Draft Environmental and Social Impact Assessment (ESIA)

Phase – 1 Corridors

Tamil Nadu Road Sector Project – II

(Roads Under Additional Financing)

Highways Department
(Government of Tamil Nadu)

April 21, 2020

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List of Abbreviation

CPCB	:	Central Pollution Control Board
CoI	:	Corridor of Impact
DEA	:	Department of Economic Affairs
EAC	:	Expert Appraisal Committee
EIA	:	Environmental Impact Assessment
ESIA	:	Environmental and Social Impact Assessment
ESMP	:	Environmental and Social Management Plan
ESMF	:	Environmental and Social Management Framework
EMP	:	Environmental Management Plan
FSI	:	Forest Survey of India
FGD	:	Focus Group Discussion
DPR	:	Detailed Project Report
GoTN	:	Government of Tamil Nadu
GoI	:	Government of India
GRC	:	Grievance Redressal Committee
HTL	:	High Tension Line
HH	:	House Hold
LARRU	:	Land Acquisition Rehabilitation and Resettlement Unit
MDR	:	Major District Road
MoEF&CC	:	Ministry of Environment, Forest and Climate Change
MoRTH	:	Ministry of Road Transport and Highways
NBWL	:	National Board for Wildlife
OP	:	Operational Policies
PIU	:	Project Implementation Unit
PMU	:	Project Management Unit
RoB	:	Rail over Bridge
RAP	:	Resettlement Action Plan
RPF	:	Resettlement Policy Framework
RoW	:	Right of Way
SEZ	:	Special Economic Zone
SEIAA	:	State Environment Impact Assessment Authority
SIA	:	Social Impact Assessment
SIPCOT	:	State Industries Promotion Corporation of Tamil Nadu
SH	:	State Highways
TNRSP	:	Tamil Nadu Road Sector Project
TNPCB	:	Tamil Nadu Pollution Control Board
ULB	:	Urban Local Body
WFPR	:	Workforce participation rate

EXECUTIVE SUMMARY

E 1. Background

GoTN is currently undertaking the second phase of works namely Tamil Nadu Road Sector Project II (TNRSP II) which is covering upgradation, maintenance and improvement of the identified core road network. For the Additional Financing, the project interventions include widening and strengthening of existing two-lane roads with paved shoulder and for some two-lane roads based on the traffic, it was decided to widen for 4 lane configurations with pavement strengthening with/without paved shoulders and all required drainage facility, road furniture and accessories.

E 2. Project Description

The Additional Financing (AF) proposes to provide extra resources to two sub-components under the parent project (TNRSP-II) and support the introduction of four new sub-components, which includes improvement of road and logistic infrastructure and institutional capacity building. The AF's sub-components (i) Upgradation and maintenance through EPC contracts (Sub-component A1), (ii) Road Safety Improvements (C7) and (iii) Logistic Improvement (Sub-component D2) are major project components with likely potential environmental and social impacts. As part of sub-component A1 of Additional Financing, TNRSP has decided to implement the "7 roads in Package – 6 (Roads under additional financing) under Phase1 and Phase 2" with financial assistance from the World Bank. Hence, in accordance with World Bank's Operational Policy OP 4.01 (Environmental Assessment) and mandate the preparation of project-specific Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP). Similarly, in accordance with World Bank's Operational Policy OP 4.12 (Involuntary Resettlement), this project mandates the preparation of the Social Impact Assessment (SIA) and Resettlement Action Plan (RAP).

Accordingly, this ESIA report is prepared for the Phase 1 Corridors for which the DPR's were prepared during the year 2015 to 2016, which had to be updated to suit the current scenario in 2020. The TNRSP II project's Environmental and Social Management Framework (ESMF) has been utilised for screening civil works, identification of environmental risks and mitigation measures that are required during project implementation. The roads proposed under the Phase-1 Corridors is depicted in the following table.

Table1: Phase-1 Corridors under TNRSP-II (Additional Financing)

Sl.no	Project Roads	Description	Length (km)
1	State Highways (SH) - 222	Omalur to Mecheri	14.600
2	State Highways (SH) - 30	Malliyakarai to Attur	10.07
3	State Highways (SH) - 15	Chithode to Erode	8.12

Source: TNRSP

E 3. Legal and Institutional Framework

The key rules and regulations applicable for this project is as follows

- Notification on use of fly ash (subsequent amendments)
- Wildlife Protection Act (subsequent amendments)
- Forest (Conservation) Act

- Biological Diversity Act
- Water (Prevention and Control of Pollution) Act (and subsequent amendments)
- Air (Prevention and Control of Pollution) Act (and subsequent amendments)
- Noise Pollution (Regulation and Control) rules
- Hazardous Waste (Management& Transboundary Movement) Rules and subsequent amendments
- The municipal solid waste management rules and subsequent amendments
- Environmental Clearance (EC) under EIA notification (and subsequent amendments) for new Quarry areas
- Central Motor Vehicle Act Central Motor Vehicle Rules
- The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act
- The Right to Fair Compensation and Transparency in Land Acquisition Rehabilitation and Resettlement Act, 2013 (Act 30 of 2013) (LARR)
- The Tamil Nadu Protection of Tanks and Eviction of Encroachment Act, 2007
- Tamil Nadu Highways Act, (TNHA)

The project-related clearances to be obtained by the Contractor are detailed in the ESIA report. The TNRSP-II environmental category A is retained for AF project, this is as per the Environmental and Social Impact Assessment (ESIA) conducted for the Phase-1 Corridors, the outcome of the assessment shows, significant impact on (i) the avenue trees due to the proposed widening (ii) requirement of construction materials including sand, gravel and water and (iii) loss of land, structures and livelihood.

E 4. Description of the Environment

The Phase-1 Corridors are falling under the Salem and Erode Districts in the state of Tamil Nadu. The topography of the project area is as follows

Sl.no	Project Roads	Topography
1	Omalur to Mecheri Road (SH 222)	The project stretch passes entirely through plain terrain. The elevation of the project road is varying from 273m to 346m AMSL
2	Malliyakarai to Attur Road (SH 30)	The project stretch passes through plain terrain. Project road elevation varies between 225m to 280m AMSL
3	Chithode to Erode Road (SH 15)	The project stretch has an undulating terrain, Chithode has 192m AMSL and Erode has 179m AMSL

Source: tn.gov.in/district

The project districts (Salem and Erode) experience semi-arid tropical climate wherein four distinct seasons. Maximum temperature is recorded in the months of March-May and minimum temperature is recorded in the months of November to February. Minimum temperature of 14.4°C has been recorded at Erode district and the maximum temperature 37.9°C was recorded at Salem district. The project districts receives the rain under the influence of both southwest and northeast monsoons. In Salem district, the normal annual rainfall varies from about 800 mm to 1400 mm. In Erode District, the normal annual rainfall varies from about 600 mm to 1100 mm. As per the seismic zone classification of India, Salem district is lying in Earthquake Zone hazard Zone III (Moderate Damage Risk Zone) and for Erode district, it is Earthquake Zone hazard Zone II (Low Damage Risk Zone).

The ambient air quality and the ambient noise levels in the project area are monitored and compared with the AAQ standards, from the comparison, it is evident that none of the monitored parameters are exceeding the stipulated standard limits for air quality, however, for the ambient noise levels, the outcome of the analysis shows a significant increase in the sound levels near the sensitive receptors, this may be due to the movement of vehicles in the project corridor. Similarly, water samples (groundwater and surface water) have been collected and analysed for its Physico-chemical properties and from the outcome of the analysis, the groundwater quality in the project area is observed to be good and suitable for the potable purpose. The quality of the surface water is observed to be contaminated (high BoD and DO concentration are observed for all samples).

The project districts are having significant areas covered under the Forest. As per the Forest Survey of India (FSI), the Erode district has the highest forest area (40%) in comparison with Salem district (28%). One of the project road (Malliyakarai to Attur Road Sh 30) in the Phase-1, starts near a reserved forest it is also called as Sri Sanaasivarathan Samy Hills, no major wildlife activities have been observed or recorded. The hill has been accessed by the devotees to reach the temple located on top of the hill lock. As per the road inventory, there are 3489 trees recorded along the Phase-1 Corridors.

Sl.no	Project Districts	Project Roads	Forest cover (sq.km)	Avenue trees	Protected areas
1	Salem	Omalur to Mecheri Road (SH 222)	1469.84	1833	-
2		Malliyakarai to Attur Road (SH 30)		831	-
3	Erode	Chithode to Erode Road (SH 15)	2249.46	825	-

Source: Tamil Nadu Forest Department and road inventory

As per the tree inventory survey, Tamarind trees (*Tamarindus indica*), Coconut trees (*Cocos nucifera*), Arasa Maram (*F. Religiosa*), Veppa Maram (*Azadirachta indica*) are observed to be the dominating species across all the project corridors. Among the faunal Species, Indian grey mongoose (*Herpestes edwardsi*), Rat snake (*Ptyas mucosa*), Russels Viper (*Daboia russelii*) are commonly observed in the surrounding agriculture areas. The common avifauna includes Crows (*Corvus splendens*), Indian Rock Pigeon (*Columba livia*), Cattle egret (*Bulbulcus ibis*), Black Kite (*Milvus Migrans*) and the mammals includes Black Naped Hare (*Lepus nigricollis*), Bat (*Pteropus madius*) and Indian palm squirrel (*Funambulus palmarum*).

E 5. Analysis of Alternatives

The Phase-I Corridors are proposed to be implemented by adopting the existing alignment to the extent possible. However, some minor modifications including realignment shall be incorporated as per the road design requirements. Major bypasses are not envisaged for any of the project roads. Except for Omalur to Mecheri Road (SH 222), it is proposed to construct a Rail Over Bridge (RoB) at 0/250 km. As per the road inventory information, it is anticipated to have significant social impacts concerning the structures existing in commercial land use area and a major junction is located within 150m from the level crossing. Hence to avoid the impacts, realignment options have been explored and three best options have been studied. The outcome of the analysis shows, Option 1 would be a better realignment. However, considering the magnitude of the impact the proposed

realignment section will be taken up for implementation at a later stage (Not as part of this package).

Omalur to Mecheri Road (SH 222) – Realignment Section at Omalur			
Design Components	**Option 1**	**Option 2**	**Option 3**
Alignment type	Greenfield	Greenfield	Existing road widening
Proposed RoW (m)	45 to 50m	45 to 50m	45 to 50m
Realignment Length (km)	1.3	1.66	3.05
Proposed Box culverts	4	4	15
Minor Bridge	-	1	-
Major Bridge	-	-	1
Rail Over Bridge (ROB)	1	1	1
Vehicle Under pass (VUP)/ Vehicle Over pass (VOP)	1	1	1
Structures affected	25	16	29
Land use pattern in the alignment	Agriculture	Agriculture	Agriculture and Partly Dry land
Land Acquisition in ha	6.99	8.77	15.65

E 6. Potential Environmental Impact and Mitigation Measure

Being existing roads, the implementation of the proposed interventions from 2 lanes to 4 lane configurations and 2 lanes with pave shoulders configurations shall not have any significant impact on the topography and terrain. The proposed project interventions are subjected to the widening of the existing roads, the Phase-I Corridors are having flat and slightly undulating terrain and hence no significant impact on geology is anticipated. Emissions from asphalt hot-mix plants, transportation of construction materials and vehicular movement along the project roads will have a temporary but significant impact on air quality during project construction, for which suitable mitigation measures are given in the ESMP. Setting up of hot mix plant/ batching plant will increase the local noise level; however, it is temporary and will last till the construction works are over.

The Phase-I Corridors are not subjected to flooding. As per the CGWB information on the groundwater availability/ status, the Phase-I Corridors, SH 222 and SH 30 are falling under over exploited areas, which is followed by SH 15 (critical area). Hence, rainwater harvesting is proposed in the road design and artificial groundwater recharge pits are proposed in the surface water bodies along the project corridor to enhance the groundwater recharge.

The Phase-I Corridors are not located or passing through protected area and forest. The proposed road improvements shall have a direct impact on the avenue trees alongside the project roads. It is estimated to remove 2,889 trees, of which 2,547 are government trees and 342 are private trees. Due to the CoI approach and design modifications nearly 455 trees have been saved. For the affected trees under existing regulations (as directed by the Hon'ble High Court of Madras during the year 2014) for each affected trees as a compensatory measure 1:10 saplings shall be planted.

Based on the public consultation, accident data and the observed ribbon development along the Phase-I Corridors, the Black Spots (mostly on the junctions) are identified, for which adequate sight distance, provision of sign boards, illuminations, rumble strip, road markings etc., are proposed in the road design. There are no Heritage sites identified

along the Phase-I Corridors and its influence areas. This has been confirmed with the list of ASI monuments identified and recorded in the state of Tamil Nadu. Avenue tree plantation along the project roads, enhancement of roadside village ponds/ water bodies, Water harvesting structures and provision of solar street lights at sensitive receptors are provided as an enhancement measure in the Phase-I Corridors.

The Social Impact Assessment (SIA) was conducted to identify the congested areas, potential impacts on the community and settlement to provide the basic information to the engineering design team to integrate it with technical design. The additional road widening and improvements proposed under additional financing will have incremental positive social impacts in the form of improved transport facilities, more employment opportunities and better access to markets, health centres, and schools. This in turn reduces the travel time and increase in the value of the land alongside the roads. Some of the adverse impacts include loss of agricultural lands, assets, increased noise, air pollution and potential for increased risk of traffic crashes due to the increased speed of vehicles.

Similar to TNTSP I, this project also retains the OP 4.12 “Involuntary Resettlement” continues to be relevant and applicable due to the substantial amount of land acquisition and resettlement impacts. The other social safeguard policy OP 4.10 “Indigenous People” was not triggered since the Phase-I Corridors which fall under the AF neither passes through tribal designated areas, nor are people with similar characteristics to those defined in OP 4.10 are present along the Phase-I Corridors.

The RPF which was prepared for parent project includes set principles/objectives of resettlement, process for conducting census survey, socio-economic surveys, and preparation of RAPs, entitlements for different types of impacts, process of land acquisition, valuation of affected assets, consultations and disclosure, institutional arrangements, coordination with civil works, grievance redress mechanism, monitoring and evaluation arrangements. This RPF is currently updated to reflect the experience and lessons learnt during the implementation of the parent project. Some of the updates including introduction of consent method for land acquisition to speed up the land acquisition process with 25 percent higher compensation, land handover schedule, process for updating resettlement unit costs based on annual inflation, land records updating prior to compensation awards, provisions for supporting basic amenities in the resettlement sites and streamlining the livelihood support.

As per the social impact assessment, it is estimated to acquire 13.06Ha of land (11.83 Ha of private land and alienation of 1.23 Ha of government land). The land acquisition shall have n impact on 859 land owners including land cum structures (346 landowners) and land only (513 landowners). As per records, the impacted land comes under non-agriculture (dry land) category. The widening proposal also has direct impact on 378 private structures, 19 Common Property Resources (CPR’s).

Labor influx impacts are expected as approximately 200-250 workers would be required for each of the project corridors of which one-third are expected to be from outside the immediate areas of the project roads. Gender based violence risks are anticipated and appropriate measures will be built into work contacts to manage the risks associated with workers, including the signing of codes of conduct by the workers and the adoption of enhanced contract conditions with explicit requirements on the management of labor influx.

As part of the Environment and Social Impact Assessment, consultations were held with community members along the Phase-I Corridors. Key concerns and interests expressed by the stakeholders include: (i) fair compensation for loss of land and assets; (ii) access to employment opportunities during construction; (iii) improvement of basic amenities along the project roads; (iv) livelihood support to affected people; (v) road safety measures; (vi) the need for sidewalks, and (vii) provision of noise barriers near schools and hospitals.

E 7. Environmental and Social Management Plan (ESMP)

Environmental and Social Management Plan (ESMP) deals with the implementation procedure of the guidelines and mitigation measures are recommended to avoid, minimize and mitigate foreseen environmental impacts anticipated during project implementation at various stages namely Pre-construction, Construction and Post Construction. Based on the impact assessment, some of the key issues identified due to the project implementation is highlighted as follows.

