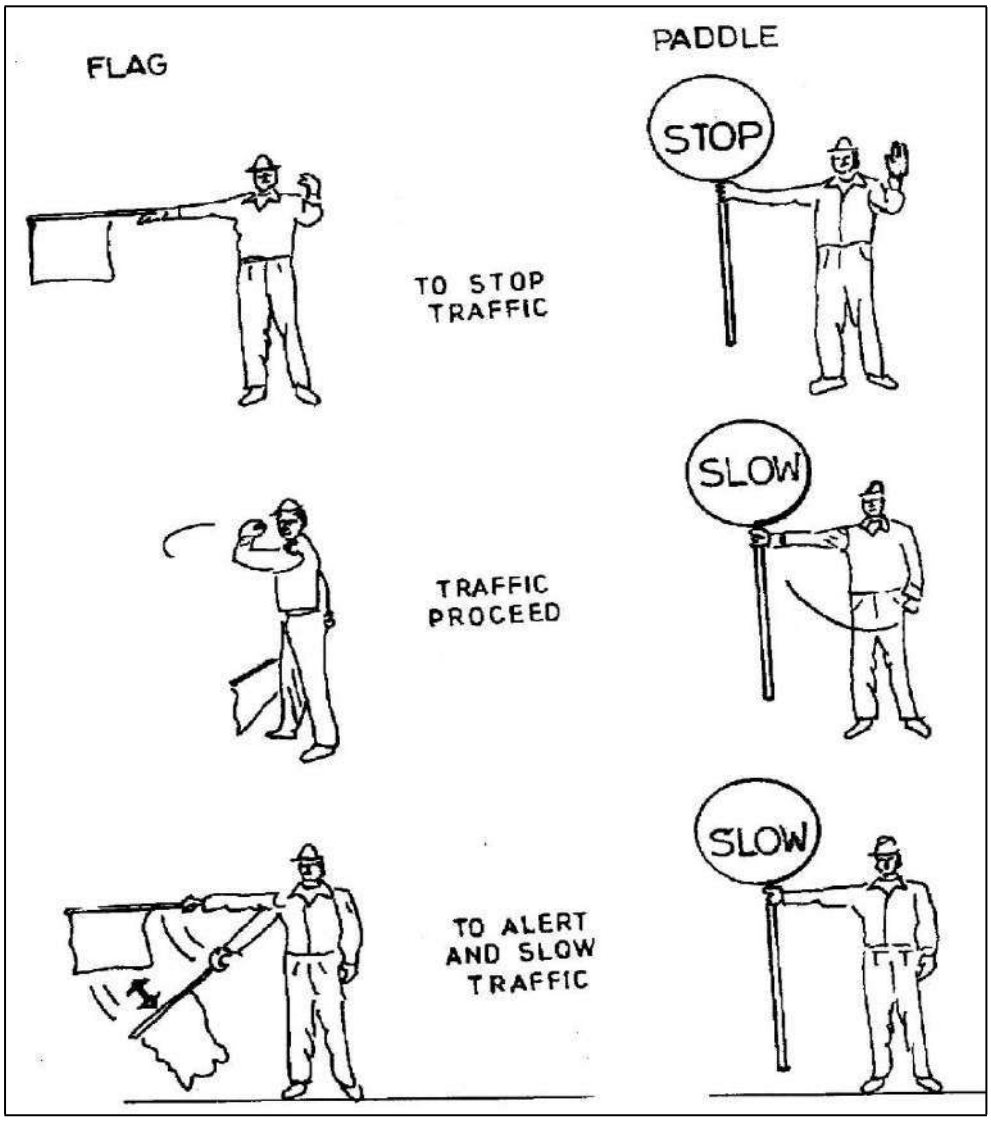


Figure 7.6: Road Signals Traffic Signals

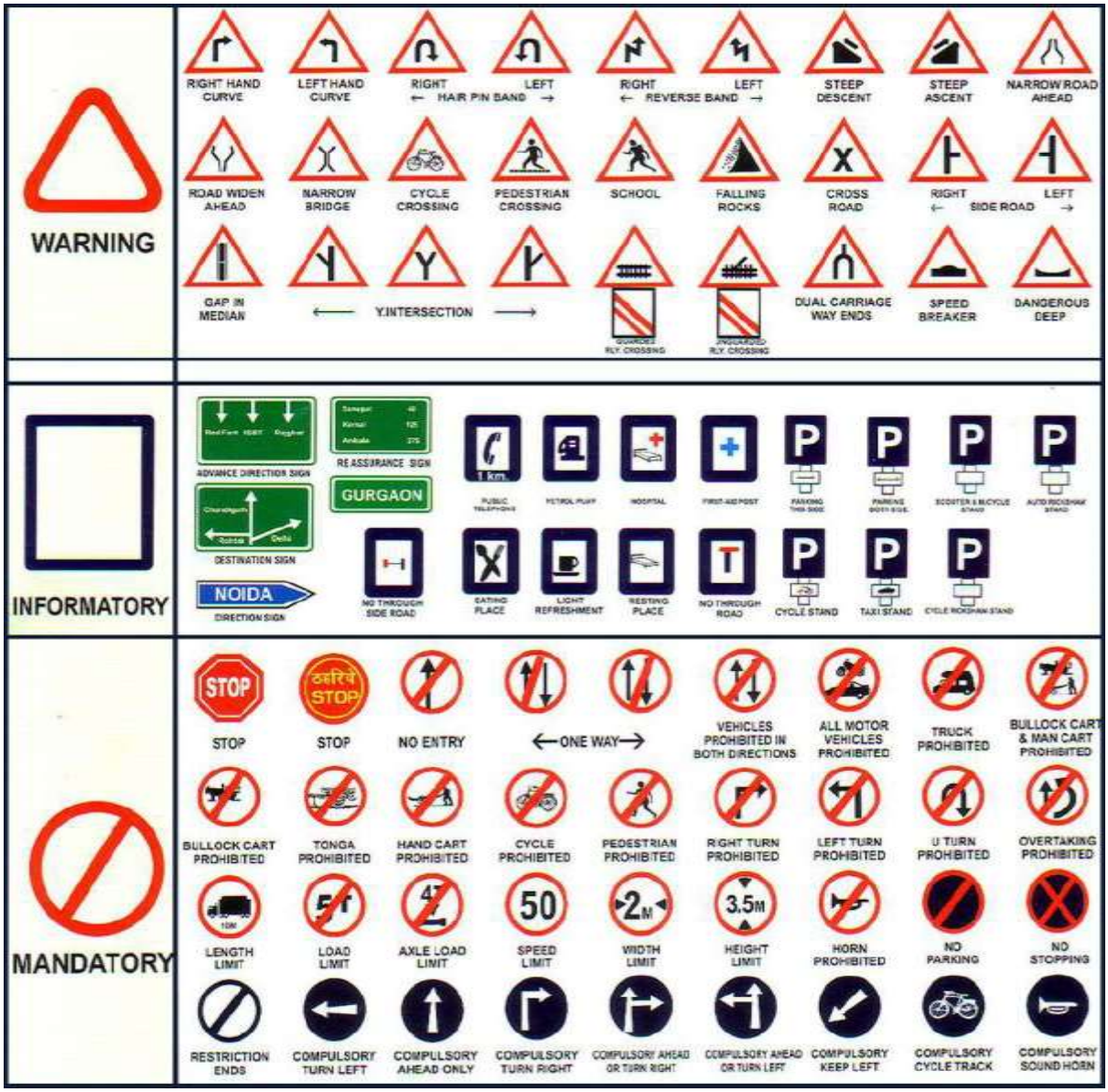


Figure 7.7: Traffic Signals

The zone that is provided to protect workmen from the traffic and to protect from them.

7.3.10.4 Approach Transition zone:

This will vary with the speed limit and the width of the works as given in (diag: Traffic Control zone)

7.3.10.5 Longitudinal buffer zone:

This is the length between the end of the lead-in taper of cones (T) and the working space. It will vary with the speed limit as given in table (Traffic Control zone)

7.3.10.6 Lateral buffer zone:

This is the width between the working space and moving traffic. It will vary with the speed as given in table (Traffic Control zone). The lateral buffer zone safety clearance is measured from the outside edge of the working space to the bottom of conical sections of the cones on the side nearest to the traffic.

7.3.10.7 Works on Strengthening of Existing Carriageway

- Approached diversion would be taken out of the works zone for the movement of construction supervision vehicles.
- The construction zone shall be barricaded with standard CMRL barricade.
- The 'works traffic" shall be governed by the location of base camp where workmanship less than 20, a flagman shall be kept for controlling traffic, public and workmen safety or more than 20 in addition to that a safety steward shall be kept for continuous monitoring to identify and removal of unsafe acts and conditions.

7.3.11 Traffic Management on Road Junction

7.3.11.1 Construction traffic meets live traffic from quarry/plant/borrow pit

- Where vehicles are more to the approach junction from the side road, permission shall be seek for providing speed breaker at junction from local traffic police and road-authority.
- The layout for signs and traffic control devices.
- Flag man shall be kept in the peak time provided with the traffic circle painted with red and white at the corner at a height of 500 mm, clearly visible to approaching traffic for a distance provided with while gloves and STOP, GO Paddle. And night time flagman should use LED Batons.
- All vehicles from approaching road should be STOP, LOOK and GO.
- Spillage of earth / Gravel / Aggregates / Bituminous mix from the tipper shall be cleaned on regular basis, if required 2 coolies permanently posted for booming.
- All Construction vehicles must follow lane discipline and road signs.

7.3.11.2 Activities inside Median / Island

- The traffic would discontinue from plying temporarily on the carriageway; for 2 min for reversing & dumping earth / stones / *etc*., , by the direction of helper and the flagman controls the traffic as shown in Picture- 01 and made continue the traffic and for the next trip repeating the same.
- The construction zone shall be barricaded with standard CMRL barricade.
- One Flagman (refer flag man clause) shall be appointed at traffic coming side of the transition zone.
- No personnel are allowed to come out of the safety zone, unless flagman guidance.

7.4 DISASTER MANAGEMENT PLAN

7.4.1 General

During Monsoon period there is absolute possibility of rains resulting in inundation, floods *etc*. The rains may cause heavy inflow of water in the rivers and jungle streams *etc*. Therefore, the water overflows thereby breaching embankments, causes enormous damages to houses, huts, agricultural lands, roads, telephone lines, railway tracks, electricity lines and other public properties. It is not feasible to completely prevent nature's fury at one stroke. However, to minimize the damage caused by nature's onslaught and to ensure speedy relief thereby mitigating the sufferings of the people. The plan can be set in motion when the need arises with the active coordination of inter departmental officials.