- **Loss of Trees**: As per the assessment 2,889 trees are getting affected, of which 2,547 are government trees and 342 are private trees. Due to the CoI approach and design modifications nearly 455 trees have been saved. As a mitigation measure the loss of tress shall be compensated in a ratio of 1:10.
- The Environmental and Social Management Plan (ESMP) also identified possible measures to address construction-stage impacts such as: (a) air and noise pollution including dust generated from material transport, crushers, and asphalt plants; (b) water and soil pollution from spills of fuel, lubricants, and construction camp wastes; (d) operation and rehabilitation of borrow pits, quarries, and construction camps; (e) traffic safety and management; (f) worker's health and safety and; (g) debris management.
- **Loss of water bodies**: The Phase – 1 corridors, Omalur to Mecheri Road (SH 222) and Chithode to Erode Road (SH 15), are proposed for 4 lane configuration, which will have significant impact on the water bodies (SH 222 and SH 15 are having one water body each) located along the project roads. The project area is also water scarce area with groundwater development falling in over exploited area making it to be semi-critical. Water harvesting structures have been included in the project design for ensuring groundwater recharge along all roads. Recharge pits for runoff water shall be constructed to facilitate the infiltration of water into the ground.
- **Impact on the social sensitive areas**: The educational institutions (including schools and colleges), hospitals, community centres and CPR's shall have direct construction related impacts due to noise and air pollution, to quantify the impact appropriate modelling studies has been carried out and based on the model outcome, construction of Noise barrier and air pollution control measures have been detailed in the ESMP. During the implementation of the project, there is a need to bring in migrant labours (30% to 50%) from other states, for which appropriate assessment has been performed to meet the requirements. To address the Gender Based Violence (GBV), the risks (issues related to women's safety and security, Physical violence, Emotional abuse, etc) has been assessed through consultations with the women group, vulnerable communities, students, educational institution authorities etc. along the project settlements/villages. Based on the outcome of the analysis, suitable mitigation measures has been included in the ESMP.
- **Surface water contamination**: Surface runoff that may increase due to increase in the paved surface and overloading of existing drainage facilities can create localized flooding or water logging and contaminating surface water. For this, improvement using both longitudinal and cross drainage shall be done to avoid such

problems. Additional culverts have been designed to minimize erosion/flooding impacts. In addition, at potential sources like construction camp, provision of the Silt traps and oil interceptors are also recommended. Similar to this, silt fencing are proposed during earthwork near to surface water bodies.

- **Integration in Bid Document:** The identified potential adverse impacts can be largely mitigated through engineering designs, good construction practices accompanied by site-specific mitigation measures. The ESIA finding and recommended environmental management measures have been made part of designs/DPRs. For impacts that are to be directly undertaken by the Contractor, relevant portions of the Environmental Management Plan form a part of the bidding/contract document.
- **Enhancement Measures:** Other mitigation/enhancement measures such as noise barriers, traffic calming measures etc. for sensitive receptors and enhancement of common property resources or cultural or religious sites have been suggested for implementation.

Other construction related impacts on the physical environment, biological environment and social environment has been listed and suitable mitigation measures has been suggested in an Environmental and Social Management Plan (ESMP). The implementation of the environmental and social management plan needs suitable organization set up and the success of any environmental and social management plan depends on the efficiency of the group responsible for the implementation of the program.

For this project, the ESMP given in the bid document will be implemented by the Contractor (Environmental and Safety Engineer), he will make sure that all the project related clearances including the NoC/ Permissions from the competent authority is obtained before the start of the construction works. He will be responsible for conducting the environmental monitoring (as per the environmental monitoring plan) and the preparation and submission of the monthly ESMP report to the Construction Supervision Consultant (CSC). The Construction Supervision Consultant (Environmental Officer) will verify the project related clearances (including the NoC/ permissions) and he will review the environmental monitoring outcomes, as well as the monthly ESMP reports and guide/ advise the contractor in implementing the ESMP. The Construction Supervision Consultant (Environmental Officer) will submit the revised monthly ESMP report to the PIU. The Environmental cell in the PIU will review the monthly ESMP reports and it will be consolidated every quarter and shared with the World Bank for review and disclosure.

E 8. Stakeholder Consultation and Information Disclosure

Consultations were done at socially sensitive locations with various stakeholders during the project screening and DPR preparation. The consulted stakeholders include owners of the residential and commercial buildings, tenants and employees of the commercial buildings, auto rickshaw and taxi drivers, students, elected representatives' members of CBO/NGOs, working women and farmers. Safety was the major issue discussed in all the meetings. People requested to provide the signboards, zebra line at settlement areas, school zones, near hospitals and factory locations and speed breakers at start and end locations of settlement areas. People suggested constructing noise barriers at school locations, hospitals and other such sensitive locations. Auto and taxi drivers demanded parking facility for them and bus bays should be provided to serve the commuters as it will reduce traffic blocks and accidents.Formal consultations have been conducted with the

affected people and villages to gather their suggestion and feedback on likely social impacts. During the consultation, information pertaining to the disclosed Summary ESIA was shared. The formal consultation was conducted after intimating the local and affected people well in advance seeking suitable time and participation.The suggestion/concerns of public such as the possibility of a bypass to avoid impacts in built-up areas, provision of basic amenities, safety measures, livelihood impacts, need for additional bus bays, etc were discussed with the design team and it would be addressed in the detailed design/ DPR. Executive summary of ESIA, gist of RAP, including entitlement matrix and grievance process (in English and Tamil) has been disclosed to the public during the consultations.

E 9. Implementation Arrangement

The existing environmental cell in the TNRSP is found to be well structured and well-functioning, it is evident from the on-going TNRSP-II. Hence, the same institutional arrangement will be adopted for additional financing.

The ESMP given in the bid document will be implemented by the Contractor (Environmental and Safety Engineer), who will make sure that all the project related clearance including the NoC/ Permissions from the competent authority is obtained before the start of the construction works. The Contractor will be responsible for conducting the environmental monitoring (as per the environmental monitoring plan) and the preparation and submission of the monthly ESMP report to the Construction Supervision Consultant (CSC). The CSC (Environmental Officer) will verify the project related clearances (including the NoC/ permissions) and he will review the environmental monitoring outcomes, as well as the monthly ESMP reports and guide/ advise the contractor in implementing the ESMP. The CSC (Environmental Officer) will submit the revised monthly ESMP report to the PIU. The Environmental cell in the PIU will review the monthly ESMP reports and it will be consolidated every quarter and shared with the World Bank for review and disclosure.

E 10. Grievance Redress Committee (GRC)

The GRC will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. For TNRSP-II, there are 3 GRC's located at Salem, Trichy and Chennai. The GRC constitutes 3 member committee chaired by a retired District Revenue Officer (DRO) and comprising of the Divisional Engineer, Highways, TNRSP acting as its member secretary and a local person of repute and standing in the society, nominated by the Project Director. Grievances/concerns can be lodged directly to the DE, Highways, TNRSP or submitted to the NGO/agency appointed for implementation support, either in person or through post or through email.

E 11. Environmental Monitoring Plan

In order to ensure that the proposed mitigation measures have the intended results and comply with GoI and World Bank requirements, the ESMF prepared for TNRSP -II provides guidance on developing an environmental performance monitoring program. The monitoring program consists of performance indicators, reporting formats and necessary budgetary provisions. For each of the environmental condition indicators, the monitoring plan specifies the parameters to be monitored, the location of the monitoring sites, frequency, and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The implementation of ESMP and environmental monitoring plan will be closely monitored by by the Environmental

officer of the Construction Supervision Consultant (CSC), who will report on regular basis to TNRSP.

1 INTRODUCTION

The Government of Tamil Nadu (GoTN), has proposed to take up upgrading of about 574km length of roads with financial assistance from the World Bank. In line with the prioritization exercise, fourteen corridors have been selected in total, aggregating to about 574 km length under TNRSP- II, where there are no sensitive environmental and major social issues are involved. Out of fourteen, eleven corridors have been proposed to implement through EPC mode and remaining three corridors through PPP mode. For the EPC mode contract packages (for a length of 428 km) the safeguard documents are prepared and disclosed. For the PPP mode contract (for a length of 146 km), the safeguard documents are under preparation.

In addition, the Government of Tamil Nadu (GoTN), has now proposed to seek Additional Finance (AF) from the World Bank for improving seven road projects totaling about 109km under TNRSP II. The Additional Financing (AF) proposes to provide extra resources to two sub-components under the parent project (TNRSP-II) and support the introduction of four new sub-components, which includes improvement of road and logistic infrastructure and institutional capacity building. The AF's sub-components (i) Upgradation and maintenance through EPC contracts (Sub-component A1), (ii) Road Safety Improvements (C7) and (iii) Logistic Improvement (Sub-component D2) are major project components with likely potential environmental and social impacts. However, as part of sub-component A1 of Additional Financing, TNRSP has decided to implement the "7 roads in Package – 6 (Roads under additional financing)" with financial assistance from the World Bank.

Out of the seven road packages, the DPRs were prepared for four corridors during the year 2015 to 2016, which had to be updated to suit the current scenario in 2020. For other three corridors, DPRs had to be prepared afresh. Based on the project readiness, the roads are proposed to be implemented under two phases as depicted in the following Table.

Table 1: Road Corridors under TNRSP-II (Additional Financing)

Phasing of the Project	Project Roads	Description	Length (km)
Phase - 1	State Highways (SH) - 222	Omalur to Mecheri	14.600
	State Highways (SH) - 30	Malliyakarai to Attur	10.07
	State Highways (SH) - 15	Chithode to Erode	8.020
Phase - 2	State Highways (SH) - 116	Kanchipuram to Cheyyar[1]	17.170
	Major District Road (MDR) - 108	Erode to Chennimalai	24.000
	State Highways (SH) - 139	Ariyalur to Reddipalayam	12.300
	State Highways (SH) - 4	Arcot to Arani	24.600

Source: TNRSP

[1] Including the Vandavasi Bypass, connecting SH 116 to SH 05 (km 36/457 to km 39/829)

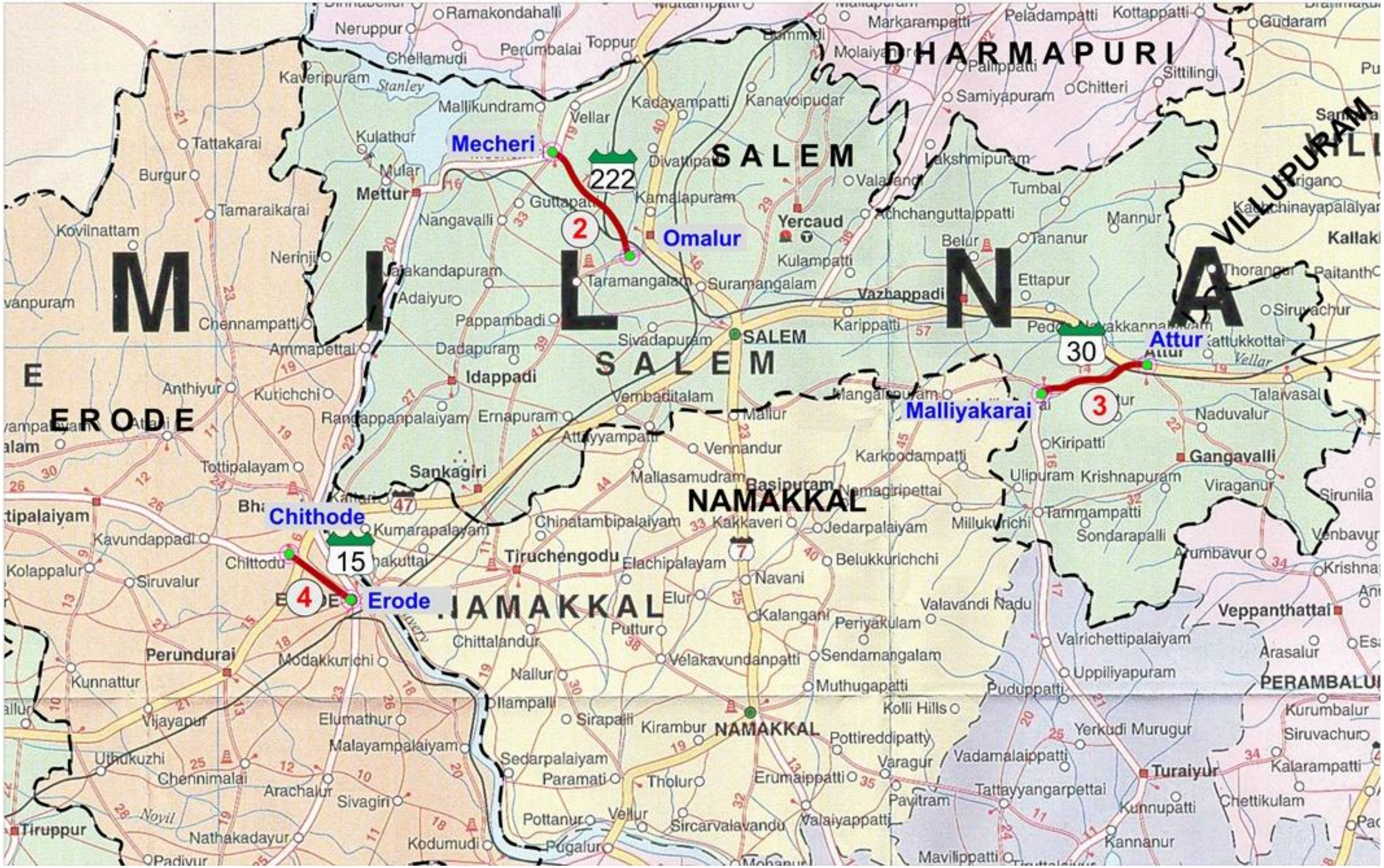


Figure 1: Location Map of Phase – 1 Corridors

The Environmental Category for the AF corridors is categorised as "A", this is due to the significant impacts anticipated with respect to the (i) the avenue trees due to the proposed widening (ii) requirement of construction materials including sand, gravel and water and (iii) loss of land, structures and livelihood. Hence, in accordance with World Bank's Operational Policy OP 4.01 (Environmental Assessment) and mandate, the preparation of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) is necessary. Similarly, in accordance with World Bank's Operational Policy OP 4.12 (Involuntary Resettlement), this project mandates the preparation of the Social Impact Assessment (SIA) and Resettlement Action Plan (RAP). The mentioned safeguard documents shall be prepared phase wise, this ESIA report is prepared for the Phase – 1 corridors.

1.1 Need for the Project

Under the Phase – 1 corridors, it is proposed to carry out widening and strengthening of (i) Omalur - Mecheri Road (SH 222), (ii) Malliyakarai to Attur (SH 30) and (iii) Chithode to Erode (SH 15). The importance of the project roads

- ***Omalur to Mecheri Road (SH 222)*** traverses through a number of rural villages (Omalur, Pacchanampatty, Tindamangalam, Thandavarayapuram, Paalikadai, Panjukallipatti, Chinthamaniyur, Olaipatti, Kamaneri, Chinasathapadi, Sathapadi, Pothiyampatty, Chandrama and Mecheri). The SH 222 connects State Highway 86 (at the start of the project stretch), one Major District Road (MDR), and many Other District Roads (ODR's), including village and street roads along its stretch and terminates at NH-544H. It also acts as one of the connecting roads for the traffic from Salem with Mettur, Hogenakkal & Dharmapuri with Tiruppur. The existing road is two-lane with paved shoulder which is proposed for strengthening and widening to four-lanes with paved shoulder. This road will connect Salem to Mettur, where most of the prominent industries are situated. Due to this, a large number of truck traffic is observed in the project region. Strengthening and widening of the project road will give traffic decongestion, better connectivity with reduced transit time, less fuel consumption and low level of vehicular emission. The economy will boost up due to good road network.
- ***Malliyakarai to Attur (SH 30)*** traverses through a number of rural villages (Malliakarai, Eachampatti, Chockkanathapuram, Thandavarayapuram, Kamraj Nagar and Narasingapuram). The SH 30 connects State Highway 79 at the start of the project stretch and crosses the project stretch at many villages and street roads as well. The project road also acts as one of the connecting roads for the traffic from Rasipuram, Thuraiyur, Tiruchirappalli to Salem, Attur and Kallakurichi. The existing road is two-lane with paved shoulder which is proposed for strengthening and widening to two-lanes with paved shoulder. Strengthening and widening will give traffic decongestion, better connectivity with reduced transit time, less fuel consumption and low level of vehicular emission. The economy will boost up due to good connectivity to Attur town.
- ***Chithode to Erode (SH15)*** passes through various villages having a significant population (such as Chithode, Kongapalayam, Mamaruthu Palayam,

Thannirpanthalpalayam, Periya Semur, and Veerappanchatram), many schools, industries, government offices, religious structures and hospitals are situated along the SH 15. It connects Major District Road (MDR- 62) as well as many village and street roads along its stretch. The project stretch also connects Erode with Gobichettipalayam, Sathyamangalam, Ooty and Karnataka (Interstate connectivity). The existing road is two lane with paved shoulder which is proposed for strengthening and widening for four lanes divided carriageway with paved shoulder. Strengthening and widening will give traffic decongestion, better connectivity with reduced transit time, less fuel consumption and low level of vehicular emission. The economy will boost up due to good connectivity to Erode City (District Head Quarter)

The improvement of the project road will play a key role in infrastructure development, commercial activities and agricultural marketing.