7.4.2 Community Awareness and Involvement

Following steps to be taken by public when a warning for Cyclone threatening the area is received:-

Keep your T.V., Radio on and listen to latest weather warnings and advisories from the Doordharsan All India Radio station. Pass on the information to others as quickly as possible.

Avoid being misled by rumours. Pass on only the official information you have got from the T.V. Radio to others.

Move away from low-lying beaches or other location, which may be swept by high tides or storm waves. Leave sufficiently early before your way to high ground gets flooded. Do not delay and run the risk of being marooned.

If your house is out of danger from high tides and flooding from the river and it is well built it is then probably the best place to weather the storm. However, please act promptly if asked to evacuate.

Be alert for high water in areas where streams of rivers may flood due to heavy rains.

Bolt up glass windows or put storm shutters in place. Use good wooden blanks securely fastened provide strong suitable support for outside doors.

If you do not have wooden boards handy, paste paper strips on glasses to prevent splinters flying in to the house.

Get extra food, especially items which can be eaten without cooking or with very little preparation. Store extra drinking water in suitably covered vessels. Make provision for children and adults requiring special diets.

If you are in one of the evacuation areas, move your valuable articles to upper floors to minimise flood damages.

Have hurricane latern, flash lights and other emergency lights in working condition and keep them ready.

Check on everything that might blow away or be born loose. Kerosene tins, canes, agricultural implements, garden tools, road signs and other objects become weapons of destruction in strong winds. Remove them and store them in a covered room.

Be sure that a window or door can be opened on the left side of the house [i.e] the side opposite the one facing the wind.

Remove cattle to safe place as far away as possible.

If the centre of eye of the storm passes directly over your place, there will be wind and rain lasting for half an hour or more. During this period stay in a safe place. Make emergency repairs during the pre-monsoon period, if necessary, but remember that strong winds will return suddenly from the opposite direction, frequently with even greater velocity.

Be calm your ability to meet any emergency which will inspire and help others.

7.4.3 Trigger Mechanism & Operational Direction

Every operation must be aimed at a direction so as to get desirable results. Disaster Management Plan aimed at to face any eventuality with confidence. It is not only guidance but also provide various insights towards disaster management and mitigation. Every new experience and instances that encountered every year are added so as to take a cue and derive a lesson. So that Disaster Management Plan is prepared and updated.

7.4.4 Damage Assessment and Immediate Restoration/ Rehabilitation

In the aftermath of rescue operations are over, the rehabilitation process has to be taken up. A quick assessment of damages to houses eligible for grant of relief for house damages, financial assistance to the families, who have lost their kith and kin, should be done pragmatically. The Revenue Divisional Officers should allocate the work of intensive enumeration to designated staff that should be fixed with the responsibility of collecting data of People death if any and Cattle death if any Damages to the houses/damages to crops *etc*. The correctness and promptness of report preparation and transmissions to higher ups are important. A duty chart should be devised involving all revenue personnel and earmarking area if possible in batches of Revenue Staff should be listed out and kept ready to depute them to the affected areas as soon as the calamities are over. As far as possible, the personnel assigned with rescue operations may be left out from enumeration work as the enumeration will have to be undertaken quickly and simultaneously. As and when the assessment of damages is over, the payment of cash doles, issue of free rice and distribution of clothing shall follow according to standing orders on the subject amended from time to time.

7.4.5 Mitigation Measures Undertaken

7.4.5.1 Relief Measures

Relief measures are taken with co-ordination of all Departments

Table 7.21: Role and Action Plan of Various Departments

S. No.	Department	Disaster Specific Action Plan
1.	Disaster Management & Relief (DM&R)	• Ensure coordinated movement of all departments, officials and agencies for combating the disaster • Issue necessary directions and ensure effective and coordinated response of all departments. • Arrange regular meetings for updating the apex body on a daily basis. • Provide inputs to concerned departments for effective implementation of the rehabilitation plans. • Document the experiences and best practices.
2.	Animal Husbandry	• Prepare contingency plan • Constitute veterinary mobile teams with required resources like medicines, doctors, subordinate staff, laboratories, protective gears, antibiotics, vaccines and antitoxins, etc. in abundance. • Constitute technical groups at state, zone and district levels. • Identification of affected areas. • Disposal of dead carcasses. • Focused attention to veterinary health. • Mass vaccination programme of animals in affected areas Make arrangements for rescue and evacuation of stranded livestock. • Pool in sufficient doctors for treatment of sick animals/ poultry. • Control spread of animal disease. • Carry out epidemiological surveillance to evade biological disasters. • Promote awareness through IEC activities.
3	Public Health Engineering Department (PHED)	• Prepare Contingency plan • Enforce ground water legislation • Strict monitoring and vigilance on water for drinking purpose only. • Identify additional sources of water for maintenance of regular supply.

S. No.	Department	Disaster Specific Action Plan
		• Ensure supply of sufficient water through tankers for habitats and cattle camps.
		• Provide household water purification tablets. • Augmentation of existing Resources • Hiring of Private Wells • Hand Pump repair programme • Installation of New Hand Pumps and Tube wells • Revival of traditional water sources like Wells, Bawdis, Tankas, etc. • Transportation of water through road tankers and by Rail • Earmark water for drinking purpose available in the tanks and ensure no illegal pumping takes place. • Provide adequate quantity of bleaching powder to PRI, especially Gram Panchayats to protect spread of water and vector borne diseases. • Promote awareness on safe hygienic practices and sanitation.
4	Department of Medical and Health	• Health and epidemiology surveillance • Constitute mobile teams with required resources like medicines, doctors, subordinate staff, laboratories, protective gears, antibiotics, vaccines, etc. in abundance. • Mobile clinics for health checkups • Organise regular rural health camps and keep public informed of such camps. • Check the nutritional status especially for women and children and give treatment. • Check samples of food grains, cooked food in community kitchens, etc. • Promote general awareness of health and hygiene • Issue warnings to all officials/ staff. • Manning of control room 24x7. • Maintain regular contact with EOC. • Keep all ambulances, mobile teams, specialists, blood, medicines, paramedics, etc. in a state of readiness. • Carry out triage. • Provide first aid to minor injuries. • Evacuate injured to hospitals.
		• Constitute and effectively deploy mobile teams having Doctors paramedical, • Set up health centers in relief camps and assure hygiene and sanitation. • Prevention/ control of epidemics and vaccination, availability of adequate x-ray machines and orthopedic, neurology equipment. • Availability of stretchers, blood, medicines, ambulances. • Arrange additional beds and medical treatment in local and nearby hospitals as required. • Psychosocial counseling to distressed people. • Health and epidemiology Surveillance • Monitor nutrition status of affected people and take appropriate actions. • Maintain continuous supply of medicines and emergency services till normalcy is restored.

S. No.	Department	Disaster Specific Action Plan
5	Disaster Management & Relief (DM& R)	• Ensure coordinated movement of all concerned departments, officials and agencies for combating Drought. • Make sufficient funds available for Drought response • Arrange regular meetings for updating the apex body and issue directions to all concerned departments regularly. • Document experiences and best practices.
6	Public Works Department (PWD)	• Listing of works that could be done as relief programmes - pond desilting, excavation of water structures, construction of Government infrastructures, etc. • Carry out sudden checks and supervise the relief works. • Generate employment through cash for work/ food for work relief programmes, Issue warnings to all officials/ staff. • Manning of control room 24x7. • Maintain regular contact with EOCs at district/ state levels. • Keep all resources in the state of readiness. • Assessment of damage to infrastructure, roads, bridges and buildings and commencement of restoration work. • Carry out search, rescue, evacuation, relief operation. • Clearance of roads and debris of collapsed infrastructures. • Identification and demolition of unsafe buildings/ infrastructures.
		• Barricade the disaster site and unsafe areas. • Identification and demarcation of safe areas and preparation of temporary shlters for relief camps. • Prepare temporary roads and bridges, helipads and air strips on the need basis for effective relief operations. • Deployment of heavy equipment like dozers, excavators, cranes, pulleys, power saws, gas cutters, L&Ts, JCBs and other specialist equipment and vehicles. • Restoration of buildings, roads, bridges and other Government buildings. • Ensure close monitoring of response and rehabilitation operations and relief camps.
7	Civil Supplies and Public Distribution System (PDS)	• Distribution of food packets, dry rations, fuel, oil and lubricants • Take precautionary steps against hoarding and profit mongering and ensure normal prices of commodities in the market. • Adequate supply and reserves of FOL and coordinate with all the national agencies for smooth transportation of food and civil supplies. • Supply daily necessities of food items, stock position and ensure continuous supply, in relief camp too. • Coordination with FCI/ warehouses. • Make public aware through media about food distribution and also about the availability of items at subsidized rates.
8	Municipal Corporation	• Coordination and supply of safe drinking water using tankers, etc. • Manning of control room 24x7. • Issue warnings to all Fire Service stations. • Keep all resources in a state of readiness • Assist in evacuation, search and rescue operations. • Ensure availability of all types of extinguishers for fire following earthquakes. • Appoint labourers for excavation works; dismantle unsafe buildings, disposal of solid garbage and liquid waste, disposal of

S. No.	Department	Disaster Specific Action Plan
		dead persons and carcasses. • Control other potential hazardous situations that might arise from oil, gas and hazardous material spills. • Organise relief camps wherever required; ensure pure drinking water, Sanitation, food, temporary shelters, basic relief materials as per requirements and needs.
		• Assist in post disaster response and rehabilitation work
9	District Administration	• Prepare Drought Contingency Plan. • Issue necessary directions/ instructions to all concerned departments to combat the upcoming situation in an effective and coordinated manner. Ensure effective coordination with all departments, agencies, NGOs and stakeholders. • Arrange/mobilize equipment and resources like water tankers, trucks/ vehicles to transport food supply, fodder, mobile medical vehicles, ambulances, etc. • Arrange for disposal of dead carcasses. • Generate daily reports of relief activities and disseminate. • Organise relief camps wherever required; ensure pure drinking water, Sanitation, food, temporary shelters, basic relief materials as per requirements and need. • Media Management • Procure tents, sanitation block, essential materials, etc. for relief camps. • Generate daily reports of relief activities and disseminate.
10	Department of Information and Public Relation	• Information dissemination, issue periodic bulletins to media. • Ensure information given to media are facts and true to avoid rumours. Arrange visit for local and foreign journalists in affected areas. • Information dissemination, update public on various relief interventions. • Operate the Control Room round the clock. • Nodal person to be designated as spokesperson for the Government. • Information dissemination, issue periodic bulletins to media.
11	Emergency Operation Centre (EOC)	• Coordinate and issue direction to all concerned stake holders/ departments regularly • Brief the Disaster Management & Relief Commissioner regularly. • Coordinate the relief and rescue operation. • EOC to function as control room where all SDMA members and experts from various departments are available and take charge for effective coordination monitoring and implementation of rescue operations.
		• Prepare, forward and compile reports and returns from time to time. • Brief media regularly about the situation' • Brief/ Update the chief minister and cabinet about the situation.
		• Manning of control room 24x7. • Maintain regular state of readiness • Communication to EOC and stakeholders instantly. • As first responder assume command for security and law and order • Demarcate entries and exits for rescue and relief operation and

S. No.	Department	Disaster Specific Action Plan
12	Police	proper traffic management. • Support SDRF, Civil Defence, Home Guard, Army, Sainik Kalyan and other first responders for search and rescue. • Take necessary actions to avoid rumours. • Ensure prevention of theft and loot. • Provide effective communication network work. • Deployment and monitoring of 108 ambulances. • Deployment of lady police personnel in relief camps for Gender concerns.
13	Electricity Board	• Issue warnings to all officials/ staff. • Manning of control room 24x7. • Keep all resources in a state of readiness • Immediately shut down the supply of electricity in the area • Start restoration work of the damaged lines • Simultaneously, make electricity arrangements at the rehabilitation, relief camp areas.
14	Rural Development Department (RDD)	• Issue warnings to all officials/ staff. • Manning of control room 24x7. • Keep all resources in a state of readiness. • Distribution of relief materials to Panchayats, • Relief equipment, tractors, labour, digging/ excavation tools, etc. to be arranged to mobilising and raising fund
		Support PRI in organising relief camps wherever required • Ensure pure drinking water, Sanitation, food, temporary shelters, basic relief materials as per requirements and needs. • Arrangement of Rural relief camps • Arrangement of community kitchens. • Assist in post disaster response and rehabilitation work
15	Indian Meteorological Department	• Transmit updated information to EOC • Mass media publicity/ issue bulletins at regular intervals.
16	Railways	• Manning of control room 24x7. • Alert officials/ staff and keep all resources in a state of readiness. • Search, rescue and evacuate injured persons to safer places. • Assess the situation for appropriate actions. • Regulate the movement of all trains • Carry out inspection of railway bridges and lines. • Deployment of equipment like generators sets, pump sets, cranes pulleys, dozers, gas cutters, earthmovers, labourers for clearance of fallen bogies, electricity Poles, damaged tracks, etc. • Transport and provide emergency tents, water, medicines, food, etc. to the accident site. • Adequate arrangement of specialized trains for transportation of rescue and relief material. • Restoration of damaged railway lines, electricity poles to restart services as soon as possible.
17	NGO	• Provide first aid, health services, financial assistance and relief materials *etc.*

CHAPTER-8: PROJECT BENEFITS

8.1 INTRODUCTION

Construction of new road will provide better, fast, safe and smooth connectivity for the commuters between the two states of Karnataka and Tamil Nadu as well as in the region. Smooth and fast moving traffic will cause lower pollutant emissions thereby reducing pollution levels. Accident rates are also expected to be under control due to enhanced road safety measures. Development of the proposed project road will boost the local agriculture and enable farmers to realize better value for their products as well as attract more investment to that region. The vehicle operating and maintenance cost is expected to go down substantially. The proposed road alignment will also include general amenities like rest areas, at built-up locations, pedestrian underpasses, landscaping and tree plantation, traffic aid post, emergency telecom system, emergency medical aid post, street light at built ups etc. and thus overall facilities to the road users shall improve. People will have increased access to better social and health infrastructure and other services located outside the project area. This will in turn lead to overall improvement of the quality of life of people residing in the project zone in terms of their economic, social and health status. Growth of local tourism and resultant boost to local economy is also expected due to proposed project

8.2 ECONOMIC DEVELOPMENT

The proposed expressway project will provide better connectivity between Chennai and Bangalore region and other areas of Tamil Nadu and Karnataka state. This can contribute to economic development by encouraging attraction of business to site equipped with good access and by improving the travel efficiencies of the existing business and to start new avenues. This also helps in developing the following:

- Development of new industries
- Development of new educational institutions and hospitals/health centres
- Development of real estates
- Development of Infrastructure projects
- Development of IT parks

8.3 EMPLOYMENT OPPORTUNITY

Highway development projects require large number of local people during construction stage and operational phase. The proposed construction of STRR and connecting roads requires large number of people from nearby villages during construction stage of the project. Thus, there will be an increase in employment opportunity for the project area.

8.3.1 Employment Opportunities for Local Community

Proportionate to the investment in the project, large employment opportunities will be generated as a consequence of the project implementation

- During the construction phase, the employment opportunities will be created for skilled (engineers, transport, mechanical), semi-skilled (technician, road Inspectors, plant operator, office support etc.) and unskilled (general labour) labourers. Most of the skilled labourers may come from other parts of the country; the opportunities for semi-skilled and unskilled sections of the work force will primarily be available from the local communities.

- Apart from these temporary employment opportunities, there would be permanent employment opportunities for the local community due to the enlarged development of industries, as it will stipulate more workers to cater to their increasing needs.
- It is expected that after construction there will be change in land use (especially along the new Highway). There will be more commercial establishments such as shops, dhaba/ restaurants/, small workshop serving the vehicles moving along the highway. These activities will provide additional socio-economic development and increased wages in the project area.
- Additional job opportunities may also be developed due to the development of proposed industrial and infrastructure activities along the expressway. As discussed above, the community people will get huge job opportunities due to the development of the planned highway, which in turn will further improve their living status and overall social paradigm of the district.

8.4 ROAD SAFETY

The construction of the new highway shall ensure smooth flow of the traffic. Installation of proper road safety system through signage, barricades, and crash barriers enhance road safety to the traffic.

8.5 REDUCTION IN VEHICLE OPERATING COST (VOC)

Vehicle Operating Cost (VOC) will be reduced when a road is improved. Fuel consumption, wear and tear of tyres, suspension will be benefited when a geometry of the road is improved. VOC consist of the following components:

- Fuel consumption
- Lubricating oil consumption
- Spare part consumption
- Tyre consumption
- Vehicle depreciation

8.6 ENVIRONMENTAL BENEFITS

The construction of the new highway will ensure the smooth flow of traffic, which reduces the emissions and noise level. Apart from these, plantation will be done throughout the project road, which will increase the aesthetic of the project road. Rest areas with various facilities are proposed for the highway users.

8.7 INDIRECT BENEFITS

In addition to the direct benefits, there are number of indirect benefits attributed to Highway project. Lowering transportation cost for users and improving access to goods and services enables new and increased economic and social activity. The indirect benefits include changes in land use and development, changes in decision on residential area or colonies where land are less expensive or more desirable, changes in development of business in order to take advantage of improved speed and reliability in the transportation system. These benefits hence lead to increased property values, increased productivity, employment and economic growth. The indirect benefit of the proposed highway would work through the dynamic developmental externalities generated through the forward and backward linkages. A better connectivity will increase the business, which will reflect in the changes in the pattern of economic activities, income generation, price evolution, and employment condition. There will be also increase in greater accessibility to market, health and educational facilities.

CHAPTER-9: ENVIRONMENTAL MANAGEMENT PLAN

9.1 INTRODUCTION

An important objective of environmental impact assessment is to develop procedures and plans to ensure that the mitigation measures and monitoring requirements shall be approved during the environmental compliance review will actually be carried out in subsequent stages of the project. As a result, preparation of EMPs during project processing and on setting out conditions and targets to be met during project Implementation.

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

9.2 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

9.2.1 Objectives of EMP

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

A description of the various management measures suggested during different stages of proposed project (viz. Construction and Operation) is provided in **Table 9.1** and **Table 9.2** respectively.

9.3 PRE-CONSTRUCTION STAGE

9.3.1 Pre-construction activities by PIU/ Independent Consultant

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

- Removal and felling of trees at very minimal possible level.
- Relocation of common property resources and community assets like telephone poles, electric poles and hand pumps will be impacted.
- Formal arrangements for maintenance of enhancement sites. This includes plantation of trees and barricades along the highway.
- Modification (if any), of the contract documents by the Engineer of the NHAI
- NOC/Clearance related to the project such as Environmental Clearance, Tree Cutting etc.

9.3.2 Pre-construction activities by Contractor

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

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

9.4 CONSTRUCTION STAGE

9.4.1 Construction activities by the Contractor

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

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

9.4.2 Construction activities by the PIU/Independent Consultant

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

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

9.5 OPERATION STAGE

The operational stage involves the following activities by PIU:

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

Table 9.1: Generic Environmental Management Plan

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
PRE-CONSTRUCTION STAGE						
Pre-construction activities by PIU						
P.1	Alignment, Width of the highway and religious structures	The proposed corridor was selected by adopting of suitable cross-sections and adjustment of the median width to minimize land acquisition, loss of settlements and to avoid environmentally sensitive features like PF/RF/WL/NP/religious structures etc. compatible with project activities.	Alignment Report and its approval (Ref. DPR)	Throughout out Corridor	PIU, Revenue Dept., NGOs, Collaborating Agencies	EO-Independent Consultant
P.2	Land Acquisition	The acquisition of land and private properties shall be carried out in accordance with the RAP and entitlement framework for the project. It shall be ensured that all R & R activities including implementation of Environment Management Plan are completed before the start of work. PIU has to ascertain that any additional environmental impacts resulting from acquisition of land are address and integrated into the EMP and other relevant documents.	EIA & SIA Report (Ref. DPR)	Throughout out Corridor	PIU, Revenue Dept., NGOs, Collaborating Agencies	EO-Independent Consultant
P.3	Preservation of Trees	All efforts shall be made to preserve trees including evaluation of minor design adjustments/ alternatives to save trees. Specific attention will be given for protecting giant trees, and locally important trees (religiously important etc.). Tree cutting is to proceed only after all the legal requirements including attaining of In-principle and Formal Clearances from the Forest Dept. / DoEF/ MoEF & CC and after permission of local authority are completed and subsequently a written order is issued to the Contractor.	Clause No. 201.2 MORT&H Specifications for Road and Bridge works	Throughout out Corridor	PIU, Forest Department, Contractor	EO-IC

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		Particular species declared as 'protected' by the State's Forest Dept. in the private land will be felled only after due clearance from the Forest Dept./ concerned agencies is obtained. 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 with "EO-IE".				
P.4	Relocation of Community Utilities and Common Property Resources	All community utilities and properties i.e., water supply lines, sewer lines, hand pumps will be relocated before construction starts, on any section of the project corridor. The PIU will relocate these properties in consultation and written agreement with the agency/ owner/community. Environmental considerations with suitable/required actions including health and hygiene aspects will be kept in mind while relocating all community utilities and resources.	As in RAP	Throughout out Corridor	PIU, Concerned Agencies, Contractor	EO-IC
P.5	Orientation of Implementing Agency and Contractors	The PIU shall organize orientation sessions and regular training sessions during all stages of the project. This shall include on-site training (general as well as in the specific context of a sub-project). These sessions shall involve all staff of Independent Consultants, field level implementation staff of PIU and Contractor, Environmental Experts. The contractor will ensure that his staff including engineers, supervisors and operators attend the training sessions.	Project Requirements	Throughout out Corridor	Contractor	EO-IC
P.6						