1.2 Purpose of the ESIA

The Phase – 1 corridors comprising of (i) Omalur - Mecheri Road (SH 222), (ii) Malliyakarai to Attur (SH 30) and Chithode to Erode (SH 15) have been assigned category "A"[2] in accordance with World Bank's Operational Policy OP 4.01 (Environmental Assessment) and mandate the preparation of project-specific Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP). Similarly, in accordance with World Bank's Operational Policy OP 4.12 (Involuntary Resettlement), this project mandates the preparation of the Social Impact Assessment (SIA) and Resettlement Action Plan (RAP). Accordingly, detailed assessment of the environmental and social impacts has been carried out following a suitable methodology.

This ESIA shall cover, the environmental and social impacts due to the Phase – 1 corridors, concerning construction-related environmental impacts, infringements with natural habitats and places of cultural heritage also in the context of 'chance-find' and impacts on local population/ community. The findings of ESIA will guide the effective development of the ESMP and facilitate the implementation of safeguard measures appropriately.

1.2.1 The approach followed for conducting ESIA study

The Phase – 1 corridors falls under the Salem and Erode Districts in the state of Tamil Nadu. To identify the environmental and social issues arising out of the current practices adopted for planning, design, construction, the environmental and social conditions along the Phase – 1 corridors were assessed. During the visits, consultations through group discussions with local communities, road users and panchayat/ village members were contacted to understand their perceptions and needs. A standard methodology was adopted for fulfilling the ESIA requirements; key features/tasks of the methodology are detailed as follows:

[2] The project categorisation is for the whole Additional Financing (AF) project roads

Task 1: Field Reconnaissance Survey and Review of Earlier Studies

The field reconnaissance surveys has been carried out along the Phase – 1 corridors to understand the salient environmental and social features that are likely to cause adverse impacts, sensitive environmental and social issues via-a-vis proposed project interventions. The salient feature includes

- The topography of the land, road geometry
- Environmental features like trees, any forest area, water bodies like ponds, rivers, etc.
- A social and physical feature like settlement pattern, its density, typology of buildings, especially the presence of religious buildings, land use, etc.

Experience of EIA, EMP, SIA, RAP study, as well as the implementation of EMP's, was also taken into account from earlier TNRSP projects.

Task 2: Review and Assessment of Applicable Environmental and Social Regulations

Various rules/regulations and guidelines applicable to the project road vis-à-vis center (GoI), state (GoTN) and World Bank statutory requirements were reviewed and referred to for assessing current environmental and social impacts that are likely to emanate.

Task 3: Delineation of Study Area for Assessment

In road projects, while the influence area may vary via-a-vis size of the road, location of the road, type of road, etc., hence, the study area was fixed based on the proposed interventions including the road sections undergoing widening and strengthening (Proposed Right of Way (PROW)), RoW availability, structural works (culverts and bridges), presence of sensitive areas, etc to assess the immediate impacts. In addition to this, the project influence area (10 km[3] buffer from the proposed RoW on either sides) for impact assessment is also considered in those areas that are directly or indirectly influenced by the project activities during construction or operation of the proposed road work such as Hot Mix plants, sand quarries, source of raw material and material transport, etc.

Task 4: Assessment of Baseline Environmental and Social Conditions

This task comprises of a collection of baseline data for the Phase – 1 corridors locations, primarily on physical, biological and socio-economic conditions. The secondary source[4] of information was utilised for giving a generic snapshot of socio environment features. In addition, existing environmental and social quality/features along the project roads were assessed based on a walk through surveys, public consultations, FGD's and discussions with line department officials.

[3] Study area is fixed as per the EIA manual for Highways guidelines published by the MoEF

[4] Secondary source of information for various socio-economic parameters were collected from government departments like Census of India, Department of Industries, Department of Economics and Statistics, Department of Agriculture, Directorate of Settlements and Land Records etc. This helped to understand the socio-economic profile of the project area with respect to indicators like population growth rate, literacy rate, work force participation rate (WFPR) etc. in comparison with the project districts and Tamil Nadu state

Task 5: Public Consultations/ Focus Group Discussions

To cover a wide range of stakeholders in the study area, corner meetings were conducted at selected places with women groups, men and road users to understand the people's perception about the project as well as their issues and concerns. Overall project features, social safeguards, issues related to women's safety and security, environmental safeguards, and enhancement measures would be implemented in the project was also discussed with the public.

Task 6: Prediction of Environmental and Social Impacts

The task identified likely impacts that would arise due to the construction of Phase – 1 corridors, through changes in the physical, biological or socio-economic environment. The assessment considered both positive and negative impacts at different stages of project implementation, i.e. pre-construction, construction and operation stages.

Task 7: Preparation of Environment and Social Management Plan (ESMP)

A comprehensive Environmental and Social Management Plan (ESMP) is prepared which included mitigation measures for all the negative impacts of Phase – 1 corridors and enhancement measures for positive impacts.

Task 8: Preparation of Resettlement Action Plan (RAP)

Based on the impacts a suitable RAP will be prepared to specify the procedures it will follow and the actions it will take to suitably resettle/compensate affected people and communities. The objective of the RAP is to assist the affected people in their efforts to improve their living standards or at least regain their living standards to their pre-displacement levels.

Task 9: Preparation of Environmental and Social Management Budget

Based on the impact assessment for the environmental and social components, a suitable budget has been estimated to compensate for the temporary and permanent impacts that are likely during the project implementation. As part of the project implementation monitoring, budgetary provision has been allotted for RAP implementation and environmental monitoring. The budget also includes compensatory afforestation measures for the loss of avenue trees due to road widening.

Task 10: Environmental Safeguard Clauses in the Bid Document

Suitable safeguard clauses have been prepared based on the ESIA, the prepared clauses shall form part of the bid document either in the General condition or Specific conditions of the contract agreement/ bid document. The prepared ESMP shall also be part of the bid document.

1.3 Structure of ESIA Report

ESIA report has been structured under various headings/subheadings and titles as depicted in the table below

Chapter 1- Introduction : Briefs the project rationale and the purpose of conducting the Environmental and Social Impact

		Assessment
Chapter 2- Project Description	:	Details the Additional Financing components in the TNRSP-II
Chapter 3- Phase – 1 Project Corridors		Gives a brief description of the project corridor and proposed design interventions including right of way, roadway improvements, cross drainage structures, community facilities, traffic projections etc.
Chapter 4- Legal Policy Framework	:	Presents the legal and administrative framework of World Bank, Government of India and Government of Tamil Nadu.
Chapter 5- Description of the Environment	:	Pronounces the existing environmental conditions along the Phase-1 Corridors ascertained by a reconnaissance survey along with collection of primary and the secondary information.
Chapter 6- Public Consultation	:	Discusses the Focus Group Discussions (FGD's), Public Consultation (with prior notice) and consultations had with women and its outcome.
Chapter 7-Analysis of Alternatives	:	Depicts the possible alternate options adopted in minimising the Environmental and Social Impacts for the project implementation
Chapter 8- Potential Environmental and Social Impacts and Mitigation Measures	:	Likely impacts caused on various environmental and social parameters by activities proposed for the project corridor were recorded for which suitable mitigation & enhancement measures were suggested
Chapter 9- Environmental and Social Management Plan	:	For the identified Environmental Impacts, suitable management/ mitigation measures are provided to minimise the impacts
Chapter 10- Implementation Arrangement for ESMP and RAP	:	Discusses the roles and responsibilities for various stakeholders in implementing the ESMP and the RAP
Chapter 11- Grievance Redressal Mechanism	:	Discusses the approach of the GRM in solving the social and environmental issues likely to be generated during the project implementation
Chapter 12- Environmental Monitoring plan	:	Depicts the various approaches in implementing the ESMP through various stages of monitoring
Chapter 13: ESMP Budget	:	A suitable budget provision has been estimated based on the prepared ESMP

2 PROJECT DESCRIPTION

The ongoing Second Tamil Nadu Road Sector project (TNRSP II) supports the GoTN's broader state highway development initiative, through three components: (A) Network Improvement; (B) Institutional Capacity Enhancement; and (C) Road Safety as described below.

Component A: Network Improvement (Total Cost: USD 746.45 million; IBRD Loan: USD 274.45 million):

- Upgradation and maintenance through EPC contracts (Sub-component A1): construction of civil works for widening and upgrading of approximately 430 km of roads of CRN;
- Upgradation and maintenance through PPP concessions (Sub-component A2): construction of civil works for widening and upgrading of approximately 145 km of roads of CRN; and
- Maintenance through Multi-year Performance-based Maintenance Contracts (Sub component A3): Maintenance of approximately 600 km of CRN for a 5-year period.

Component B: Institutional Capacity Enhancement (Total Cost: USD 11 million; IBRD Loan: USD 8.8 million): The project will support

a) policy level actions and commitments to improve both mobilization and allocation of resources in the road sector and
b) operational level initiatives to enhance enterprise-level efficiency through
   (i) process improvements;
   (ii) organizational restructuring;
   (iii) sustaining investments in IT infrastructure; and
   (iv) Training & Knowledge Management.

Component C: Road Safety (Total Cost: USD 20 million; IBRD Loan: USD 16 million): The project will support achievement of improved road safety, at two levels. First, at the state level, GoTN's capacity to achieve better road safety will be enhanced through a combination of strategic (development of a comprehensive road safety strategy, delineating the roles, responsibilities, investments and other initiatives of various stakeholder departments involved in the road safety agenda) and operational interventions (support implementation of the road safety strategy including through assistance in planning, investments and monitoring and evaluation). Second, at the field level i.e. in two districts and a corridor, the project will support designing and implementation of road safety improvement initiatives, to demonstrate how multiple stakeholder departments could achieve better outcomes through coordinated efforts and investments.

2.1 Additional Financing

The proposed components under Additional Financing (AF) will scale-up activities to enhance the impacts of TNRSP II. The Additional Financing will provide extra resources to two sub-components under the parent project and support the introduction of four new sub-components.

Under Component A: Network Improvement

- Sub-component A1: Upgradation and maintenance through EPC contracts. The AF will finance the upgrading of seven additional road sections with an approximate total length of 108 km.
- Sub-component A4: Supervision during construction. The AF will support consultancy services contracts for the Authority Engineers to supervise the seven EPC civil works contract, RAP implementation agencies; third-party audit consultancy that will monitor the seven civil works contracts and the achievement of payment milestones, and a RAP monitoring consultancy.
- Sub-component A5: Maintenance of project roads (EPC) for 5 years. The GoTN will fund the maintenance of the seven roads constructed under sub-component A1 through EPC contracts for a period of 5 years.
- Sub-component A8: Other costs. The GoTN will finance land acquisition, resettlement and rehabilitation, and the relocation of utilities for the seven upgraded roads.

Under Component C: Road Safety

- Sub-component C6: Road Safety Institutions. The establishment and strengthening of road safety management institutions and funding arrangements in the state will be supported under this new sub-component.
- Sub-component C7: Road Safety Improvements. The new sub-component will support prioritized road safety improvements that include: (i) civil works for localized road realignment, junction improvement, and the provision of road safety features such as paved shoulders, footpaths, bus bays and parking areas; (ii) installation of signs, road markings and crash barriers; (iii) road safety enforcement measures and equipment; (iv) accident response and trauma care; (v) data collection and analysis; and (vi) training for staff and capacity building of institutions involved in road safety.

Under Component D: Transport and Logistics Services - new component

- Sub-component D1: Institutional support for transport and logistics services. This sub-component will support: (i) development and adoption of a Logistics Strategy; (ii) establishment of institutional arrangements to coordinate transport and logistics services; and (iii) preparation of a Logistics Master Plan and associated State-Level Action Plan.
- Sub-component D2: Infrastructure improvements to remove logistics choke-points on a pilot corridor. This sub-component will support: (i) localized civil works to improve accessibility or traffic flow; (ii) preparation of reforms to logistics administration procedures; and (iii) civil works, goods, and services required to implement reform of logistics procedures.

3 PHASE – 1 PROJECT CORRIDORS

3.1 Omalur - Mecheri Road SH 222

The project road starts from the existing km 0/000 on SH 222 (Junction with SH-86) in Omalur and ends at the existing km 14/600 in Mecheri, project length is 14/600 km. The coordinates of the project stretch are from 11°44'16.50"N latitude and 78° 2'7.43"E longitude to 11°49'50.56"N latitude and 77°56'47.97"E longitude. It passes through various villages such as Omalur, Pacchanampatty, Tindamangalam, Thandavarayapuram, Paalikadai, Panjukallipatti, Chinthamaniyur, Olaipatti, Kamaneri, Chinasathapadi, Sathapadi, Pothiyampatty, Chandrama and Mecheri in Salem district.

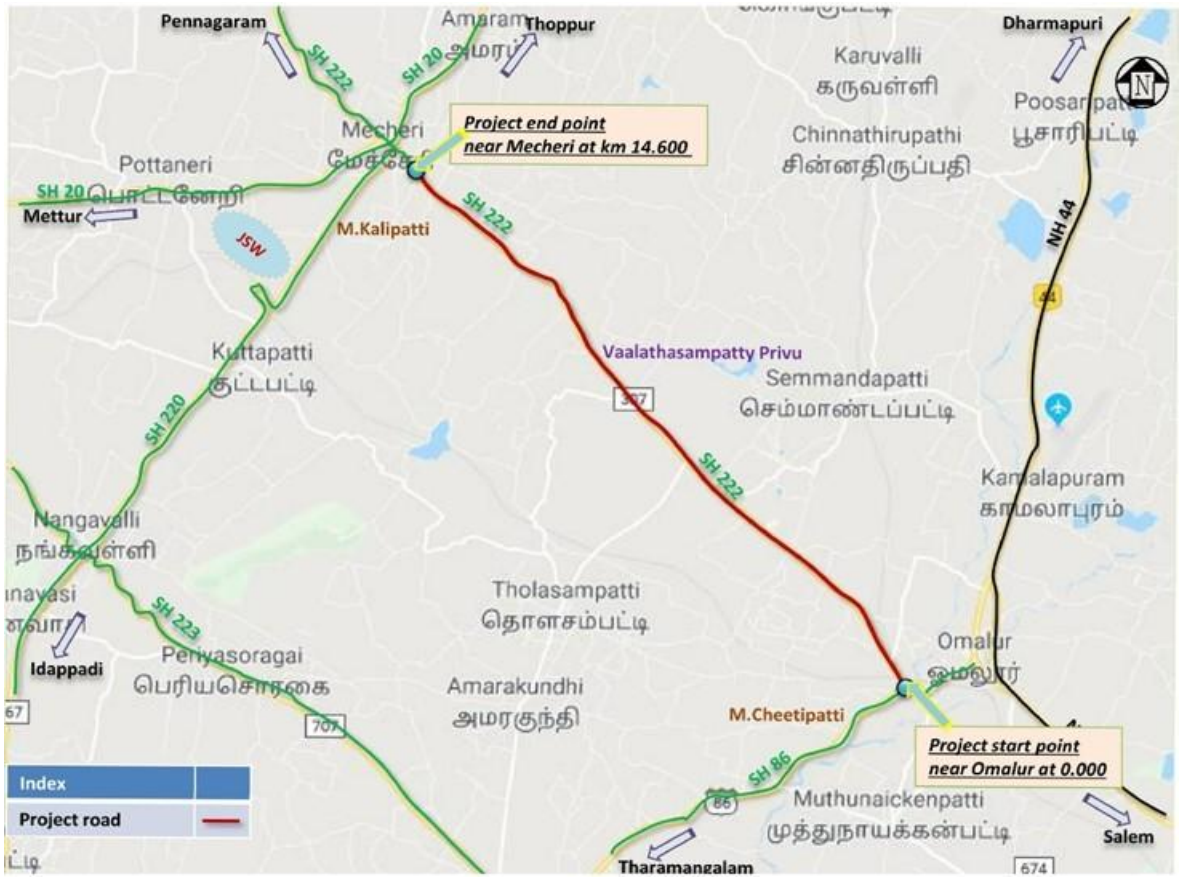
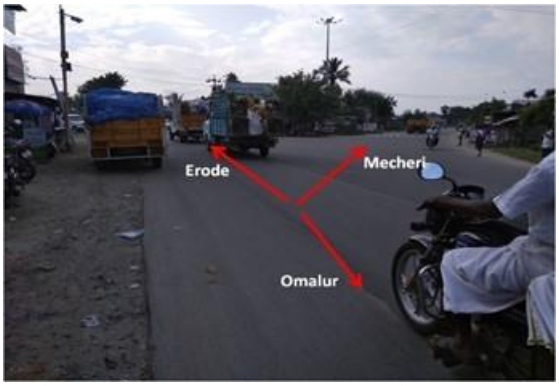


Figure 2: Location Map of Omalur to Mecheri Road (SH 222)



The start point of SH 222 (km 0/000)

The endpoint of SH 222 (km 14/600)

Project road forms a important link between Omalur to Mecheri, it connects NH-44 and SH 86 with SH-20, MDR-347 and MDR 767. It also provide connectivity for Mettur dam, Mettur thermal power plant and other industries in and around Mettur.

Salient Features of the SH 222

(i) **Right of Way**: Boundary stones for demarcating the ROW are available along the project road. The available RoW along the project road varies from 17 – 38m and at built-up locations it is varying from 17 - 30m. The existing RoW (ERoW) available for the Omalur – Mecheri road is depicted in the following table.

Table 2: Existing RoW along the Omalur – Mecheri Road

S. No	Existing km		ERoW (m)	S. No	Existing km		ERoW (m)
	From	To			From	To	
1	0/0	0/2	25.3	38	7/4	7/6	21
2	0/2	0/4	19 to 23	39	7/6	7/8	26 to 32
3	0/4	0/6	20	40	7/8	8/0	17 to 21
4	0/6	0/8	20	41	8/0	8/2	23 to 27
5	0/8	1/0	21 to 26	42	8/2	8/4	25 to 29
6	1/0	1/2	21 to 26	43	8/4	8/6	24 to 26
7	1/2	1/4	23	44	8/6	8/8	26
8	1/4	1/6	22 to 24	45	8/8	9/0	23
9	1/6	1/8	25 to 38	46	9/0	9/2	20 to 22
10	1/8	2/0	21 to 25	47	9/2	9/4	20 to 25
11	2/0	2/2	29 to 32	48	9/4	9/6	21 to 25
12	2/2	2/4	34	49	9/6	9/8	20 to 23
13	2/4	2/6	22 to 29	50	9/8	10/0	21 to 24
14	2/6	2/8	22 to 24	51	10/0	10/2	24 to 33
15	2/8	3/0	18	52	10/2	10/4	23
16	3/0	3/2	28	53	10/4	10/6	18 to 20
17	3/2	3/4	28 to 31	54	10/6	10/8	19
18	3/4	3/6	22 to 27	55	10/8	11/0	23 to 27
19	3/6	3/8	34	56	11/0	11/2	26 to 30
20	3/8	4/0	20 to 37	57	11/2	11/4	22 to 24
21	4/0	4/2	30 to 34	58	11/4	11/6	15 to 17
22	4/2	4/4	24 to 31	59	11/6	11/8	20
23	4/4	4/6	23 to 32	60	11/8	12/0	14 to 19
24	4/6	4/8	17 to 20	61	12/0	12/2	14 to 16
25	4/8	5/0	17 to 21	62	12/2	12/4	19
26	5/0	5/2	23	63	12/4	12/6	19 to 21
27	5/2	5/4	23.8	64	12/6	12/8	17 to 19
28	5/4	5/6	21	65	12/8	13/0	20
29	5/6	5/8	21	66	13/0	13/2	20
30	5/8	6/0	25 to 35	67	13/2	13/4	18 to 21
31	6/0	6/2	25 to 29	68	13/4	13/6	22
32	6/2	6/4	20	69	13/6	13/8	19 to 21
33	6/4	6/6	28 to 32	70	13/8	14/0	21 to 24
34	6/6	6/8	28 to 33	71	14/0	14/2	19
35	6/8	7/0	28 to 30	72	14/2	14/4	17
36	7/0	7/2	31 to 34	73	14/4	14/6	15
37	7/2	7/4	22 to 27				

Source: DPR, 2020

It is observed that existing RoW is insufficient to improve the existing 2 lane road to 4 lane divided road. Permanent structures such as Buildings (Residential & Commercial), Sensitive locations, Utilities etc. were observed at the end of EROW in few locations. Particularly at built up locations care should be taken to avoid the major acquisition of Permanent structures

(ii) **Carriageway Width**: Existing carriageway of Omalur – Mecheri Road (SH 222) is of bituminous surface with configuration of two lane with earthen shoulders on either side. The width of main carriageway width is 7m in entire project stretch, expect km 3/450 to km 4/150 (Panjukalipatti), km 7/650 to km 7.940 (Kamaneri) and km 12.210 to km 12.400 (Chandramakadai) the carriageway width is 14m. Earthen shoulder of width ranging from 0.5 to 1.5m exists on both sides for the majority stretch of the project road. Existing carriageway is two lane except at few locations. Existing road configuration crosses its maximum capacity as per IRC Guidelines, which leads to reduction in speed and accidents.

(iii) **Existing Alignment**: Majority of Existing road is 2 lane carriageway with ERoW varying from 17 to 38m. A total of about 22 horizontal curves are present, among these, some curves are observed to have insufficient sight distance and poor geometry. At some locations, it was observed that camber and Super elevation is insufficient. Vertical profile of existing road is poor with respect to IRC design standards. In few locations, longitudinal gradient of existing road is more than 3.3% i.e. varies from 3.3 to 5%. At following locations, it was observed that sight distances were insufficient. The existing traffic warrants for 4-Laning but at present, the existing carriageway is 2 lane wide. There are many cross roads which connects to the project road. There are no traffic calming measures observed along the road. Due to two lane road, there is no channelization of traffic which leads to accidents.

(iv) **Traffic Scenario**: The vehicle-wise average daily traffic (ADT) figures were estimated by classified count survey. The table presents a summary of the vehicle-wise AADT (base year 2019) on the project road, for each homogenous section.

Table 3: AADT along Homogeneous Segments of the Project Road

Mode of vehicle		Existing km 6/600
Tollable vehicles	Car	2707
	Mini Bus	36
	School. Bus	98
	Govt. Bus	294
	Pvt. Bus	235
	LMV	737
	LCV	37
	2 Axle	305
	3 Axle	144
	MAV (4 to 6 Axles)	127
	MAV (> 6 Axles)	0
	Total tollable vehicles	**4720**
	Total tollable PCUs	**7353**
Non-Tollable vehicles	2 Wheeler	11801
	3 wheeler/Auto	114
	Agricultural tractor	22

Mode of vehicle		Existing km 6/600
	Tractor with trailer	5
	Cycle	34
	Cycle rickshaw	0
	Animal Drawn	0
	Toll exempted fast vehicles	34
	Total non tollable vehicles	**12,010**
	Total non tollable PCUs	**6,150**
Total	**Vehicles**	**16,730**
	PCUs	**13,503**

Source: DPR, 2020

A seven day traffic Volume count survey was conducted at km 6/600, the traffic currently plying on the project road is 13503 PCU's. Thus, as per IRC: SP-73-2018, the capacity of 2-Lane road with paved shoulder is 10000 PCU. Hence, current traffic warrants improving the existing 2 lane to 4 lane divided carriageway.

(v) **Accident scenario:** MoRT&H has identified two black spot locations by using accident records of past 3 years (from 2016 to 2018) along this corridor and the details of the same are collected. The summary of the identified MoRT&H blackspot locations on the project road are presented in table below

Sl. No	Name of the location/place	Blackspot location chainage (km)	Number of accidents	Fatality
1	Tholasampatty Pirivu	km 1/200	7	1
2	Anjavathu Mile Jn. road	km 6/200	11	3
3	Kamaneri Jn. road	km 7/100	7	3
4	SenkatturPrivu Jn. road	km 11/400	7	2
5	ChandramaKadai Jn. road	km 12/400	6	2

Past 3 years (from 2017 to 2019) accident records were collected from Superintendent of police office, Salem district for entire project stretch. Most of the accident spots are at Junction locations. Proper signboards such as junction warning, LED Blinkers, Road studs, Hazard markers and Medium mast lighting is provided at all junctions. Thus, detailed road furniture plan is attached in Volume-VI showing signage plan and road safety measures proposed for the project road in order to reduce the accidents.

(vi) **Landuse pattern**: The land use pattern along the project road are built-up (55.1%), agricultural (39.7%) and barren land (5.1%), the predominant land use pattern is built-up. There is ribbon development along the road with small settlements at frequent intervals (Omalur (km 0/350), Paalikadai (km 3/350), Panjukalipatti (km 4/000), Chinthamaniyur aprivu (km 4/800), Tharamangalam (km 6/220), Chinnasattappadi (km 8/500), Sathapadi (km 9/000) and Mecheri (km 14/000)), for which suitable road safety measures are included in the project design.

Table 4: List Towns/Villages along the section

Sl. No	Existing km		Length, km	Name of Village
	From	To		
1	0/000	1/000	1.0	Omalur
2	1/000	2/000	1.0	Pacchanampatty

Sl. No	Existing km		Length, km	Name of Village
	From	To		
3	2/000	2/800	0.8	Tindamangalam
4	2/800	4/000	1.2	Paalikadai
5	4/000	4/800	0.8	Panjukallipatti
6	4/800	6/000	1.2	Chinthamaniyur
7	6/000	7/200	1.2	Olaipatti
8	7/200	8/000	0.8	Kamaneri
9	8/000	9/000	1.0	Chinasathapadi
10	9/000	10/200	1.2	Sathapadi
11	11/000	12/000	1.0	Pothiyampatty
12	12/000	13/000	1.0	Chandrama
13	13/000	14/600	1.6	Mecheri

Source: DPR, 2020

(vii) **Existing Drainage system**: Earthen drain is present along the entire stretch with isolated stretches having RCC drain. Most of the built up stretches are observed without RCC Drain except in Panjukalipatti Village. Provision of RCC drain at built up locations is required to drain off storm water. Due to inadequate camber, water may stagnate on the pavement surface.

(viii) **Condition of Pavement and Shoulder**: The existing pavement is flexible, the general condition of the pavement varies between good to very poor. Around 56% of the pavement was observed to be in good condition. However, in some sections, the pavement is observed with alligator cracking, longitudinal cracking, edge drop & patching along the carriageway. Paved shoulder observed on either side at few built-up sections and earthen shoulders are observed throughout on either side, the width of earthen shoulder varies from 0.5m to 1m.

Alligator cracks at km 2/000

Edge drop at km 2/600

(ix) **Intersections**: There are one major three-legged intersections with MDR at km 6/225 and 28 minor intersections along the project road, out of which three are four-legged Intersections and rest are three-legged.

Table 5: List of Major and Minor Intersections along the Project Road

Sl. No	Existing km	Type of Junction	Category of Road	Leads To	
				LHS	RHS
1	6/225	T	MDR	Tholasampatty	-
2	1/660	Y	VR		Thimirikottai
3	1/900	T	VR	-	Kamandapatty

Sl. No	Existing km	Type of Junction	Category of Road	Leads To	
				LHS	RHS
					Branch
4	2/640	+	VR/ODR	Tindamangalam	Karupanampatti
5	3/015	T	VR	Village	
6	3/300	Y	VR	-	Yerikadu Road
7	3/430	T	ODR	-	Karupanampatti
8	3/550	+	ODR	Tindamangalam	Semmandapatti
9	4/060	T	VR		Panjukalipatti Road
10	4/580	Y	VR	Kattaperiyampatti	-
11	4/965	T	ODR	-	Chinthamaniyur
12	5/345	T	VR	-	Chinthamaniyur
13	6/980	T	VR	Vaalathasampatty	-
14	7/810	T	ODR	-	ChinnaTirupathi
15	7/960	T	ODR	Ramakrishnanur	-
16	8/550	T	VR	-	Thalampoo Colony
17	8/830	T	VR	-	Athimarathur
18	9/130	T	ODR	Sathampaddy	-
19	10/000	Y	VR	Periyasattappadi	-
20	10/470	T	VR	-	Mamarthur Piravu
21	11/230	T	ODR	SenkaturPiruve	-
22	11/260	T	VR	-	Parakkallur
23	11/875	T	VR	-	Reddiyur
24	11/970	T	VR	-	Pothiyam Patti
25	12/300	T	ODR	-	Pukkampatty
26	12/565	T	VR	Koppampatti	
27	12/965	T	VR	Soonakavundan	-
28	13/465	+	ODR	Koppamputhur	Amaram Kamchiammankoil
29	13/920	T	VR	Soonakavandur valaivu	

Source: DPR, 2020

Major Intersection (SH-86) at km 0/000

Minor Intersection at km 0/550

(x) **Bridges and Cross Drainage Structures**: 1 Railway Level crossing (km 0/250) and 23 Culverts along the project stretch. There are no major or minor bridges in the project road. Details of condition and capacity of existing culverts (Omalur to Mecheri Road) is given in the following table.

Sl. No.	Existing km (SH-222)	Type of Culvert	Span Arrangement No. of Vents x Span x Vent height (m)	Existing width of Culvert (m)	Overall Condition of Culvert	Approximate Capacity of Existing CD Structure (Cumecs)	Remarks
1	1/615	Stone Slab Culvert	1x0.80x0.55	12.27	Fair	0.660	Stone slab culvert are reconstructed with Box culvert
2	1/999	Pipe Culvert	1x0.90	10.00	Fair	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
3	2/058	Stone Slab Culvert	2x0.80x0.55	12.40	Fair	1.320	Stone slab culvert are reconstructed with Box culvert
4	3/258	RCC Slab Culvert	3x1.50x2.10	8.20	Fair	14.175	RCC slab culvert with SSM Substructure is reconstructed with Box culvert
5	3/697	Box Culvert	1x1.90x1.30	17.50	Good	5.32	Culvert is widened since it is in good condition and hydrologically adequate
6	3/922	Box Culvert	LHS-1x1.00x1.40 RHS-1x0.75x1.40	19.00	Good	2.100	Culvert is Reconstructed since it is hydrologically inadequate
7	4/359	Pipe Culvert	1x0.90	10.00	Fair	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
8	5/117	Pipe Culvert	1x0.90	12.30	Fair	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
9	5/897	Stone Slab Culvert	1x0.90x1.60	11.20	Fair	2.160	Stone slab culvert are reconstructed with Box culvert
10	6/519	Stone Slab Culvert	2x1.00x1.60	8.40	Fair	4.800	Stone slab culvert are reconstructed with Box culvert
11	6/597	Stone Slab Culvert	1x0.90x0.50	11.10	Fair	0.675	Stone slab culvert are reconstructed with Box culvert
12	6/908	Stone Slab Culvert	1x0.90x0.80	11.20	Fair	1.080	Stone slab culvert are reconstructed with Box culvert
13	7/265	Pipe Culvert	3x0.90	10.10	Fair	2.861	As instructed by TNRSP officials, All Pipe culverts are reconstructed

Sl. No.	Existing km (SH-222)	Type of Culvert	Span Arrangement No. of Vents x Span x Vent height (m)	Existing width of Culvert (m)	Overall Condition of Culvert	Approximate Capacity of Existing CD Structure (Cumecs)	Remarks
							with Box culvert
14	7/886	Box Culvert	1x2.00x0.70	17.60	Good	2.100	Culvert is Reconstructed since it is hydrologically inadequate
15	8/700	Stone Slab Culvert	1x1.10x0.45	11.60	Fair	0.743	Stone slab culvert are reconstructed with Box culvert
16	9/233	Stone Slab Culvert	1x0.65x0.55	11.00	Fair	0.536	Stone slab culvert are reconstructed with Box culvert
17	9/783	Pipe Culvert	1x0.90	12.90	Fair	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
18	10/210	Pipe Culvert	2x0.90	12.70	Fair	1.908	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
19	10/353	Stone Slab Culvert	1x0.90x1.10	11.20	Fair	1.485	Stone slab culvert are reconstructed with Box culvert
20	11/016	Stone Slab Culvert	2x1.00x0.80	8.13	Fair	2.400	Stone slab culvert are reconstructed with Box culvert
21	11/996	Pipe Culvert	3x0.90	12.50	Fair	2.861	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
22	12/608	Pipe Culvert	1x0.90	12.60	Fair	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
23	13/122	Pipe Culvert	3x0.90	12.62	Fair	2.861	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert

Source: DPR 2020

Railway Level crossing at Km 0/250

Pipe Culvert at Km 1/990

Box Culvert at Km 3/700

Cut Stone Slab Culvert at Km 6/900

(xi) **Utilities**: There are 13 transformers, 5 HTL crossings, 7 OHT, 2 water tank observed along the project road.