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
P.6.1	Joint Field Verification	The Environmental Expert of Supervision Consultant and the Contractor will carry out joint field verification to ascertain any additional possibility to saving trees, environmental and community resources. The verification exercise should assess the need for additional protection measures or changes in design/ scale/ nature of protection measures including the efficacy of enhancement measures suggested in the EMP. Proper documentation and justifications/reasons shall be maintained in all such cases where deviation from the original EMP is proposed.	Project Requirements	Throughout out Corridor	Contractor/ Environmental Expert of IE	PIU
P.6.2	Assessment of Impacts due to Changes/Revisions/Additions in the Project Work	The Environmental Expert of IC will assess impacts and revise/ modify the EMP and other required sections of the project documents in the event of changes/ revisions (including addition or deletion) in the project's scope of work.	Project Requirements	Throughout out Corridor	Contractor/ Environmental Expert of IE	PIU
P.6.3	Crushers, hot-mix plants and Batching Plants Location	Hot mix plants and batching plants will be sited suffiently away from settlements and agricultural operations or any commercial establishments. Such plants will be located at least 1000m away from the Waterbody, nearest village/ settlement preferably in the downwind direction. The Contractor shall submit a detailed layout plan for all such sites and approval of Environmental Expert of SC shall be necessary prior to their establishment. Arrangements to control dust pollution through provision of windscreens, sprinklers, and dust encapsulation will have to be provided at all such sites.	Clause No 111.1 MoRT&H Air (P&CP) Act 1981,	Throughout out Corridor	Contractor	Engineer, EO-IC

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		Specifications of crushers, hot mix plants and batching plants will comply with the requirements of the relevant current emission control legislations and Consent/NOC for all such plants shall be submitted to the "PIU through Independent Consultant. The Contractor shall not initiate plant/s operation until the required legal clearances are obtained and submitted. The engineer will ensure that the regulatory and legal requirements are being complied with.				
P.6.4	Other Construction Vehicles, Equipment and Machinery	All vehicles, equipment and machinery to be procured for construction will confirm to the relevant Indian Standard (IS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 will be strictly adhered to. Noise limits for construction equipment's to be procured such as compactors, rollers, front loaders concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB (A), measured at one meter from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced for EO – Supervision Consultant and PIU verification whenever required. Mobile equipment shall be placed at least 100metres away from the nearest dwelling.	Project Requirement Guideline-I	Throughout out Corridor	Contractor	Engineer, EO-IC
P.7						
7.1	Borrow Areas	Finalizing borrows areas for borrowing earth and all logistic arrangements as well as compliance to environmental	Clause No. 111.2 & 305.2.2 MORT&H Specifications for	Borrow Areas	Contractor	EO-IC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		requirements, as applicable, will be the sole responsibility of the contractor. The Contractor will not start borrowing earth from select borrow area until the formal agreement is signed between landowner and contractor and a copy is submitted to the "EO-IC/PIU through the Engineer. Locations finalized by the contractor shall be reported to the Environmental Expert of SC and who will in turn report to PIU. Planning of haul roads for accessing borrow materials will be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas as far as possible (in case such a land is disturbed, the Contractor will rehabilitate it as per Borrow Area Rehabilitation Guidelines and will use the existing village roads wherever available. In addition to testing for the quality of borrow materials by the SC, the environmental personnel of the SC will be required to inspect every borrow area location prior to approval The SC will make sure that each such site is in line with IRC and other Project Guidelines.	Road and Bridge works			
P.7.2	Quarry	Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials, quality and other logistic arrangements. In case, the contractor decides to use quarries other than recommended by the DPR consultants, then it will be selected	Clause No. 111.3 & MORT&H Specifications for Road and Bridge works	Along the Project Influence Area	Contractor	EO-IC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		based on the suitability of the materials and as per established law. The contractor will procure necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the "PIU through Engineer. Contractor will also work out haul road network and report to Environmental Expert of SC and SC will inspect and in turn report to PIU before approval.				
P.7.3	Arrangement for Construction Water	The contractor will use ground water as a source of water for the construction and can set up the own bore well facility for construction work. To avoid disruption/disturbance to other water users, the contractor will extract water from fixed locations and consult the Environmental Expert of SC before finalizing the locations. The Contractor will provide a list of locations and type of sources from where water for construction will be used. The contractor will seek approval from the EO-IC prior to the finalization of these locations The contractor will not be allowed to pump from any irrigation canal and surface water bodies used by community. The contractor will need to comply with the requirements of the State Ground Water Department and seek their approval for	Clause No. 1010 MORT&H Specifications for Road and Bridge works EP Act 1986	Along the Project Corridor	Contractor	EO-IC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		doing so and submit copies of the permission to Supervision Consultant and PIU prior to initiation of any construction work.				
P.7.4	Labor Requirements	The contractor preferably will use unskilled labour drawn from local communities to give the maximum benefit to the local community.	Conditions of Contract	Along the Project Area	Contractor	EO-IC, PIU
P.7.5	Construction Camp Locations – Selection, Design and Lay-out	Siting of the construction camps will be selected by the contractor as per the guidelines. Construction camps will not be proposed within 500 m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community applies only in case where a construction camp does not house plant sites and shall be located 200m away from water sources to avoid contamination and spread of water borne disease Location for stockyards for construction materials will be identified at least 1000m from watercourses. The waste disposal and sewage system for the camp will be designed, built and operated such that no odor is generated.	Appendix-7.5 Guidelines for Siting and Layout of Construction Camp	Along the Project Corridor	Contractor	EO- SC, PIU
P.7.6	Arrangements for Temporary Land Requirement	The contractor as per prevalent rules will carry out negotiations with the landowners for obtaining their consent for temporary use of lands for construction sites/hot mix plants/traffic detours/borrow areas etc. The Contractor will submit a copy of agreement to the Environment Expert of Independent Consultant. The Environmental Expert of SC will be required to ensure that the clearing up of the site prior to handing over to the owner (after	Project Requirements	Along the Project Corridor	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		construction or completion of the activity) is included in the contract.				
P.7.7	Implementation - Information Meetings	The contractor will organize at least 2 implementation information meetings in the vicinity of Project Site (minimum one in each section) for general public to consult and inform people about his plans covering overall construction schedule, safety, use of local resources (such as earth, water), traffic safety and management plans of debris disposal, drainage protection, canal training work during construction, pollution abetment and other plans, measures to minimize disruption, damage and in convenience to roadside users and people along the road. The first Implementation information meeting conducted within four weeks of mobilization. The people should be informed about the date, time and venue at least 7 days prior to meetings. Public shall be informed about the meeting through display of posters at prominent public places (panchayat offices, offices of Market committees, Notice board of religious places etc.) and distribution of pamphlets along roadside communities or in any manner deemed fit. The contractor will maintain a channel of communication with the communities through his designated Environment and Safety Officer to address any concern or grievances. Periodic meetings will also be conducted during the construction period to take feedback from communities or their representatives to ensure minimum disturbance. The mechanism and contents for disclosure shall be approved by PIU prior to the meetings.	Project Requirements	Along the Project Corridor	Contractor	EO- SC, PIU
CONSTRUCTION STAGE						
C.1						