Pylon HT line Crossing at km 9/050

Overhead tank on RHS at km 14/140

(xii) **Sensitive Locations**: There are 3 schools, 1 college, 3 hospitals, 9 temples and a graveyard observed in the project road.

Hospital on LHS at km 3/810

Temple on LHS at km 6/200

Sl. No	Existing km	Religious Place	Side
1	0/390	Temple	LHS
2	0/510	Temple	LHS
3	0/840	Temple	LHS
4	1/100	Temple	LHS
5	1/460	Temple	LHS
6	3/350	Temple	RHS
7	3/440	School	RHS
8	3/810	School	RHS
9	4/620	School	LHS
10	6/200	Temple	RHS
11	8/450	Temple	LHS
12	9/000	College	RHS
13	14/600	Temple	LHS

Source: DPR, 2020

3.2 Malliyakarai – Attur SH 30

The road starts from the existing km 81/054 on SH 30 (Junction with SH 79) in Malliyakarai. Since the junction of the project road with SH 79 is recently improved up to km. 81/150 on SH 30, thus the start point of the project is considered as km 81/150. The project road length is 10.1km. The coordinates of the project stretch are from 11°34'15.40"N latitude and 78°29'58.39"E longitudes to 11°36'4.70"N latitude and 78°34'56.42"E longitude. SH 30 passes through Malliakarai, Eachampatti, Chockkanathapuram, Thandavarayapuram, Kamraj Nagar and Narasingapuram villages in Salem district.About 21 horizontal curves are present along the alignment, among these, some curves are observed to have insufficient sight distance and poor geometry. Project road is a missing section of Attur – Malliyakarai - Rasipuram – Trichengode – Erode road. This will connect NH 79, NH 44 and NH 544 (near Erode) and many State Highways and MDR's. Section from Malliyakarai – Erode is developed as two lane with paved shoulder under EPC-06.

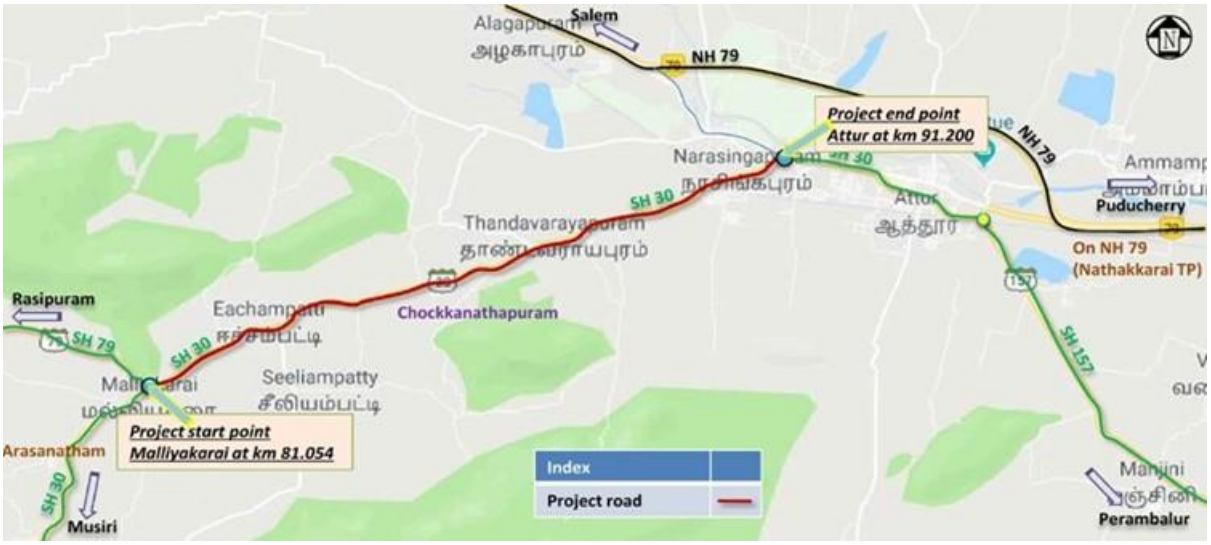


Figure 3: Location Map of Malliyakarai – Attur (SH 30)

The start point of SH 30 (km 81/054)

The endpoint of SH 30 (km 91/200)

Salient Features of the SH 30

(i) **Right of Way**: Boundary stones for demarcating the ROW are available along the project road. The available RoW varies between 11m to 43m. The existing RoW (ERoW) available for the Malliyakarai – Attur road is depicted in the following table

Table 6: Existing RoW along theMalliyakarai - Attur Road

Sl. No	Existing km		EROW in m
	From	To	
1	81/000	81/800	27
2	81/800	82/000	29
3	82/000	82/400	27
4	82/400	82/600	26
5	82/600	83/000	19
6	83/000	83/200	17
7	83/200	83/400	19
8	83/400	83/600	20
9	83/600	83/800	19
10	83/800	84/000	26
11	84/000	84/400	19
12	84/400	84/600	17
13	84/600	84/800	16
14	84/800	85/400	18
15	85/400	85/600	20
16	85/600	85/800	19
17	85/800	86/200	21
18	86/200	86/400	23
19	86/400	86/600	19
20	86/600	86/800	20

Sl. No	Existing km		EROW in m
	From	To	
21	86/800	87/000	21
22	87/000	87/200	20
23	87/200	87/400	19
24	87/400	87/800	18
25	87/800	88/200	13
26	88/200	88/400	19
27	88/400	88/600	17
28	88/600	88/800	19
29	88/800	89/000	23
30	89/000	89/200	22
31	89/200	89/400	21
32	89/400	89/600	25
33	89/600	89/800	23
34	89/800	90/000	20
35	90/000	90/200	18
36	90/200	90/400	21
37	90/400	90/600	20
38	90/600	90/800	21
39	90/800	91/000	17
40	91/000	91/200	21

Source: DPR, 2020

(ii) **Carriageway Width:** The project road (SH-30) has 2 lane configuration without paved shoulder and varied width near junctions and built-up. The existing type of pavement is flexible throughout. Existing carriageway details are shown in the following table.

Sl. No	Existing km		Length, km	Carriageway Width, m
	From	To		
1	81/054	81/090	0.04	8.5+0.5+8.5
2	81/090	87/400	6.31	7.0
3	87/400	88/000	0.60	6.0
4	88/000	91/200	3.20	7.0

Source: DPR, 2020

(iii) **Traffic Scenario:** The vehicle-wise average daily traffic (ADT) figures were estimated by classified count survey. The table shows the Vehicle class wise AADT at count location along the project road.

Table 7: Annual Average Daily Traffic for SH 30

Sl.no	Mode of Vehicle	km 84.700 (SH 30)
		Chockkanathapuram
1.	Car / Jeep / Van	1548
2.	Mini Bus	42
3.	School Bus	61
4.	Govt. bus	159
5.	Pvt. Bus	156
6.	Multi axle bus	2
7.	LMV	411
8.	LCV (4 Wheels)	41
9.	LCV (6 Wheels)	53
10.	2 Axle	339
11.	3 Axle	216
12.	MAV (4 - 6 Axles)	147
13.	MAV (7++ Axles)	0
14.	2 Wheeler	3783
15.	3 wheeler/Auto	37
16.	Tractor	7
17.	Tractor with trailer	11
18.	Cycle	19
19.	Cycle rickshaw	0
20.	Animal drawn	0
21.	Toll exempted Vehicles	5
Motorised Vehicles		**7018**
Non-Motorised Vehicles		**19**
Total Vehicles		**7037**
Total PCU		**7629**

Source: DPR, 2020

(iv) **Accident Scenario:** As per MoRT&H data, there is no blackspot location along this corridor. However, the Highways Department Govt. of Tamil Nadu has identified two blackspot/Vulnerable locations (ex.km 88/2 at Thandavarayapuram and ex.km 83/6 at Eachampatti). Thus, detailed road furniture plan is attached in Volume-VI showing signage plan and road safety measures proposed for the project road in order to reduce the conflict.

(v) **Landuse pattern:** The land use patterns along the project road SH 30 are agricultural (58.0%) and built-up (42.0%), the predominant land use pattern is agricultural. There is ribbon development along the road with small settlements at frequent intervals

(Malliakarai (km 81/500), Eachampatti (83/160), Thandavarayapuram (km 87/340), Narasingapuram (km 91/100)), for which suitable road safety measures are included in the design.

Table 8: List Towns/Villages along the section

Sl. No	Existing km		Length, km	Name of Village
	From	To		
1	81/000	82/000	1.0	Malliakarai
2	82/000	83/400	1.4	Eachampatti
3	83/400	86/000	2.6	Chockkanathapuram
4	86/800	88/400	1.6	Thandavarayapuram
5	88/400	88/800	0.4	Kamraj Nagar
6	88/800	91/200	2.4	Narasingapuram

Source: DPR, 2020

(vi) **Existing Drainage system**: Earthen drain is present along the entire stretch with isolated stretches provided with RCC drain

(vii) **Condition of Pavement and Shoulder:** The pavement is flexible, the general condition of the pavement varies between good to very poor. Around 36.92% of the pavement was observed to be in good condition. However, in some sections, the pavement is observed with alligator cracking, rutting, potholes, patching and bleeding along the carriageway. Earthen shoulders are observed on either side, the width of the earthen shoulder is 1m. Based on the existing crust composition and the engineering studies, the use of existing pavement materials will be finalised.

Alligator cracks at km 82/600

Potholes at km 86/550

(viii) **Intersections:** There are two major intersections for the project road one at SH-79 at the start of the project & another at SH-30 at the end of the project. Apart from this, there are 15 minor intersections (Other District/Village Roads) & 39 Local/Street roads along the project stretch, out of which 4 (four) four legged Intersections and rest are three legged Intersections. The intersections are given in the following table.

Table 9: List of Junctions along SH 30

Sl. No	Existing km	Type of Junction	Category of Road	Leads To		Type of Road
				LHS	RHS	
Major Junction						
1	81/125	Y	SH-79	Erode	-	BT

Sl. No	Existing km	Type of Junction	Category of Road	Leads To		Type of Road
				LHS	RHS	
2	91/200	T	SH-30	Salem	Chennai	BT
Minor Junction						
1	82/760	Y	VR	Thalavapatty	-	BT
2	83/150	+	VR	Street	Keeripatty	CC/BT
3	84/290	T	VR	Kotambadi	-	BT
4	84/652	Y	ODR	-	Seeliampatty	BT
5	85/500	T	VR	Chockkanathapuram	-	BT
6	85/700	T	VR	-	Mottur	CC
7	85/765	T	VR	Village	-	BT
8	86/655	Y	VR	-	Echampatty	BT
9	87/390	Y	VR	Chockkanathapuram	-	BT
10	87/520	T	VR	-	Village	BT
11	88/120	Y	ODR	-	Kirapatti	BT
12	88/180	T	VR	Thandavarayapuram	-	BT
13	88/670	Staggered (+)	VR	Street (VOC Nagar)	Narasingapuram	BT
14	89/309	T	VR	-	Village Road	BT
15	90/490	Y	VR	-	Village Road	CC

Source: DPR, 2020

Major Intersection (SH 79) at km 0/000

Minor Intersection at km 87/390

(ix) **Utilities:** There are 22 transformers, 1 HTL crossings, 1 substation and 13 water tanks observed along the project road

Sl. No	Existing km	Description	Side
1	82/880	Transformer	LHS
2	82/920	Transformer	LHS
3	83/690	Transformer	LHS
4	84/840	Transformer	LHS
5	84/910	Transformer	LHS
6	86/700	High Tension Line	Crossing
7	87/550	Syntex Tank	LHS
8	89/180	Sub Station	RHS
9	89/450	Transformer	LHS

Source: DPR, 2020

Pylon HT line Crossing at km 86/700

Substation RHS at km 89/180

(x) **Bridges and Cross Drainage Structures:** There are 2 Minor bridges at km 82/442 and km 86/379, 1 Causeway, 1 Railway level crossing (km 89/530) and 11 Culverts along the project stretch. Details of condition and capacity of existing structures (Malliyakarai to Attur Road) is given in the following table

Sl. No.	Existing km (SH-30)	Type of Structure	Span Arrangement No. of Vents x Span x Vent height (m)	Existing width of Structure (m)	Overall Condition of Structure	Approximate Capacity of Existing CD Structure (Cumecs)	Remarks
1	81/876	Pipe Culvert	1x0.90	10.50	Fair	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
2	82/442	Minor Bridge	1x7.35x0.75	8.55	Fair	9.702	Structure is reconstructed since it is hydrologically inadequate
3	82/522	Pipe Culvert	1x0.90	10.10	Fair	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
4	84/641	Slab Culvert	1x3.35x1.20	8.10(SQ) 9.90(SK)	Fair	6.030	RCC slab culvert with SSM Substructure is reconstructed with Box culvert
5	86/379	Minor Bridge	4x9.10x3.40	13.60(SK) 11.90(SQ)	Fair	211.045	Structure is widened since it is in fair

Sl. No.	Existing km (SH-30)	Type of Structure	Span Arrangement No. of Vents x Span x Vent height (m)	Existing width of Structure (m)	Overall Condition of Structure	Approximate Capacity of Existing CD Structure (Cumecs)	Remarks
							condition
6	86/670	Pipe Culvert	2x0.90	12.40	Good	1.908	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
7	87/565	Slab Culvert	1x1.60x0.75	8.20	Poor	1.800	RCC slab culvert is in poor condition and with SSM Substructure is reconstructed with Box culvert
8	87/661	Pipe Culvert	2x0.75	8.50	Fair	1.325	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
9	88/040	Slab Culvert	2x0.90x0.70	8.40	Poor	7.673	RCC slab culvert is in poor condition So,it is reconstructed with Box culvert
10	88/653	Pipe Culvert	1x0.90	9.95	Fair	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
11	89/530	Causeway	9x0.75	10.30	Fair	7.392	Structure is reconstructed since it is hydrologically inadequate
12	89/752	Slab Culvert	1x3.00x1.55	12.15	Fair	6.975	-
13	89/920	Slab Culvert	1x1.00x1.00	12.25	Fair	1.500	Structure is reconstructed since it is

Sl. No.	Existing km (SH-30)	Type of Structure	Span Arrangement No. of Vents x Span x Vent height (m)	Existing width of Structure (m)	Overall Condition of Structure	Approximate Capacity of Existing CD Structure (Cumecs)	Remarks
							hydrologically inadequate
14	90/481	Pipe Culvert	3x0.90	9.95	Fair	2.861	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert

Source: DPR 2020

Minor Bridge at km 82/447

Minor Bridge at km 86/430

Railway Level crossing at km 90/320

Causeway at km 89/525

(xi) **Sensitive Locations:** There are 2 schools, 2 hospitals, 5 temples and a Church which was observed in the project road.