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
C.1.1	Clearing and Grubbing	Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert of SC. The Contractor under any circumstances will not cut trees other than those identified for cutting and for which he has written instructions from the PIU. The PIU will issue these instructions only after receiving all stages of clearances from the Forest Department/ MoEF&CC Vegetation only with girth of over 30 cm will be considered as trees and shall be compensated, in the event of PIU's instruction to undertake tree cutting. The sub grade of the existing pavement shall be used as embankment fill material. The existing base and sub-base material shall be recycled as sub-base of the haul road or access roads. • The existing bitumen surface may be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes etc.	Clause No. 201 MORT&H Specifications for Road and Bridge works, chapter 3	Along the project Corridor work in progress	Contractor	EO-IC, PIU
C.1.2	Disposal of debris from dismantling structures and road surface (if any)	The contractor shall identify disposal sites. The identified locations will be reported to the Environmental Expert of IC. These locations will be checked on site and accordingly approved	Clause No. 201.4 MORT&H Specifications for	Along the project Corridor work in progress	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		by Environmental Expert of SC prior to any disposal of waste materials. All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, will be considered incidental to the work and will be planned and implemented by the contractor as approved and directed by the Environmental Expert of SC. The pre-designed disposal locations will be a part of Comprehensive Solid Waste Management Plan to be prepared by Contractor in consultation and with approval of Environmental Expert of SC. 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.	Road and Bridge works			
C.1.3	Other Construction Wastes Disposal	The pre-identified disposal locations will be a part of Comprehensive Waste Disposal Management Plan to be prepared by the Contractor in consultation and with approval of Environmental Expert of SC. Location of disposal sites will be finalized prior to initiation of works on any particular section of the road. The Environmental Expert of SC will approve these disposal sites after conducting a joint inspection on the site with the Contractor. Contractor will ensure that any spoils of material unsuitable for embankment fill will not be disposed of near any water course,	Clause No. 301.3.2 MORT&H Specifications for Road and Bridge works	Along the Project Corridor	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		agricultural land, and natural habitat like grass lands or pastures. Such spoils from excavation can be used to reclaim borrow pits and low-lying areas located in barren lands along the project corridors (if so desired by the owner/community and approved by the Environment Expert SC). Non-bituminous wastes other than fly ash may be dumped in borrow pits (preferably located in barren lands) covered with a layer of the soil. No new disposal site shall be created as part of the project, except with prior approval of the Environmental Expert of SC. All waste materials will be completely disposed and the site will be fully cleaned and certified by Environmental Expert of SC before handing over. The contractor at its cost shall resolve any claim, arising out of waste disposal or any non-compliance that may arise on account of lack of action on his part.				
C.1.4	Stripping, stocking and preservation of top soil	The topsoil from all areas of cutting and all areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way will be earmarked for storing topsoil. The locations for stock piling will be pre-identified in consultation and with approval of Environmental Expert of SC. The following precautionary measures will be taken to preserve them till they are used: 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	Clause No. 301.2.2 MORT&H Specifications for Road and Bridge works	Along the Project Corridor	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		m. To retain soil and to allow percolation of water, silt fencing will protect the edges of the pile. 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. It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles. Such stockpiled topsoil will be utilized for - covering all disturbed areas including borrow areas only in case where these are to be rehabilitated as farm lands (not those in barren areas) top dressing of the road embankment and fill slopes filling up of tree pits, in the median and In the agricultural fields of farmers, acquired temporarily. Residual topsoil, if there is any will be utilized for the plantation at median and side of the main carriageway.				
C.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 corridor, providing temporary connecting road. The Contractor will take care that Schools and religious places are accessible to Public. The contractor will also ensure that the work on / at existing accesses will not be undertaken without		Along the Project Corridor	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		providing adequate provisions and to the prior satisfaction of Environmental Expert of SC. The contractor will take care that the cross roads are constructed in such a sequence that construction work over the adjacent cross roads are taken up one after one so that traffic movement in any given area not get affected much.				
C.1.6	Planning for Traffic Diversions and Detours	Temporary diversions will be constructed with the approval of the Resident Engineer and Environmental Expert of SC for which contractor will seek prior approval for such plans. Detailed Traffic Control Plans will be prepared and submitted to the Resident Engineer for approval, seven days prior to commencement of works on any section of road. The traffic control plans shall contain details diversions; traffic safety arrangement during construction; safety measures for night – time traffic and precautions for transportation of hazardous materials. Traffic control plans shall be prepared in line with requirements of IRC's SP- 55 document and The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. The contractor will also inform local community of changes to traffic routes, conditions and pedestrian access arrangements with assistance from SC and PIU. The temporary traffic detours will be kept free of dust by sprinkling of water three times a day and as required under specific conditions (depending on weather	Clause No. 112 MORT&H Specifications for Road and Bridge works IRC; SP 55	Along the Project Corridor	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		conditions, construction in the settlement areas and volume of traffic).				
C.2						
C.2.1	Earth from Borrow Areas for Construction	No borrow area will be opened without permission of the Environmental Expert of SC. The location, shape and size of the designated borrow areas will be as approved by the Environmental Expert of SC and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961). 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 Expert of SC will decide the numbers of sprinkling depending on the local requirements. Contractor will rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area in accordance with the Guidelines for Redevelopment of Borrow Areas or as suggested by Environmental Expert of SC. The final rehabilitation plans will be approved by the Environmental Expert of the SC.	Clause No. 305.2.2 MORT&H Specifications for Road and Bridge works	Borrow Areas	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
C.2.2	Quarry Operations	The contractor shall obtain materials from quarries only after the consent of the Department of Mining / SPCB (both the states) / District Administration or will use existing approved sources of such materials. Copies of consent/ approval/ rehabilitation plan for opening a new quarry or use of an existing quarry source will be submitted to Environment Expert SC and the Resident Engineer. The contractor will develop a Comprehensive Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy to PIU and SC prior to opening of the quarry site. The quarry operations will be undertaken within the rules and regulations in force in the state.	Clause No. 111.3 MORT&H Specifications for Road and Bridge works	Quarry Areas	Contractor	EO- SC, PIU
C.2.3	Transporting Construction Materials and Haul Road Management	Contractor will maintain all roads (existing or built for the project), which are used for transporting construction materials, equipment and machineries as précised. All vehicles delivering fine materials to the site will be covered to avoid spillage of materials. All existing highways and roads used by vehicles of the contractor or any of his sub-contractor or suppliers of materials and similarly roads, which are part of the works, will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. Contractor will arrange for regular water sprinkling as necessary for dust suppression of all such roads and surfaces with specific attention to the settlement areas.	Project Requirement	All Roads Used	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		The unloading of materials at construction sites/close to settlements will be restricted to daytime only.				
C.2.4	Construction Water	Contractor will arrange adequate supply and storage of water for the whole construction period at his own costs. The Contractor will submit a list of source/s from where water will be used for the project to 'PIU' through the Engineer. The contractor will source the requirement of water preferentially from ground water but with prior permission from the Ground Water Board. A copy of the permission will be submitted to 'PIU' through the Engineer prior to initiation of construction. The contractor will take all precaution to minimize the wastage of water in the construction process/ operation.	Clause No. 1010 EP Act 1986 MORT&H Specifications for Road and Bridge works	Along the Project Corridor	Contractor	EO- SC, PIU
C.3						
C.3.1	Disruption to Other Users of Water	While working across or close to any perennial water bodies, contractor will not obstruct/ prevent the flow of water. Construction over and close to the non-perennial streams shall be undertaken in the dry season. If construction work is expected to disrupt users of community water bodies, notice shall be served well in advance to the affected community by the contractor. The contractor will take prior approval of the River Authority or Irrigation Department for any such activity. The PIU and the Engineer will ensure that contractor has served the notice to the downstream users of water well in advance.	Chapter-3	All Water Bodies	Contractor	EO- SC, PIU
C.3.2	Drainage	Contractor will ensure that no construction materials like earth, stone, ash or appendage is disposed off in a manner that blocks the flow of water of any water course and cross drainage	Clause No. 501.8.6 MORT&H Specifications for	Drainage line along the road	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		channels. Contractor will take all-necessary measures to prevent any blockage to water flow. In addition to the design requirements, the contractor will take all required measures as directed by the 'EO-IC' and the 'Resident Engineer' to prevent temporary or permanent flooding of the site or any adjacent area.	Road and Bridge works			
C.3.3	Siltation of Water Bodies and Degradation of Water Quality	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 ROW and around the stockpiles at the construction sites close to water bodies. The fencing will be provided prior to commencement of earthwork and continue till the stabilization of the embankment slopes, on the particular sub-section of the road. The contractor will also put up sedimentation cum grease traps at the outer mouth of the drains located in truck lay byes and bus bays which are ultimately entering into any surface water bodies / water channels with a fall exceeding 1.5 m. in present case three Sedimentation Cum Grease Trap are proposed, However the item has been kept in case need arises during construction. 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.	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works Water (P & CP) Act 1981 Chapter-3	All Surface Water Bodies Along the Project Corridor	Contractor	EO- SC, PIU
C.3.4	Slope Protection and Control of Soil Erosion	The contractor will take slope protection measures as per design, or as directed by the Environmental Expert of SC to control soil erosion and sedimentation.	Clause No. 306 & 305.2.2 MORT&H Specifications for	Along the Project Corridor	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		All temporary sedimentation, pollution control works and maintenance thereof will be deemed as incidental to the earth work or other items of work and as such as no separate payment will be made for them. Contractor will ensure the following aspects: • During construction activities on road embankment, the side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. • Turfing works will be taken up as soon as possible provided the season is favorable for the establishment of grass sods. Other measures of slope stabilization will include mulching, netting and seeding of batters and drains immediately on completion of earthworks. • In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank. • Along sections abutting water bodies, stone pitching as per design specification will protect slopes.	Road and Bridge works			
C.4						
C.4.1						
C.4.1.1	Water Pollution from Construction Wastes	The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system. Contractor will avoid construction works close to the streams or water bodies during monsoon.	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works Water (P & CP) Act 1974	Along the Project Corridor	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		All waste arising from the project is to be disposed off in the manner that is acceptable and as per norms of the State Pollution Control Board.				
C.4.1.2	Water Pollution from Fuel and Lubricants	The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500 m from rivers and irrigation canal/ponds. All location and layout plans of such sites will be submitted by the Contractor prior to their establishment and will be approved by the 'EO-IC, PIU/ NHAI. Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided for vehicle parking, wash down and refueling areas as per the design provided. In all, fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage. Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to SC and PIU) and approved by the Environmental Expert of SC. All spills and collected petroleum products will be disposed off in accordance with MoEF&CC and state PCB guidelines. 'EO-IC and Resident Engineer' will certify that all arrangements comply with the guidelines of PCB/ MoEF&CC or any other relevant laws.	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works Water (P & CP) Act 1974 Guideline XI Guidelines For The Storage, Handling, Use And Emergency Response For Hazardous Chemicals	Along the Project Corridor	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
C.4.2						
C.4.2.1	Dust Pollution	The contractor will take every precaution to reduce the level of dust from crushers/hot mix plants, construction sites involving earthwork by sprinkling of water, encapsulation of dust source and by erection of screen/barriers. All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement. The contractor will provide necessary certificates to confirm that all crushers used in construction conform to relevant dust emission control legislation. The suspended particulate matter value at a distance of 40m from a unit located in a cluster should be less than 500 micro gram/m^3. The pollution monitoring is to be conducted as per the monitoring plan. Alternatively, only crushers licensed by the SPCB shall be used. Required certificates and consents shall be submitted by the Contractor in such a case to the 'EO-PIU' through the 'Engineer'. Dust screening vegetation will be planted on the edge of the RoW for all existing roadside crushers. Hot mix plant will be fitted with dust extraction units.	Clause No. 111 & 501.8.6 MORT&H Specifications for Road and Bridge works Air (P & CP) Act 1981	Along the Project Road, Construction Site/ Camps	Contractor	EO- SC, PIU
C.4.2.2	Emission from Construction Vehicles, Equipment and Machineries	Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of SPCB.	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works	Along the Project Road, all vehicles used/ Camps	Contractor	EO- SC, PIU,

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		The Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project. Monitoring results will also be submitted to 'PIU' through the 'SC'.	Air (P & CP)Act 1981 Central Motor & Vehicle Act 1988			
C.4.3.3	Ventilation	The workplace must be ventilated to enable workers to carry out work without risk to health and safety. The Contractor will be fully responsibility for providing Power Supply and illumination during construction, The Contractor shall also provide suitable movable lamps to illuminate any area in Underground Works including areas for instrumentation and where the Engineer may wish to carry out inspection and rock mechanics tests or instrumentation The contractor shall design, install and operate ventilation system for the Underground Works and provide an underground atmosphere monitoring system.	As per the Labor Act	Underground work	Contractor	EO-IC,PIU
C.4.3						
C.4.3.1	Noise Pollution: Noise from Vehicles, Plants and Equipment	The Contractor will confirm the following: • All plants and equipment used in construction shall strictly conform to the MoEF&CC/CPCB noise standards. • All vehicles and equipment used in construction will be fitted with exhaust silencers. • Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. • Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works EP Act 1986 Noise Rules 2002	Along the Project Road , all vehicles used/Camps	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986. • Maintenance of vehicles, equipment and machinery shall be regular to keep noise levels at the minimum. • At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching will be stopped during the nighttime between 9.00 pm to 6.00 am. No construction activities will be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 9.00 am to 6.0 pm. Monitoring shall be carried out at the construction sites as per the monitoring schedule and results will be submitted to 'PIU' through the 'EO-IC'.				
C.5						
C.5.1	Personal Safety Measures for Labour	Contractor will provide: • Protective footwear, headwear and protective goggles to all workers employed on mixing asphalt materials, cement, lime, mortars & concrete etc. • Welder's protective eye-shields to workers who are engaged in welding works • Protective goggles and clothing to workers engaged in stone breaking activities and workers will be seated at sufficiently safe intervals	The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and cess Act of 1996 Factories Act 1948	Along the Project Road , all vehicles used/ Camps/quarry area	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		• Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. • Adequate safety measures for workers during handling of materials. • The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. The contractor will not employ any person of adolescent age (14-18 yrs) for any work and no woman will be employed on the work of painting with products containing lead in any form. The contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. Contractor will provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint dry is rubbed and scrapped.				

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		The Contractor will mark 'hard hat' and 'no smoking' and other 'high risk' areas and enforce non-compliance of use of PPE with zero tolerance. These will be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and will be approved by 'SC' and 'PIU'.				
C.5.2	Traffic and Safety	The contractor will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the 'EO-IC' and 'Resident Engineer' for the information and protection of traffic approaching or passing through the section of any existing cross roads. The contractor will ensure that all signs, barricades, pavement markings are provided as per the MORT&H specifications. Before taking up of construction on any section of the project corridor, a Traffic Control Plan will be devised and implemented to the satisfaction of 'EO-IC' and ' Resident Engineer'	IRC: SP: 55	Along the Project Road , all vehicles used/ Camps	Contractor	EO- SC, PIU
C.5.3	Risk from Electrical Equipment(s)	The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that – • No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. • All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the 'Resident Engineer'.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Along the Project Road /Camp	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
C.5.4	Risk Force Measure	The contractor will take all reasonable precautions to prevent danger to the workers and public from fire, flood etc. resulting due to construction activities. The contractor will make required arrangements so that in case of any mishap all necessary steps can be taken for prompt first aid treatment. Construction Safety Plan prepared by the Contractor will identify necessary actions in the event of an emergency.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Along the Project Road, construction Camps	Contractor	EO- SC, PIU
C.5.5	First Aid	The contractor will arrange for - • a readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone • availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital • Equipment and trained nursing staff at construction camp.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Along the Project Road, construction Camps	Contractor	EO- SC, PIU
C.5.6	Informatory Signs and Hoardings	The contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required as per IRC and MORTH specifications.	IRC:SP:55	Along the Project Road, construction Camps	Contractor	EO- SC, PIU
C.6						
C.6.1	Road side Plantation Strategy	The contractor will do the plantation at median and/or turfing at embankment slopes as per the tree plantation strategy prepared for the project. Minimum 80 percent survival rate of the saplings will be acceptable otherwise; the contractor will replace dead plants at his own cost. The contractor will maintain the plantation until they handover the project site to PIU.	Forest Conservation Act 1980 Guideline for median plantation and grass turfing of MORT&H	Along the Project Road	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		The Environmental Expert of SC will inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.				
C.6.2	Flora and Fauna	The contractor will take reasonable precaution to prevent his workers or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Environmental Expert of SC and carry out the SC's instructions for dealing with the same. The Environmental Expert of SC will report to the nearby forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.	Forest Conservation Act 1980 Wild Life Act 1972	Along the Project Road	Contractor	EO- SC, PIU
C.6.3	Chance Found Archaeological Property	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 workers 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 SC of such discovery and carry out the SC's instructions for dealing with the same, waiting which all work shall be stopped. The SC will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.	The Ancient Monument and Archaeological Site Remains Act 2010	Along the Project Road, construction sites/Camps	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
C.7						
C.7.1	Accommodation	Contractor will follow all relevant provisions of the Factories Act, 1948, the Building, and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labor camp. The location, layout and basic facility provision of each labor camp will be submitted to 'EO-IC and 'PIU' prior to their construction. The construction will commence only upon the written approval of the Environmental Expert of SC. The contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the SC.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948 Guidelines II Guidelines for Siting and Layout of construction camp	Along the Project Road, construction Camps/site	Contractor	EO- SC, PIU
C.7.2	Potable Water	The Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. The Contractor will also provide potable water facilities within the precincts of every workplace in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. The contractor will also guarantee the following: a) Supply of sufficient quantity of potable water (as per IS) in every workplace/labor campsite at suitable and easily accessible places and regular maintenance of such facilities. b) If any water storage tank is provided that will be kept such that the bottom of the tank at least 1mt. from the surrounding ground level.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Along the Project Road, construction Camps/construction site	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
		c) If water is drawn from any existing well, which is within 30mt. proximity of any toilet, drain or other source of pollution, the well will be disinfected before water is used for drinking. d) All such wells will be entirely covered and provided with a trap door, which will be dust proof and waterproof. e) A reliable pump will be fitted to each covered well. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. Testing of water will be done as per parameters prescribed in IS 10500:2012.				
C.7.3	Sanitation and Sewage System	The contractor will ensure that - • the sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place • separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women • adequate water supply is to be provided in all toilets and urinals All toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition.	Project Specific Requirement	Along the Project Road, construction Camps/Construction Sites	Contractor	EO- SC, PIU
C.7.4	Waste Disposal	The contractor will provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of SC. Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Environmental Expert of SC will have to be provided by the contractor.	Guidelines for Siting and Layout of Labor Camp of 6 MORT&H	Along the Project Road, construction Camps	Contractor	EO- SC, PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning and Execution	Supervision/ Monitoring
C.8						
C.8.1	Accessibility	The 'EO-IC' will contact the responsible people with the enhancement drawing of the site for which enhancement has been proposed and take their consent before the start of work. Accesses to Different Schools along the road will be developed to the satisfaction of 'PIU'.		Along the Project Road	Contractor	EO-IC, PIU
C.9						
C.9.1	Clean-up Operations, Restoration and Rehabilitation	Contractor will prepare site restoration plans, which will be approved by the Environmental Expert of SC. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. The contractor will clear all temporary structures; dispose all garbage, night soils and POL waste as per Comprehensive Waste Management Plan and as approved by SC. All disposal pits or trenches will be filled in and effectively sealed off. Residual topsoil, if any will be distributed in pre identified approved areas or in places suggested by the 'EO -SC' areas in a layer of thickness of 75 mm-l50 mm. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, at the contractor's expense, to the entire satisfaction to the Environmental Expert of SC and PIU/ NHAI will certify in this regard.	Guidelines for Disposal Site management of 6 MORT&H	Along the Project Road, construction Camps	Contractor	EO- SC, PIU

Table 9.2: Environmental Management Plan for Operation Phase

Sl. No.	Environmental Issue	Management Measures	Reference	Time Frame	Location	Responsibility	
						Execution/ Civil Work	Supervision/ Monitoring
OPERATION STAGE							
Activities to be carried out by the PIU							
O.1	Monitoring Operation Performance	The PIU will monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project. The Supervision Consultant selected for monitoring include the survival rate of trees; utility of enhancement provision, status of rehabilitation of borrow areas and disposal sites,		Operation Phage	Along the Project Road	PIU	PIU
O.2	Maintenance of Drainage	PIU will ensure that all drains (side drains, median drain and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding. PIU will ensure that all the sediment and oil and grease traps set up at the water bodies are cleared once in every three months.		Operation Phase	Along the Project Road	PIU	PIU
O.3	Pollution Monitoring	The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination in the selected locations as suggested in pollution monitoring plan or as recommended by SC-EO (Refer Chapter 3 for Monitoring Locations of air, water and noise) will be responsibility of PIU. PIU will either appoint PCB or its approved pollution-monitoring agency for the purpose		Operation Phase	Along the Project Road	PIU through Pollution Monitoring Agency	PIU

Sl. No.	Environmental Issue	Management Measures	Reference	Time Frame	Location	Responsibility	
						Execution/ Civil Work	Supervision/ Monitoring
O.3.1	Atmospheric Pollution	Ambient air concentrations of various pollutants shall be monitored as envisaged in the pollution-monitoring plan	Air (P & CP) Act 1981	Operation Phase	Along the Project Road	PIU through Pollution Monitoring Agency	PIU
O.3.2	Noise Pollution	The noise barriers will be provided at sensitive locations. No horn signs will be provided at locations sensitive due to noise. Noise pollution will be monitored as per monitoring plan at sensitive locations. Noise control programs are to be enforced strictly.	Noise Rules 2002	Operation Phase	Along the Project Road	PIU through Pollution Monitoring Agency	PIU
O.3.3	Water Pollution	Water Quality will be monitored as per monitoring plan	Water (P & CP) Act 1974	Operation Phase	Along the Project Road	PIU through Pollution Monitoring Agency	PIU
O.4.	Soil Erosion and Monitoring of Borrow Areas	Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), and embankment > 2m and other places expected to be affected, will be carried out once in every three months as suggested in monitoring plan.	IRC/Environmental Conservation Act	Operation Phase	Along the Project Road	PIU	PIU
O.5	Road Safety	Road Safety will be monitored during operation especially at location where traffic-calming measures have been proposed.	IRC Guidelines	Operation Phase	Along the Project Road	PIU	PIU

9.6 GREENBELT DEVELOPMENT PLAN

Afforestation should commence with the start of the project. The entire available land should be covered with trees under the afforestation programme. If the land is not sufficient on the project routes, separate proposal for afforestation should be planned for the plantation of tree away the project site, where land is available in order to recover greenery loss. Green belt development plan is formulated as part of new road construction project. As part of greenbelt development, plantation should be made in entire open space on the both side of the road and median to enhance floral cover and scenic beauty as well as sink of air pollution and act as noise barrier. Plantation may be carried out around the water bodies or along riverfront.

Table 9.3 Species recommended for Median Plantation

S. No.	Botanical name/Scientific Name	Local / Tamil name
1	*Cassia Montana*	Malaiyavaram maram
2	*Cassia siamea*	Pon-avarai maram
3	*Ficus bengalensis*	Ala maram
4	*Ficus glomerata*	Athi maram
5	*Lagerstroemia parviflora*	Peikadukkai maram
6	*Lagerstromia lanceolata*	Venthekku maram
7	*Moringa concanensis*	Kattu murungai maram
8	*Anona squamosa*	Seetha-palam maram
9	*Cassia fistula*	Konnai maram
10	*Acacia nilotica*	Karuvela maram
11	*Acacia suma*	Celai maram
12	*Aegle marmelos*	*Vilva maram*
13	*Alstonia scholaris*	*Palegaruda maram*
14	*Buchanania latifolia*	*Sarai paruppu maram*
15	*Butea frondosa*	*Elaiporasu maram*
16	*Mimusops hexandra*	*Palai maram*
17	*Pterospermum xylocarpum*	*Vedam-kurunai maram*
18	*Albizzia procera*	Velvagai maram
19	*Azadirachta indica*	Veppam maram
20	*Dalbergia paniculata*	Porapatchalai maram
21	*Ficus bengalensis*	Ala maram
22	*Gmelina arborea*	Kumil maram
23	*Mangifera indica*	Mamaram
24	*Tectona grandis*	Thekku maram
25	*Terminalia arjuna*	Neermaddi maram
26	*Tamarindus indica*	Pulia maram

Source: Hosur Forest Division Working Plan (PWPR) and Green Corridor Planning for Highways Project by Green Highways Division, NHAI, 2018

The loss of forest due to felling of trees in the process of construction shall be compensated as a part of afforestation program. It is proposed to develop greenbelt around the perimeter of various project's appurtenances, selected locations such as along water reservoir periphery, along the sensitive receptors near institutions, hospital etc., if any. The plantation will act as sound barriers also.