Sl. No	Existing km	Religious Place	Side
1	82/950	Temple	LHS
2	87/390	Temple	RHS
3	88/060	Church	RHS
4	89/990	Temple	LHS
5	91/020	Temple	LHS
6	91/180	Temple	LHS

Source: DPR, 2020

Church on RHS at km 88/060

School on RHS at km 82/950

3.3 Chithode to Erode SH 15

The project road starts from the existing km 153/500 on SH 15 (Bhavani-Perundarai Main Road) and ends at the existing km 161/625 at Erode, project road length is 8.12 km. The coordinates of the project stretch are from 11°23'35.32"N latitude and 77°39'36.98"E longitudes to 11°20'53.05"N latitude and 77°43'8.47"E longitudes. SH 15 passes through various villages such as Chithode, Kongapalayam, Naripalayam, Mamaruthu Palayam, Thannirpanthalpalayam, Periya Semur, Soolai and Veerappanchatram in Erode district. About 17 horizontal curves are present along the alignment, among these, some curves are observed to have insufficient sight distance and poor geometry.

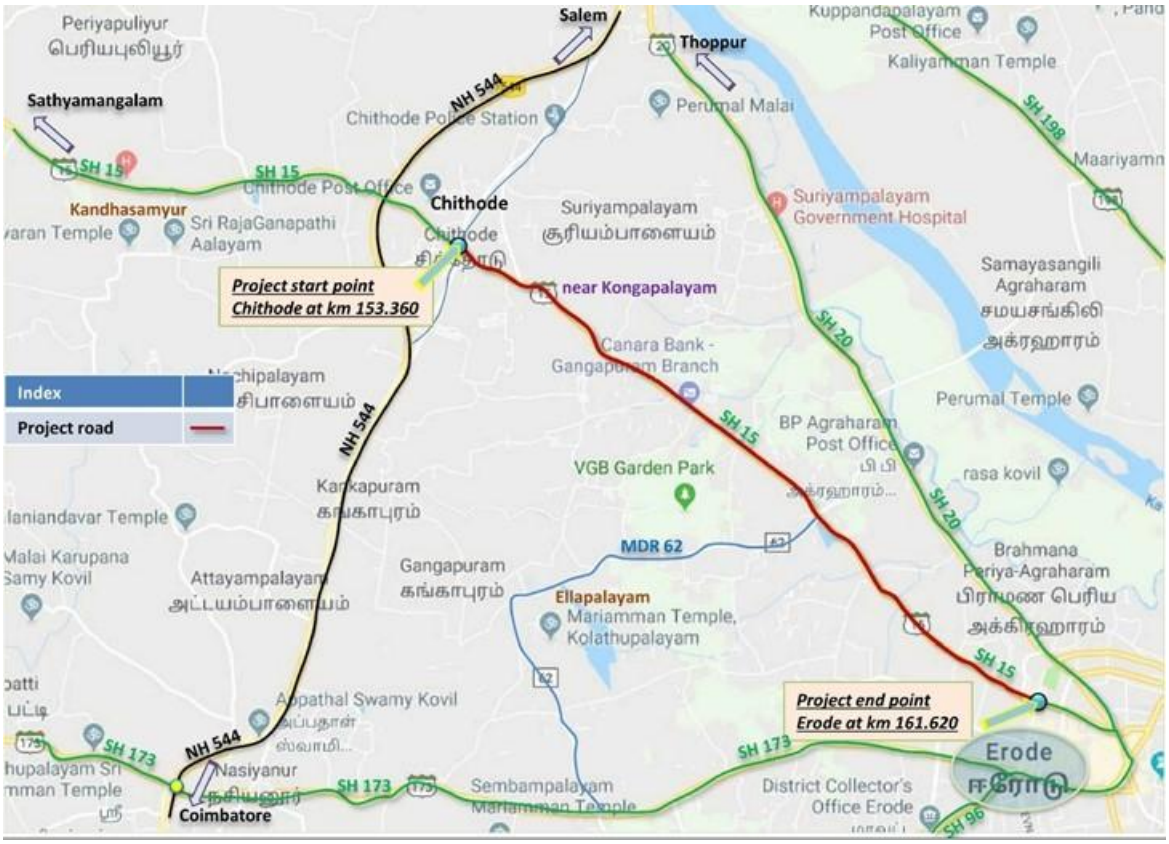


Figure 4: Location Map of Chithode to Erode (SH 15)

The start point of SH 15 (km 153/360)

The endpoint of SH 15 (km 161/620)

Salient Features of the SH 15

(i) **Right of Way**: The road section between Gobi – Erode (km 123/000 to km 153/600) is improved under PPC-01 and the section between km 153/600 to km 161/620 is taken up for improvement under additional financing. Erode is having many spinning mills and improvement of this section provides better connectivity between Erode with NH 544. It forms connectivity between NH 544 with many State Highways and NH 381A in Erode. The existing RoW available for the SH 15 is depicted in the following table

Table 10: Existing RoW along the Chithode to Erode Road

S. No	Existing km		ERoW, m	S. No	Existing km		ERoW, m
	From	To			From	To	
1	153/500	153/600	24.03	43	157/700	157/800	29.66
2	153/600	153/700	27.67	44	157/800	157/900	32.61
3	153/700	153/800	30.85	45	157/900	158/000	36.90
4	153/800	153/900	31.98	46	158/000	158/100	32.30
5	153/900	154/000	28.03	47	158/100	158/200	23.70
6	154/000	154/100	31.04	48	158/200	158/300	26.08
7	154/100	154/200	34.41	49	158/300	158/400	25.10
8	154/200	154/300	34.80	50	158/400	158/500	21.92
9	154/300	154/400	34.53	51	158/500	158/600	25.40
10	154/400	154/500	27.92	52	158/600	158/700	24.81
11	154/500	154/600	37.14	53	158/700	158/800	24.09
12	154/600	154/700	33.81	54	158/800	158/900	30.27
13	154/700	154/800	31.91	55	158/900	159/000	33.77
14	154/800	154/900	27.17	56	159/000	159/100	31.68
15	154/900	155/000	24.87	57	159/100	159/200	30.03
16	155/000	155/100	24.58	58	159/200	159/300	27.15
17	155/100	155/200	21.56	59	159/300	159/400	28.42
18	155/200	155/300	21.21	60	159/400	159/500	28.41
19	155/300	155/400	22.78	61	159/500	159/600	25.30
20	155/400	155/500	28.97	62	159/600	159/700	34.43
21	155/500	155/600	23.25	63	159/700	159/800	44.35
22	155/600	155/700	21.86	64	159/800	159/900	47.83

S. No	Existing km		ERoW, m
	From	To	
23	155/700	155/800	21.48
24	155/800	155/900	21.03
25	155/900	156/000	31.01
26	156/000	156/100	30.27
27	156/100	156/200	19.41
28	156/200	156/300	21.77
29	156/300	156/400	30.03
30	156/400	156/500	25.12
31	156/500	156/600	29.04
32	156/600	156/700	26.47
33	156/700	156/800	26.05
34	156/800	156/900	35.85
35	156/900	157/000	40.31
36	157/000	157/100	38.17
37	157/100	157/200	34.91
38	157/200	157/300	34.05
39	157/300	157/400	34.45
40	157/400	157/500	29.65
41	157/500	157/600	31.59
42	157/600	157/700	29.72

S. No	Existing km		ERoW, m
	From	To	
65	159/900	160/000	49.43
66	160/000	160/100	32.25
67	160/100	160/200	37.31
68	160/200	160/300	31.29
69	160/300	160/400	29.79
70	160/400	160/500	28.56
71	160/500	160/600	22.02
72	160/600	160/700	17.35
73	160/700	160/800	34.66
74	160/800	160/900	34.93
75	160/900	161/000	22.94
76	161/000	161/100	27.13
77	161/100	161/200	26.41
78	161/200	161/300	21.10
79	161/300	161/400	22.90
80	161/400	161/500	24.78
81	161/500	161/600	25.99
82	161/600	161/610	29.45
83	161/610	161/625	31.26

Source: DPR, 2020

(ii) **Carriageway Width**: The project road (SH 15) has 2 lane configuration with/without paved shoulder and a 4 lane divided carriageway at few built-up sections and has varied width near junctions and built-up. The existing type of pavement is flexible throughout. The average width varies from 6m to 16m.The existing road level at the built-up section is in line with the adjacent area/ surrounding areas. The project road level is in line with the general ground for majority of its length as it is passing through built up area of Chithode and Erode and as such there is not much embankment present. At present there is direct entry to the project road from adjacent habitations and cris- crossing of traffic is also observed.

(iii) **Existing Alignment:** The project road has a total of 17 horizontal curves along the alignment. Among these, some curves have insufficient sight distance and poor geometry. The existing traffic warrants for 4-Laning but at present, the existing carriageway is 2 lane wide. There are many cross roads which connects to the project road. There are no traffic calming measures observed along the road. Due to two lane road, there is no channelization of traffic which leads to frequent accidents.

(iv) **Traffic Scenario**: The vehicle-wise average daily traffic (ADT) figures were estimated by classified count survey. The table presents a summary of the vehicle-wise AADT (base year 2019) on the project road, for each homogenous section.

Table 11: Annual Average Daily Traffic for SH 15

Sl.no	Mode of vehicle	km 154/600 (SH 15)
1.	Car / Jeep / Van	5852
2.	Mini Bus	139
3.	School Bus	124
4.	Govt. bus	540
5.	Pvt. Bus	408
6.	Multi axle bus	10
7.	LMV	1648
8.	LCV (4 Wheels)	207
9.	LCV (6 Wheels)	221
10.	2 Axle	371
11.	3 Axle	172
12.	MAV (4 - 6 Axles)	73
13.	MAV (7++ Axles)	0
14.	2 wheelers	18981
15.	3 wheelers/Auto	261
16.	Tractor	7
17.	Tractor with trailer	9
18.	Cycle	69
19.	Cycle rickshaw	0
20.	Animal drawn	0
21.	Toll exempted Vehicles	28
Motorised Vehicles		**29051**
Non-Motorised Vehicles		**69**
Total Vehicles		**29120**
Total PCU		**23430**

(v) **Accident scenario**: MoRT&H has identified two blackspot locations by using accident records of past 3 years (from 2016 to 2018) along this corridor and the details of the same are collected. The summary of the identified MoRT&H blackspot locations on the project road are presented in table below

Sl. No	Name of the location / place	From (km)	To (km)	Number of accidents	Fatality
1	Soolai reliance bunk to Soolai bus stop	km 159/200	km 159/800	11	4
2	Thaneerpandalpalaayam	km 157/000	km 157/600	11	11

Past 3 years (from 2017 to 2019) accident records were collected from Superintendent of police office, Erode district for entire project stretch. Most of the accident spots are at Junction locations. Proper signboards such as junction warning, LED Blinkers, Road studs, Hazard markers and Medium mast lighting is provided at all junctions. Thus, detailed road furniture plan is attached in the DPR (Volume-VI) showing signage plan and road safety measures proposed for the project road in order to reduce the accidents.

(vi) **Landuse pattern:** The land use pattern along the project road SH 15 arebuilt-up (86.1%), Agriculture (7.3%), Barren (3.0%), Industries (1.2%) and water bodies (2.4%), the predominant land use pattern is built-up. High ribbon development is observed along the existing road for the entire stretch (Chithode (km 153/900), Kongampalayam

(km 156/600), Mamarathupalayam (km 156/900), Periyasemur (km 158/040), Maligainagar (km 159/320) and Veerappanchatram (km 161/000)), for which suitable road safety measures are included in the design.

Table 12: List Towns/Villages along the section

Sl. No	Existing km		Length, km	Name of Village
	From	To		
1	153/500	154/300	0.8	Chithode
2	155/300	156/000	0.7	Kongapalayam
3	156/000	156/200	0.2	Naripalayam
4	156/200	157/000	0.8	Mamaruthu Palayam
5	157/000	158/000	1	Thannirpanthalpalayam
6	158/000	159/200	1.2	Periya Semur
7	159/200	160/000	0.8	Soolai
8	160/000	161/625	1.625	Veerappanchatram

Source: DPR, 2020

(vii) **Existing Drainage system**: Earthen drain is present along the entire stretch with isolated stretches having RCC drain. No flooding is recorded along the project stretch.

(viii) **Condition of Pavement and Shoulder:** The pavement is flexible, the general condition of the pavement varies between good to very poor. Around 44.3% of the pavement was observed to be in good condition. However, in some sections, it is observed with alligator cracking, longitudinal cracking, edge drop & patching along the carriageway. Paved shoulder is observed on either side at few built-up sections and earthen shoulders are observed throughout on either side, the width of the earthen shoulder varies from 0.5m to 1m. Based on the existing crust composition and the engineering studies, the use of existing pavement materials will be finalised.

Longitudinal cracking at km 154/100

Distressed pavement at km 161/200

(ix) **Intersections:** There are 3 Major Intersections and 54 Minor Intersections along the project road, out of which, nine four-legged Intersections and rest are three-legged. The major Intersections (with State highways and Major District Roads) and minor intersections(with village/street roads) are given in **Table 13**.

Table 13: List Intersections along the SH 15

Sl. No	Existing km	Type of Junction	Category of Road	Leads To		Type of Road
				LHS	RHS	
Major Intersections						
1	153/360	+	ODR/VR	Bhavani	Perundurai	BT
2	158/400	T	MDR-62		Villarasanpatti	BT
3	161/620	+	SR	VOC Nagar	Erode Bus Stand	BT
Minor Intersections						
1	153/940	T	VR	-	Kummilampara	BT
2	154/110	Y	VR	Chithode Bypass Road	-	BT
3	156/200	T	SR	-	Street	BT
4	156/240	T	SR	-	Street	BT
5	156/400	T	SR	Street	-	CC
6	156/580	+	SR	Street	-	CC
7	156/780	T	SR	Street	-	BT
8	157/060	Y	SR	Street	-	BT
9	157/160	T	SR	Street	-	BT
10	157/190	T	SR	-	Street	BT
11	157/360	T	VR	Thannirpanthalpalayam	-	BT
12	157/530	+ Staggered	SR	Street	Street	CC
13	157/630	T	SR	Street	-	BT
14	157/730	T	SR	Street	-	CC
15	158/060	Y	SR	Street	-	CC
16	158/130	Y	SR	Street	-	CC
17	158/190	Y	SR	Street	-	CC
18	158/230	T	SR	Street	-	CC
19	158/350	+ Staggered	VR	Varasanpatti	Villarasanpatti	BT
20	158/520	T	SR	Street	-	BT
21	158/630	T	SR	Street	-	BT
22	158/870	T	SR	Street	-	CC
23	158/970	T	SR	Street	-	CC
24	159/020	T	SR	Street	-	CC
25	159/100	T	SR	-	Street	BT
26	159/180	T	SR	-	Street	BT
27	159/250	T	SR	Street	-	BT
28	159/300	T	SR	Street	-	BT
29	159/325	T	SR	-	Manickam Palayam	BT
30	159/400	+ Staggered	SR	Street	Street	BT
31	159/500	T	SR	-	Street	BT
32	159/540	T	SR	-	Street	BT
33	159/630	Y	SR	Street	-	BT
34	159/900	+	SR	Street	Street	BT
35	159/940	T	SR	Street	-	BT
36	159/980	T	SR	Street	-	BT
37	160/040	T	SR	Street	-	BT
38	160/190	T	SR	Street	-	BT
39	162/280	Y	SR	Street	-	BT
40	160/320	T	SR	Street	-	BT
41	160/480	T	SR	Street	-	BT
42	160/520	T	SR	Street	-	BT
43	160/610	+ Staggered	SR	Street	Street	BT

Sl. No	Existing km	Type of Junction	Category of Road	Leads To		Type of Road
				LHS	RHS	
44	160/700	T	SR	Street	-	BT
45	160/740	T	SR	-	Street	BT
46	160/760	T	SR	Street	-	BT
47	160/830	T	SR	-	Street	BT
48	160/950	+ Staggered	SR	Street	Street	BT
49	161/020	T	SR	-	Street	BT
50	161/130	T	SR	Street	-	BT
51	161/220	T	SR	-	Street	BT
52	161/290	T	SR	Street	-	BT
53	161/450	T	SR	Veerappanchatram	-	BT
54	161/500	T	SR	Veerappanchatram	-	BT

Source: DPR, 2020

Major Intersection at km 158/400

Minor Intersection at km 154.110

(x) **Utilities:** There are 12 transformers, 2 HTL crossings, 1 OHT observed along the project road. There are 4 Bus Shelters located at km 159/320, km 160/130, km 160/640 and km 161/180.