The general consideration involved while developing the greenbelt are:

- Trees growing up to 10.0 m or above in height with perennial foliage should be planted around various appurtenances of the proposed project.
- Planting of trees should be undertaken in appropriate encircling rows around the project
- Generally, fast growing species should be planted.

The species recommended for greenbelt development are given below.

METHODOLOGY FOR PLANTATION

The following strategy is to be followed while taking-up avenue plantation along the project corridor on the available land of proposed ROW of National Highway.

Treatment & Site Preparation

a) Planting Site should be cleaned and cleaned with stones, graveled etc. The stretch of rocky and Hardy patch (If any) should be carefully treated by breaking the stones and removal of Kankers pan down the pit depth as specified.

b) In the site preparation, weeds and unwanted vegetation growth should be cleared enough and land should be leveled. Line and level, size of pits, digging of pits should be properly maintained.

c) Plantation shall be done with the approval of Engineer.

Digging of pits

a) Size of pits = 1.0 meter (dia) x 1.0 meter (depth).

b) Topsoil up-to a depth of 30 cm may be kept aside for the treatment with Farm Yard Manure in order to develop microbial activities.

c) The bottom of the pit shall be forked to break up the subsoil.

Materials

a) Dump Manure: Dump manure shall be of well decayed (at least six months) organic or vegetable matter, obtained in the dry state from the municipal dump or other similar sources approved by the Engineer. The manure shall be free from earth, stone, brickbats or other extraneous matter.

Fertilization

a) The Neem/Castor/Groundnut cake shall be free from bush, dust, and any other foreign matters.

b) Basal dressing of Urea, Ammonium sulphate, Potassium sulphate Or DAP shall be applied at appropriate proportion with the approval of Engineer.

Plantation Activities

a) Planting of Trees: Plantation shall be made in rows in the available land.

b) Spacing: Plant to plant spacing shall be kept not farther away than 10.0 m. Or Plant to Plant = 9m – 10 m c/c; Row to Row = 7m - 8m c/c. Plantation should be staggered arrangement.

c) Size of Saplings: The live saplings shall be planted in uniformity in lines to the directions of the Engineer and the height of saplings shall be approx. 2 m with 14" x 20" size of bags.

d) Quantity of Manure @ plant:Farm Yard Manure/Dump Manure - ½ cft or 1:3 (1 part Farm Yard Manure to 3 part earth by volume) Urea - 25gm; Ammonium Sulphate - 25 gm; Potassium Sulphate – 25gm in mix} Or DAP – 100 gm in tussle.

e) Planting of Sapling: Initially, the bottom of planting pit should be covered with 40 cm of excavated earth.

f) Lindane dust shall be sprinkled on the wall of remaining pit depth @ 200gm/pit (i.e. 150 gm on the inside wall and earth of excavated pit to 20cm depth to be filled with mixed 50gms Lindane dust.

The balance earth shall be filled in the mixture of Farm Yard Manure in the ration of 1:3 (i.e. one part Farm Yard Manure and Three-part earth by volume). The manure shall be applied as Urea – 25 gm, Ammonium Sulphate -25gm, Potassium Sulphate-25gm in a mix of 5-liter water, Or DAP-100 gm/plant in tussle applied as basal dressing at the end of plantation and subsequently in the rotation of 30 days from the beginning of monsoon till the end of winter.

While planting the sapling, the bag should not be removed, only the poly of bottom surface should be removed and four cut on the side of bag by a sharp blade to be made carefully as the root undisturbed. It has been found by experience / experiment that the planting done with bags has better survival and growth compared to that when the bags are removed. This is because while removing the bag of the tall plant the ball of the earth is broken and consequently transplanting shock is very heavy. Sapling shall be planted at the Original Soil Depth i.e. the soil marked on stem will be maintained at the finished level.

Post Plantation Activities/Maintenance

Plantation shall be watered and maintained for one year until the area is handed over in whole or in phases. Maintenance shall include watering, weeding - out of undesirable vegetation growth, replacement of casualty, manuring, trimming of the hedges and using fertilizer in requisite doses, control of insects, fungus and other diseases by means of spraying with an insecticide or fungicide, pruning, and other horticulture operations necessary for proper growth of the plants and for keeping the landscape sub-contract area neat in appearance.

a) Weeding & Soil Working: First at the end of three months after plantation of saplings and minimum total of four times a year. Cleaning of Stumps and removal of thorny growth and copping (if any). Deep soil working should be done to the coppice shoots at least to a radius of 0.5m.

b) Watering: Watering is required at non rainy days at a rate of 15 liters per plant each time for 26 watering.

1) During June immediately after planting - 2 watering
2) During June - July, once in a week - 4 watering
3) August to November once in 15 days - 8 watering
4) December to March, once in 10 days - 12 watering

c) Casualty replacement: Adequate care to be taken for minimal mortality rate after the plantation and if occurs, dead plants shall be replaced immediately.

d) Fertilization: It shall be carried-out in rotation of every 30 days from the beginning of monsoon till the end of winter at a recommended quantity.

9.7 EMP BUDGET

A budgetary cost estimated for environmental management activities is presented in **Table 9.4**

Table 9.4: Environmental Management Cost

Particulars	Estimated Rate	Total Cost (INR)
Environmental training	Lump sum	10,00,000
Cost of Compensatory afforestation (1:10).i.e.12111 trees	INR 1517.1/Tree	183,37,265
Environmental Monitoring for Construction and Operation Period		18,57,000
Dust Suppression by water sprinkling	Considered under Civil Costs	
Environmental measures in Worker's Camp	Lump sum	20,00,000
Rainwater Harvesting Structures @ every 500m (aaprox.80 structures)	INR.25,000 per structure	20,00,000
Maintenance of structures @ every 500m (aaprox.80 structures)		
Maintenance of RWH structures during defect liability period		10,00,000
Cost for Corporate Environmental Responsibilities (CER) @1 % activities along project roads (schools, hospitals, dispensaries or public facilities) as per requirement		60700000
	Total	**8,68,94,265**

CHAPTER-10: EXECUTIVE SUMMARY

10.1 INTRODUCTION

The Ministry of Road Transport and Highways (MORTH), Government of India has proposed the "Bharat Mala Pariyojana", an umbrella scheme of road development projects which would be executed through the National Highways Authority of India (NHAI), National Highway and Industrial Development Corporation (NHIDC) and the respective State Public Works Departments (PWD).

In pursuance to the above program, NHAI is undertaking "Satellite Town Ring Road (West Side), a newly declared highway as NH-948A" under the *Bharatmala Pariyojana (Lot-3)* and has appointed M/s Louis Berger Consulting Private Limited, New Delhi. The proposed Greenfield highway starts from Ch. 0.000 in Dobbaspet in Karnataka and ends at Ch. 179.969 near Devarapalli village in Tamil Nadu/Karnataka Border. Bifurcation of the highway length between Karnataka and Tamil Nadu is 134.942 km and 45.027 km respectively.

This Report is for the Environmental Impact Assessment of Phase-III of the Satellite Town Ring Road (West Side) starting from Ch. 140.000 to Ch. 179.969 (Project) and having length 39.969 Kms. As it is a Greenfield highway, the proposed Project falls under "Category A" and attracts the conditions of obtaining prior Environmental Clearance from Ministry of Environment, Forest & Climate Change (MoEF&CC).

The objective of the Project is to improve the performance of the State road and regional transport network and make it a part of the ongoing Bharatmala Pariyojana (Lot-3) by improving road conditions and capacity, as well to avoid traffic congestion of Bangalore city in terms of heavy vehicles.

10.2 PROJECT DESCRIPTION

With an estimated civil cost of INR 756.68 crore, total length of 39.969 km, the alignment traverses through Denkanikottai and Hosur taluks of Krishnagiri. The proposed alignment comprises sections of newly declared National Highway-948A. The proposed alignment section of NH-948A starts at Peddamadhagondapalli village (design km 140.000) and terminates at Devarapalli village (design km 179.969). The Project road intersects the existing Ring Road of Hosur town (an automobile Hub of Tamil Nadu) and further connects with NH 207 and the proposed Bangalore – Chennai Expressway.

Further, the Project is anticipated to be of a 4/6 divided carriageway with a ROW of 70 m, with land requirement of 348.29 Ha. No tunnels are proposed, while 4 interchanges, 1 RUB, 1 major bridge, 12 minor bridges and 46 culverts are considered in proposed development. An overview of the Project location is provided in **Figure 10.1**.

Figure-10.1: Project location

10.3 BASELINE ENVIRONMENT

From an Environmental and Social perspective, the Project does not pass through any Wildlife area/ Protected area or CRZ and has no Protected Monuments/ Structures. The land use pattern of Project district is primarily agricultural/ vegetation (92%) with an estimated presence of 12,111 trees, which would be replaced tenfold as per Compensatory Afforestation rules. The alignment will affect 24 villages and 182 social structures, while the Environmental Management cost is INR 8.68 crore.

Coming to the description of the present physical environment, the Project road section of NH 948A passes mainly through rolling terrain while few stretches pass through plain terrain. Ponnaiyar River is the major water body traversing the proposed alignment at chainage of 158.500 km. In addition, the geological formation of Krishnagiri district consists largely of hard crystalline rocks of Archaean age comprising of various rock types such as Gneiss, Charnockite, etc. and seismically, the Project influence area falls under the least active to moderate damage risk Zone II. Soil tests conducted by the Consultant show the presence of mainly red loamy and sandy soil which suggest that the soils are fertile and could support a variety of crops. Lastly, 6 Borrow Areas have been identified while the Fly Ash for construction will be procured from three thermal Power Plant located within 300 Kms radius.

The Project area receives average rainfall between 750 mm and 900 mm. About 76 percent of the total rainfall is concentrated during the months of July to November. Mean daily maximum temperature is about 30°C and the mean daily min. is about 19°C. The winds are predominantly southwesterly during the summer monsoon and northeasterly during the winter monsoon. Further, Ambient Air Quality data was collected and analysed by the Consultant during the month of June 2018 in Krishnagiri District and it was ascertained that the air quality was good as per the prescribed permissible limits of the CPCB.

Also, the water quality was monitored, and it was found that the water was of good quality, and could be classified as Class A of the CPCB standards. Further, Ambient Noise levels were monitored during the study period from 6:00 am to 10:00 pm (Day) and from 10:00 pm to 6:00 am (Night). The daytime and nighttime noise levels were found be marginally exceeding the prescribed limits of CPCB at monitored locations.