(xi) **Bridges and Cross Drainage Structures:** There are no Major Bridges in the project corridor. However, there are 4 Minor bridges and 16 Culverts along the project stretch. Details of condition and capacity of existing structures (Chithode to Erode Road) is given in the following table

Sl. No	Existing km (SH-15)	Type of Structure	Span Arrangement No. of Vents x Span x Vent height (m)	Existing width of Structure (m)	Overall Condition of Structure	Approximate Capacity of Existing CD Structure (Cumecs)	Remarks
1	153/554	Pipe Culvert	3x0.75	13.34	Fair	1.987	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
2	153/686	Pipe Culvert	3x0.75	13.09	Fair	1.987	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
3	153/935	Pipe Culvert	1x0.30	16.10	Fair	0.106	As instructed by TNRSP officials, All Pipe culverts are

Sl. No	Existing km (SH-15)	Type of Structure	Span Arrangement No. of Vents x Span x Vent height (m)	Existing width of Structure (m)	Overall Condition of Structure	Approximate Capacity of Existing CD Structure (Cumecs)	Remarks
							reconstructed with Box culvert
4	154/654	Slab Culvert	1x1.60x1.80	18.10	Fair	4.320	RCC slab culvert with SSM Substructure is reconstructed with Box culvert
5	154/893	Slab Culvert	1x1.40x1.15	16.80	Fair	2.415	RCC slab culvert with SSM Substructure is reconstructed with Box culvert
6	155/364	Slab Culvert	1x1.60x0.60	15.40	Poor	1.440	RCC slab culvert with SSM Substructure is reconstructed with Box culvert
7	155/520	Pipe Culvert	1x0.75	16.20	Fair	0.662	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
8	155/568	Pipe Culvert	1x0.90	14.90	Fair	0.759	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
9	156/220	Minor Bridge	7x2.10x1.85	12.00	Poor	56.022	Bridge is in fair condition with SSM substructure and hydrologically inadequate. So, the bridge is reconstructed.
10	156/648	Pipe Culvert	1x0.90	17.30	Fair	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
11	157/159	Pipe Culvert	Buried	15.10	Fair	-	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
12	157/518	Pipe Culvert	1x0.90	17.40	Fair	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
13	157/928	Pipe Culvert	1x0.30	19.35	Fair	0.106	As instructed by TNRSP officials, All Pipe culverts are

Sl. No	Existing km (SH-15)	Type of Structure	Span Arrangement No. of Vents x Span x Vent height (m)	Existing width of Structure (m)	Overall Condition of Structure	Approximate Capacity of Existing CD Structure (Cumecs)	Remarks
							reconstructed with Box culvert
14	159/198	Minor Bridge	(1x8.90+1x8.90 +1x8.80 +1x9.00)x3.00	8.80	Fair	184.000	Bridge is in fair condition and hydrologically adequate. So, the Bridge is widened
15	159/709	Minor Bridge	5x2.10x2.40	9.90	Poor	46.620	Bridge is in poor condition with SSM substructure and hydrologically inadequate. So, the bridge is reconstructed.
16	160/442	Pipe Culvert	1x0.90	12.60	Poor	0.954	As instructed by TNRSP officials, All Pipe culverts are reconstructed with Box culvert
17	160/700	Slab Culvert	1x1.00x1.00	30.00	Poor	1.500	RCC slab culvert with Poor condition is reconstructed with Box culvert
18	160/820	Slab Culvert	Buried	14.90	Fair	-	RCC slab culvert with buried condition is reconstructed with Box culvert
19	160/852	Pipe Culvert	Buried	15.90	Fair	-	RCC slab culvert with buried condition is reconstructed with Box culvert

Source: DPR 2020

Minor Bridge at Km 156/230

Minor Bridge at Km 159/215

Slab Culvert at Km 154/870

Pipe Culvert at Km 156/660

(xii) **Sensitive Locations:** There are 8 temples, 5 Schools and 1 hospital which was observed along the project road.

Sl. No	Existing km	Description	Side
1	154/680	Temple	LHS
2	156/520	Temple	RHS
3	157/040	Temple	LHS
4	158/020	Temple	LHS
5	158/040	Temple	LHS
6	160/500	Temple	RHS
7	160/660	Temple	RHS
8	161/360	Temple	LHS

Source: DPR, 2020

School on RHS at km 156/520

Temple on RHS at km 160/500

3.4 Proposed Design Interventions

The proposed improvements are aimed at easing traffic congestion, reducing the road accidents by improving physical characteristics of the road, which includes geometry, pavement strength, drainage, road safety appurtenance and also enhancing the aesthetics. General philosophy followed in formulating the improvement proposals are

- Improve the existing project facilities and introducing new facilities
- Strengthening/reconstruction/ new construction of the existing pavement;
- Improvement of geometric deficient curves;
- Provision of footpath cum built-up drains;
- Provision of utility corridors and cross ducts at junctions;
- Junction improvements;
- Widening/ reconstruction of existing Bridge and culverts and provision of additional culverts depending on the drainage condition;

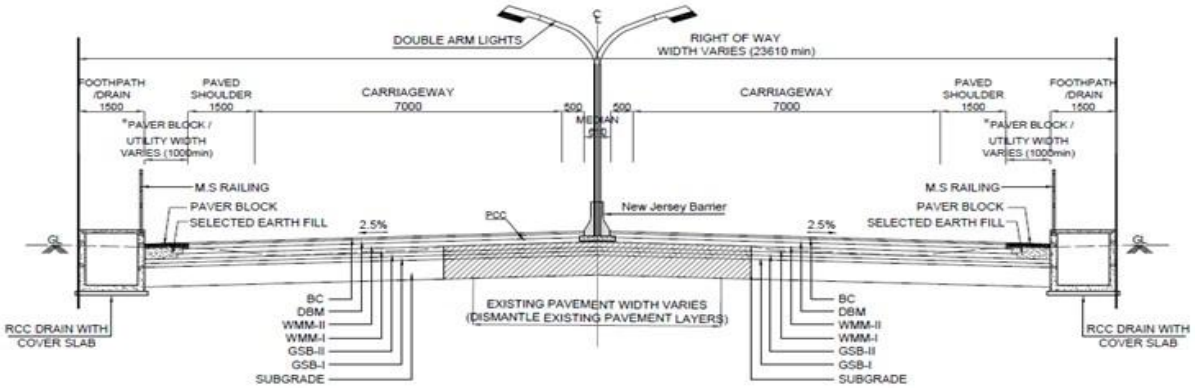
- Provision for Pedestrian crossing facilities;
- Provision of traffic signs and road furniture;
- Improvement of road safety features;
- Provision of bus bays and passenger shelters.
- Provision for Rainwater/ groundwater recharge well

3.4.1 Proposed Carriageway Configuration and Cross Sections

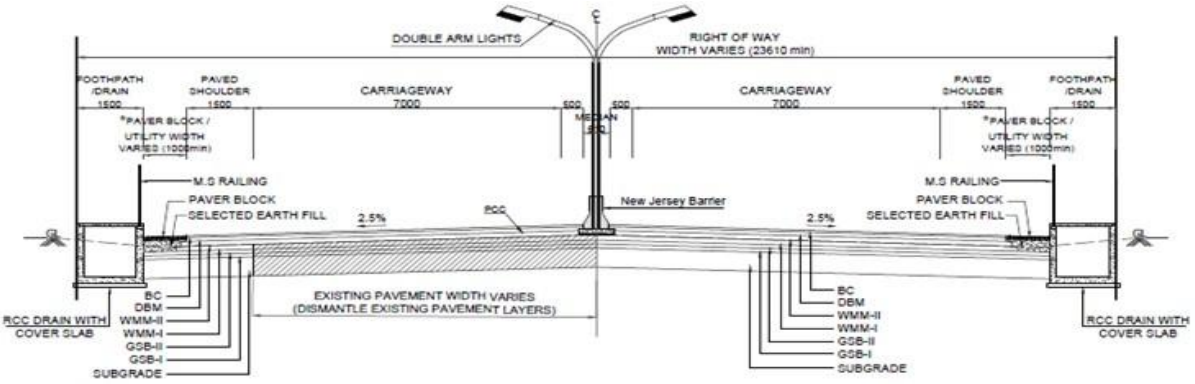
Based on the traffic considerations, geometric standards and existing site condition from the inventory information (on the available RoW, location of the settlements, avenue trees, water bodies, cultural properties and public utilities), typical cross sections have been developed and discussed in the following sections (for more information please refer Detailed Project report).

Sl.no	Phase – 1 Corridors	Existing Carriage Way	Proposed Carriage way
1.	Omalur to Mecheri Road (SH 222)	2 lane without paved shoulder and 4 lanes divided carriageway at few built-up sections and varied width near junctions and built-up	4 lane configuration with paved shoulder
2.	Malliyakarai to Attur Road (SH 30)	2 lane without paved shoulder throughout and varied width near junctions and built-ups	2 lane configuration with paved shoulder
3.	Chithode to Erode Road (SH 15)	2 lane with/without paved shoulder and 4 lanes divided carriageway at few built-up sections and varied width near junctions and built-up	4 lane configuration with paved shoulder

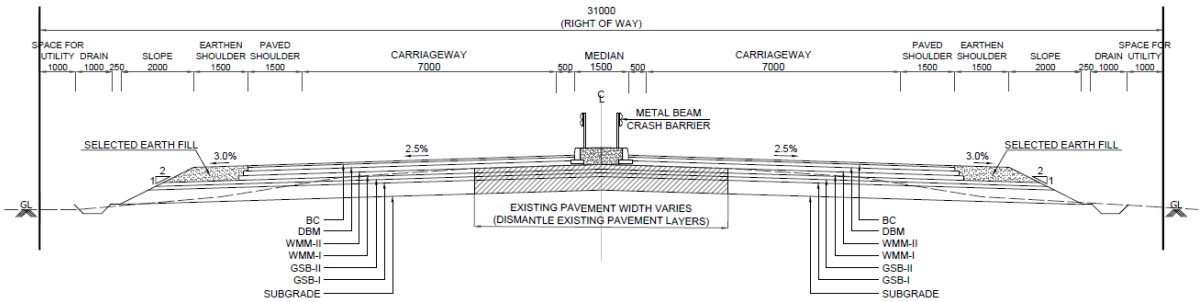
(i) **Omalur to Mecheri Road (SH 222):**



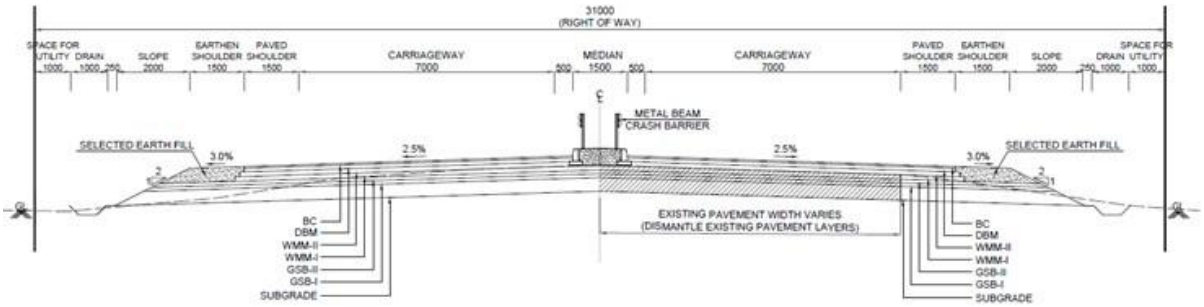
Type-1A Typical Cross Section of 4 Lane in Urban Area (Concentric Widening)



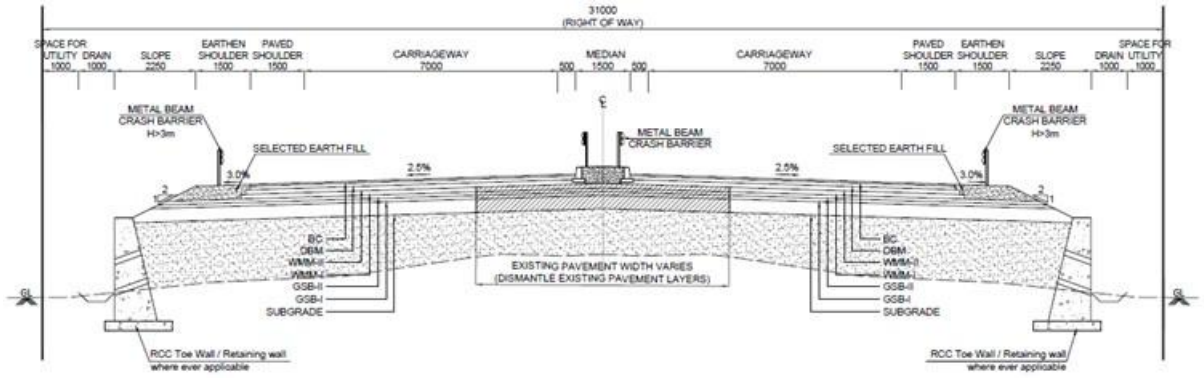
Type-1B Typical Cross Section of 4 Lane in Urban Area (Eccentric Widening)



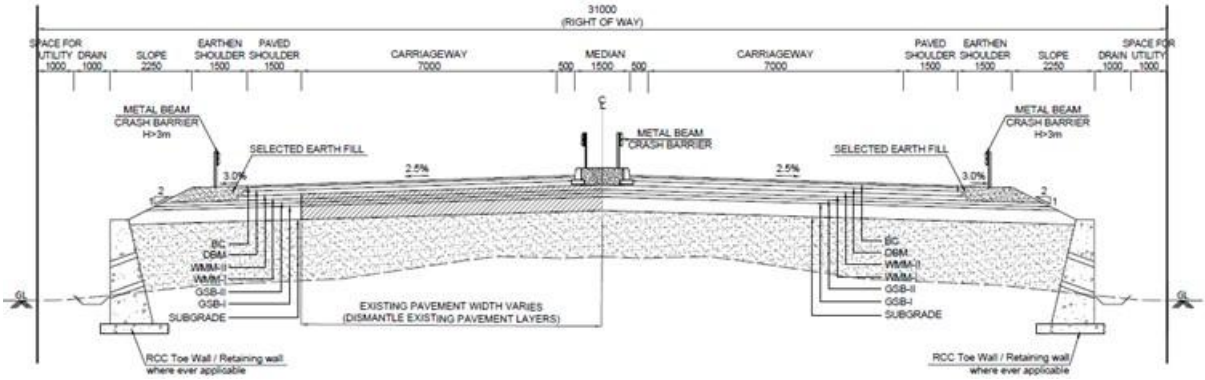
Type 2A : Typical Cross Section of 4 Lane in Rural Area Difference Between OGL & FRL < 1.1mt (Concentric Widening)



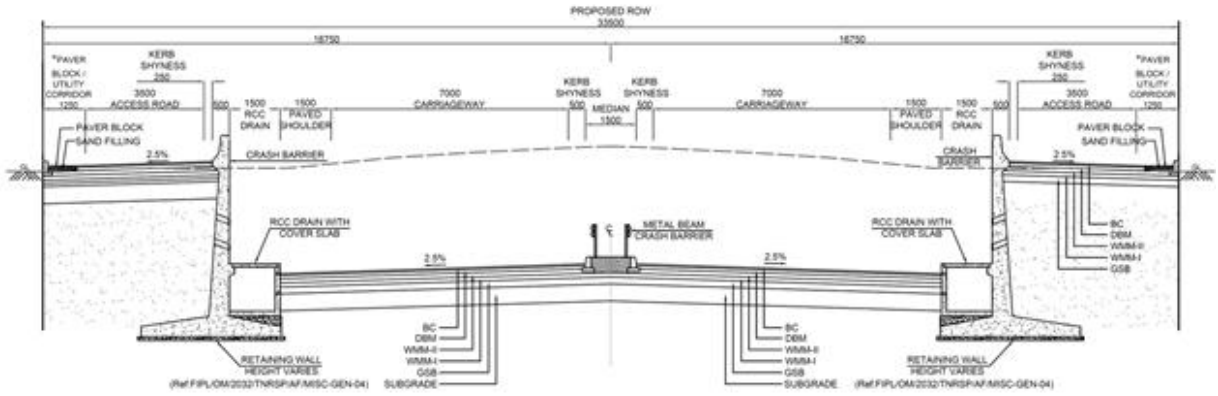
Type 2B : Typical Cross Section of 4 Lane in Rural Area Difference Between OGL & FRL < 1.1mt (Eccentric Widening)