With regards to the Biological Environment, which includes the Forest Ecosystem, Flora and Fauna, the following observations have been made:

As far ecologicay sensitivity of the project area, there is no forest land in the project alignment, however tree will be affected due to proposed project. Predominant tree species found along the NH-948A project road sections in Krishnagiri are Acacia, Tectona, Zizyphus etc. The total number of trees falling within the 70 m Project RoW are 12,111 nos. Plantation along the highway shall be taken up as per Green plantation strategy (as per IRC: SP-21:2009). Shrubs will be planted on the medians.

The fauna in the Project vicinity is reported to be not rich. No habitat fragmentation is likely to take place as a result of the proposed Project.

From a Socio-Economic standpoint, 24 villages lie en-route NH-948A with 182 Structures will be affected. Also the land requirement is 351.30 Ha in project affected villages. Accordingly, the compensation for the affected land, property and other structures would be awarded on the basis of the RCFTLARR Act 2013 in addition to local State laws as applicable. Most of the people in affected villages depend on agriculture for their livelihood. The major agricultural crops in the district are grown Paddy, Ragi, Redgram, Cowpea, Maize, Cumbu, Groundnut, Horsegram and minor millets. People are also employed in constructions, government jobs, agriculture and household activities.

10.4 STAKEHOLDERS CONSULTATION

As is standard practice, initial Public Consultations have been carried out in this Project during the site surveys with the objectives of minimizing probable adverse impacts of the Project through alternate design solutions (alignment and cross-sectional) and to achieve speedy implementation of the Project through bringing awareness amongst the community on the benefits of the Project. Items of discussions included pollution, drainage, tree felling, irrigation, land and affected properties. Also, the public hearing was conducted as per the procedure mentioned in the EIA notification. The major issues raised during public hearing was issues of land, properties, water bodies, employment and pollution during construction stage. The concern of the people recorded and considered in design for implementation and mitigation.

10.5 IMPACTS AND MITIGATION

For the Project Impact Mitigation, prevention or avoidance of impact is better than mitigation of impact. Hence, avoidance and reduction of adverse impacts approaches were adopted during the design stage through continued interaction between the design and environmental teams. This is resulted with designs having least social and environmental impacts. In-depth site investigations have been carried out so that sensitive environmental resources are effectively avoided, leading to the environmentally best-fit alignment option. Lastly, during the construction activities, there would be some impacts on environmental factors such as air& noise pollution, waste water and solid waste etc. which would be mitigated based on the Environmental Management Plan (EMP).

As land requirement is 348.29 Ha, it will affect 24 villages and 182 Structures. Accordingly, the compensation for the affected land, property and other structures would be given on the basis of the National R&R Act 2013 in addition to local State laws as applicable.

10.6 PROJECT BENEFITS

In all, the Project will give significant economic benefits to the region. Construction of the Project road will lead to better connectivity and will also play a significant role in changing the socio-economic condition of the people living in the region. Installation of proper road safety system through signage, barricades, crash barriers and by providing adequate bus bays, truck lay byes, underpasses, etc. on project roads will further enhance the road safety on these project roads. The Project will also generate direct and indirect employment to the local people of the State. The indirect benefits include savings in vehicle operating costs, less fuel consumption and decreased cost of passenger travel.

10.7 PROJECT COST AND ENVIRONMENTAL COST

The overall cost of the Project, the civil works are expected to cost INR 756.68 crore for a 4/6 lane 39.969 km stretch of the newly declared Greenfield National Highway 948A. The cost for the Environmental Monitoring Programme is pegged at 18.57 lakh while the Environmental Management Plan (EMP) with CER cost is 8.68 crore.

CHAPTER-11: DISCLOSURE OF CONSULTANTS ENGAGED

11.1 DISCLOSURE OF CONSULTANTS

M/s Louis Berger Consulting Pvt. Ltd, have been entrusted with the Consultancy services for obtaining environmental clearance from the Ministry of Environment, Forests and Climate Change (**MoEF&CC**), Government of India.

Modern Highway infrastructure is essential to facilitating economic growth and improving quality of life. With increasing traffic congestion world-wide, improving travel conditions, constructing new highways and upgrading existing infrastructure is critical.

Louis Berger has worked in the highway transportation market since 1953, when the firm undertook its first highway assignment with the design of major segment of the Pennyslyvania Turnpike-the first superhighway in the United States.

The firm's team of transportation planners and engineers work collaboratively with our environmental scientist, economist, financial analysts and program and construction managers to provide our clients with full lifecycle support for their transportation projects.

Louis Berger is one of the largest multi-disciplinary consulting organizations in the world, being amongst the leaders in the transportation (urban roads, highways, expressways, bridges etc.), urban infrastructure development (water supply, sewerage, solid waste management, etc.) and environmental engineering sectors (as per rankings of the Engineering News Record published by McGraw Hill). With over fifty five (55) years of experience worldwide including about 50 years in South Asia, the Berger Group can draw upon the experience, versatility and innovativeness of over 5,000 professional staff members in all facets of planning, design, design vetting, supervision, project management, monitoring, evaluation, technical assistance, operation and maintenance, independent engineering, impact assessment and management of multi-faceted and complex projects worldwide.

Specialized expertise:

Highways and expressways, Airports, Smart Cities, Metros, Tunnels, Biodiversity Projects, etc.

11.2 DISCLOSURE OF PROJECT AND EIA/EMP REPORT

In order to enable timely project implementation, continued dialogue and coordination will need to take place between the Client, Consultant and relevant agencies.

Intimation on the availability of the report to the public will be made through mass media. The English version of the document will be available in the offices of Project office NHAI/PCB and Concerned Collectors.

This EIA report will also be made available on the websites of the NHAI/MOEF&CC. The short CV of experts are attached as **Appendix-11.1.**

11.2.1 Approved Key Professional from QCI

The LBG is NABET accredited consultancy company and accredited for Sector-34, category A projects. Mohammad Akhtar worked as Environmental coordinator for the EIA. He is NABET accredited EIA coordinator for sector 34. The other functional area experts are given in Table below.

DISCLOSURE OF CONSULTANT

Declaration by Expert contributing to the Environmental Impact Assessment study for Development of Satellite Town Ring Road (STRR) Phase-III newly declared National Highway NH-948A from Peddamadhagondapalli to Tamil Nadu/Karnataka Border (km 140.000 to km 179.969) 39.969 km in District Krishnagiri, Tamil Nadu

I, hereby, certify that we were part of the EIA team in the following capacity developed the above EIA Report,

Signature : 

Name of EIA Coordinator : Mohammad Akhtar

Date : 13.03.2020

Period of Involvement : March 2019 to till date

Contact Information : Mohammad Akhtar
Head (Environment & Social
Louis Berger Consultant Pvt. Ltd
5th Floor Jakhar Bhavan (IFFCO)
Plot No.3| Sector 32| Gurgaon|
Haryana|122001|India

S. No	Functional Areas	Name of the experts with duration of Employment with organization.	Task	Signatures
1.	Air Pollution Monitoring, Prevention and Control-AP	Mohammad Akhtar (March 2019 to till date)	• Review of EIA Report • Review of Air Monitoring data • Impact Examination and Mitigation Measures. • Report Preparation	
2.	Water Pollution Monitoring, Prevention and Control-WP	Sridhar Janaswamy (Mar 2018 to till date)	• Preparation of Scope for baseline study • Review of water monitoring data • Impact assessment for water quality • Mitigation measures for water pollution	

3.	Meteorology, Air Quality and Modeling and Prediction-AQ	Mohammad Akhtar (March 2019 to till date)	• Study of wind pattern and weather conditions. • Preparation of Meteorology Report • Air quality Modelling • Impact identification and mitigation measures • Report Preparation	
4.	Ecology and Biodiversity -EB	Mohammad Shabbir Ali (August 2019 to till date)/ Mohammad Akhtar (March 2019 to till date)	• Ecology & biodiversity survey of the study area • Consultation with Forest officials and local people. • Joint survey of forest and trees with forest department and revenue department • Examine Impact and mitigation measures • Preparation of Ecological Report.	
5.	Land Use-LU	K.Mohan (March 2011 to till date)	• Preparation Land Use Maps • Examine impact of land use • Mitigation Measures.	
6.	Socio-Economic-SE	PDV Ramana Kumar (April 2018 to till date)/ Rajesh Kumar Verma (November 2019 to till date)	• Socio-economic and Census survey of the area • Impact of PAP • Review of R&R Framework • RAP and SIA Preparation	
7.	Soil Conservation-SC	D.M. Godbole (November 2003 to till date)/ Vivek Anand (March 2017 to till date)	• Preparation of Scope for baseline study • Review of soil monitoring data • Impact assessment for soil quality • Mitigation measures for soil conservation • Report Preparation.	
8.	Noise and Vibration-NV	Imtiyaz Mallick (April 2018 to till date)	• Noise monitoring scoping • Noise impact analysis • Preparation of Management plan	
9.	Hydrology, Ground Water and Water Conservation-HG	Dr. Navin Kumar Singh (Aug 2016 to till date)	• Review of Hydro-geological pattern of the area • Assessment of impact	

			• Mitigation Measures • Report Preparation	
10.	Risk and Hazard Management-RH	Manjunath K.B (Apr 2018 to till date)	• Assessment of Construction related risks and hazards. • Report Preparation	
11.	Municipal Solid Waste-MSW	Imtiyaz Mallick (Apr 2018 to till date)	• Quantitative assessment of municipal waste likely to be generated • Development of waste management plan	
12.	Solid and Hazardous Waste-SHW	Sridhar Janaswamy (March 2018 to till date)	• Impact assessment for SHW • Mitigation measures for water SHW • Preparation of SHW Report	
13.	EIA Expert & Report Reviewer	Mohammad Akhtar (March 2019 to till date)	• Project Management • Report Review	

Declaration by the Head of the Accredited Consultant Organization/ Authority

I, Kshitish V Nadgauda, hereby, confirm that the above-mentioned experts prepared the EIA for Development of Satellite Town Ring Road (STRR) Phase-III newly declared National Highway NH-948A from Peddamadhagondapalli to Tamil Nadu/Karnataka Border (km 140.000 to km 179.969) 39.969 km in District Krishnagiri, Tamil Nadu. I also confirm that I shall be fully accountable for any mis-leading information mentioned in this statement.

Name: Sh. Kshitish V Nadgauda
Designation: SVP & MD (Asia)

Name of the EIA Consultant Organization: Louis Berger Consultant Pvt, Ltd.
NABET Certificate No. & Issue Date: QCl/NABET/EIA/AC0/19/1150 dated December 02,2019