Type-3A : Typical Cross Section of 4 Lane in Rural Area Difference Between GL & FRL > 1mt (Concentric Widening)



Type-3B : Typical Cross Section of 4 Lane in Rural Area Difference Between GL & FRL > 1mt (Eccentric Widening)



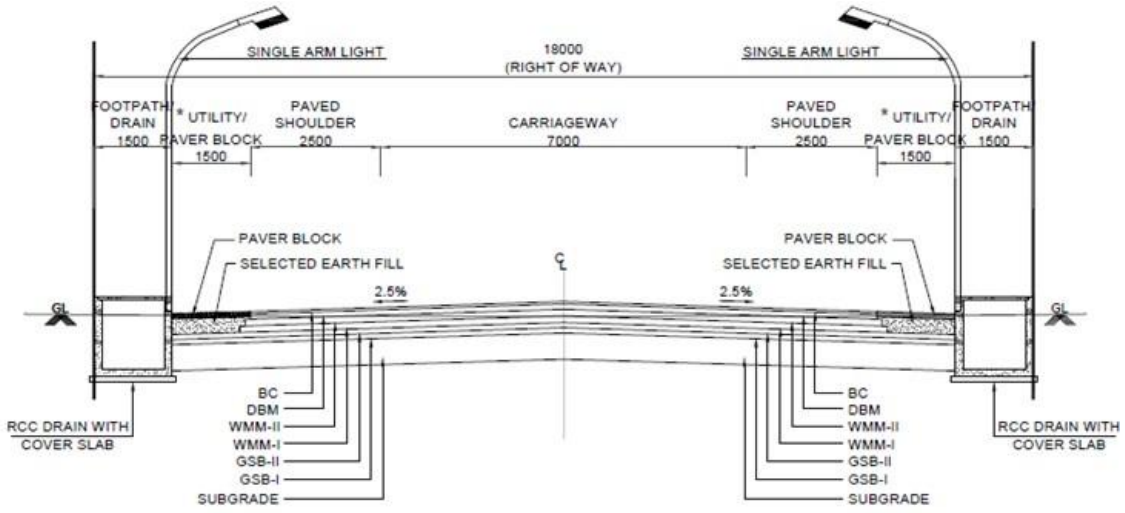
Type-4 : Typical Cross Section of 4 Lane with Divided Carriageway in Rural Area at Cutting location

Summary of Cross section details for Omalur to Mecheri Road

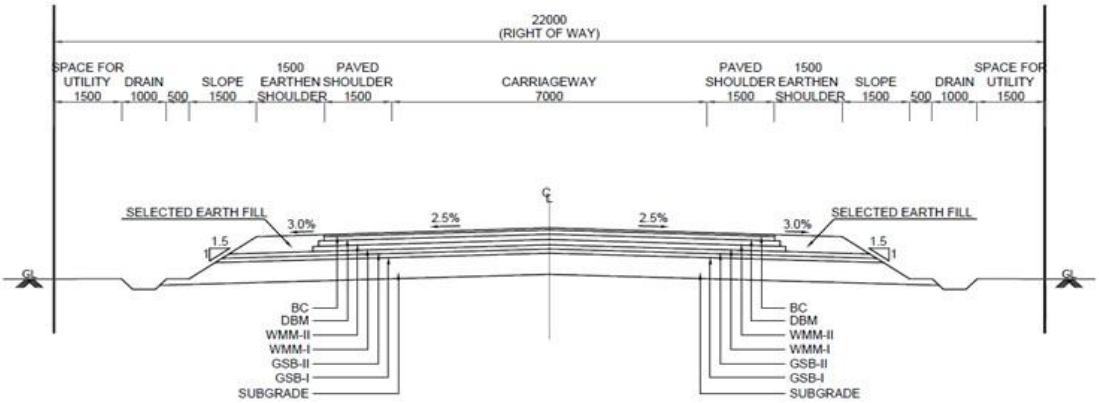
S. No	TCS Type	Description	Length, m
1	TCS 1A	Typical Cross Section of 4 Lane Divided Carriageway in Urban Area (Concentric Widening)	5670
2	TCS 1B	Typical Cross Section of 4 Lane Divided Carriageway in Urban Area (Eccentric Widening)	2560
3	TCS 2A/3A*	Typical Cross Section of 4 Lane Divided Carriageway in Rural Area (Concentric Widening) with & without retaining wall	2700
4	TCS 2B/3B*	Typical Cross Section of 4 Lane Divided Carriageway in Rural Area (Eccentric Widening) with & without retaining wall	2090
5	4	Typical Cross Section of 4 Lane with Divided Carriageway in Rural Area at Cutting location	150
Total			**13170**

**Note: In TCS 3A and 3B, all cross section elements are same as TCS 2A and 2B. If height of embankment is more than 1m, Retaining wall/Toe wall is proposed to reduce the additional land acquisition. Total length of Toe/Retaining wall is 2910m on both sides*

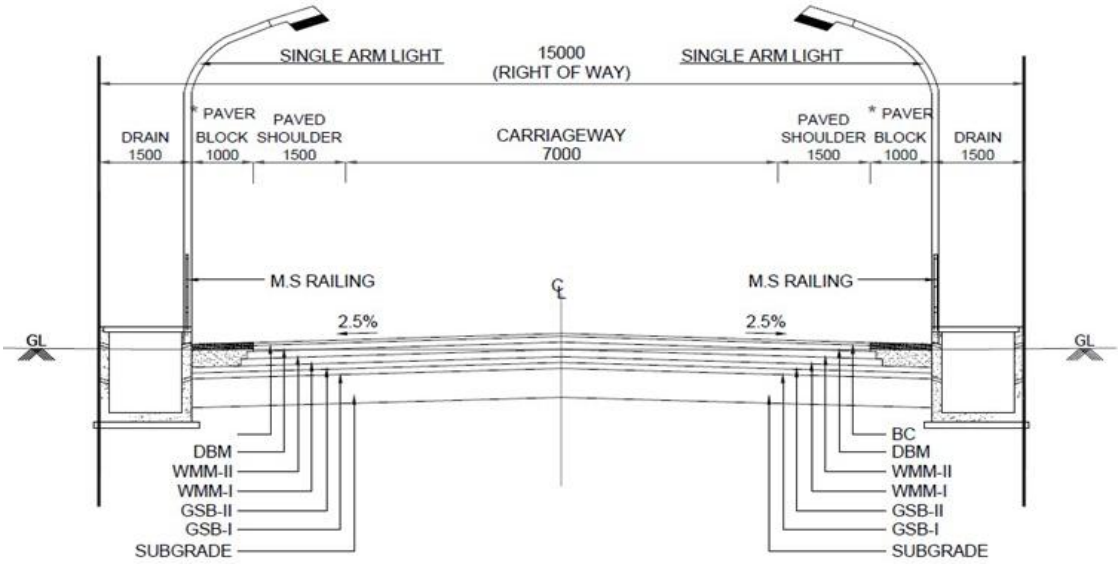
(ii) **Malliyakarai to Attur Road (SH 30)**



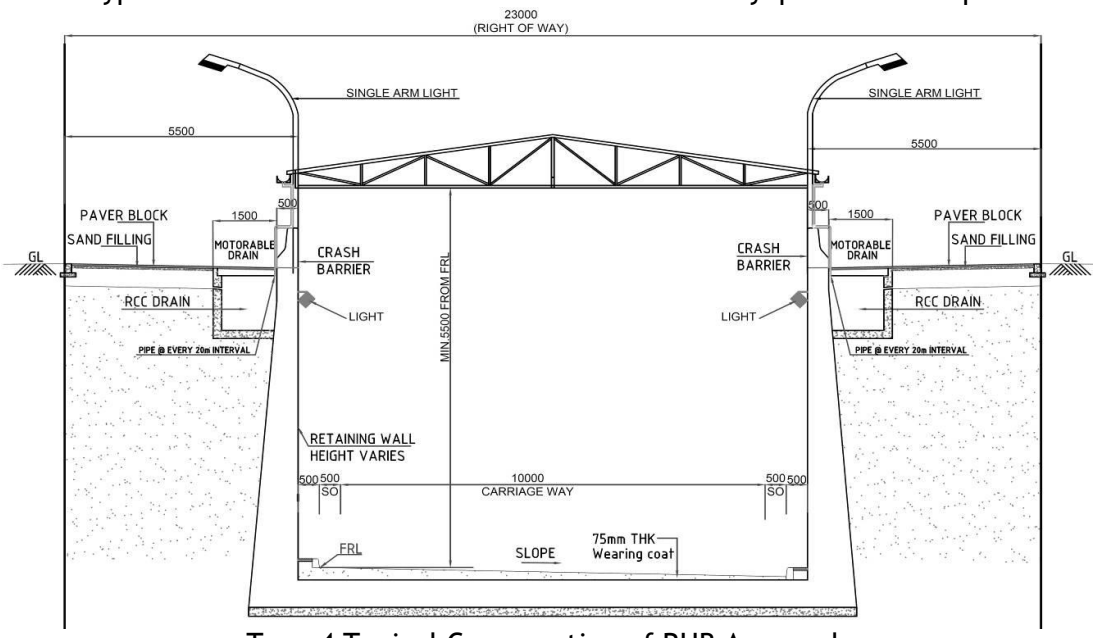
Type-1 : 2 Lane with Paved Shoulder (Built-Up Area) Realignment



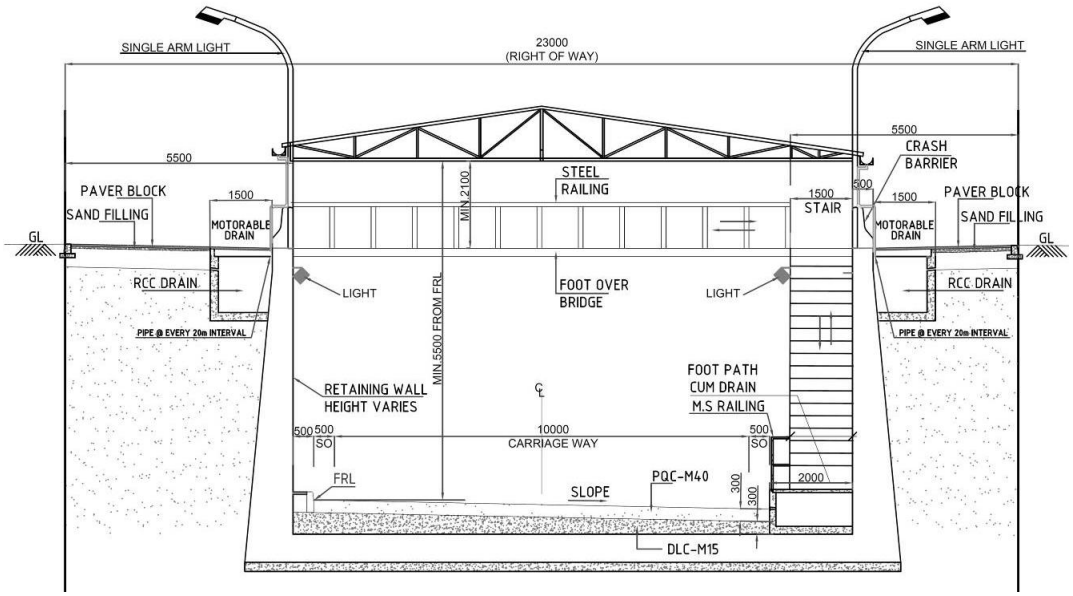
Type-2 : Typical Cross Section of 2-Lane Road With Paved Shoulders - Rural Area - Realignment



Type-3 : 2 Lane with Paved Shoulder - Thandavarayapuram Built-Up



Type 4 Typical Cross section of RUB Approach

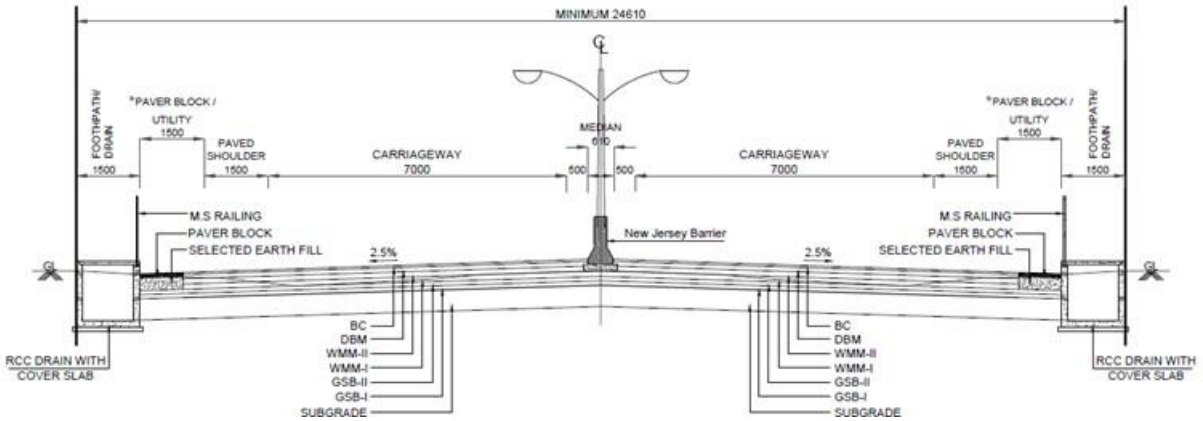


Type 4A1: Typical Cross Section of RUB Approach with Stair

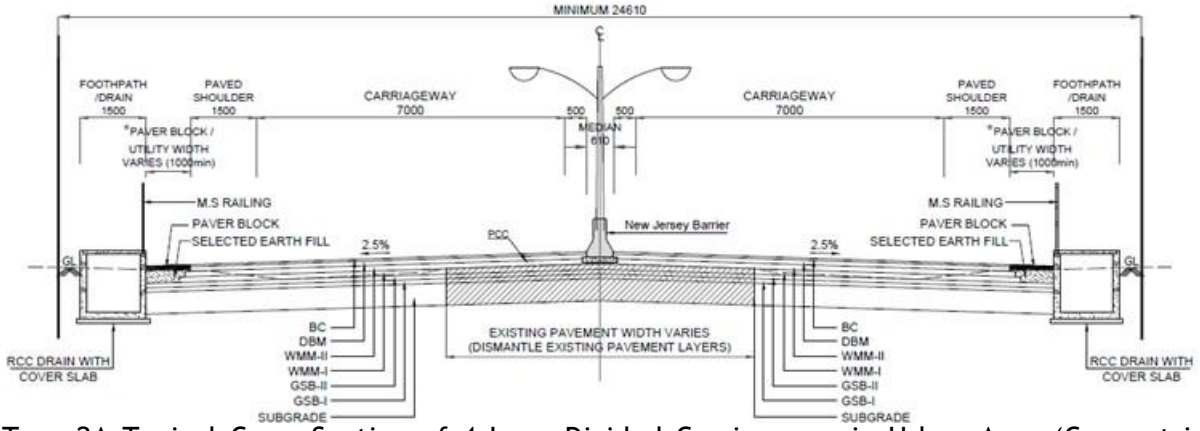
Summary of Cross section details for Malliyakarai to Attur Road

Sl No	CS type	Length, m	Type of Widening
1	1	300	Curve Improvement/Realignment in Built-up
2	1A	1364	Concentric in Built-up
3	1B	460	Eccentric in Built-up
4	2	1070	Curve Improvement/Realignment in Rural
5	2A	3529	Concentric in Rural
6	2B	2230	Eccentric in Rural
7	3A	310	Concentric in Thandavarayapuram
8	4	621	RUB and its approach
9	4A1		
10	4A2		
11	4B		
12	4C		
Total		**9884**	

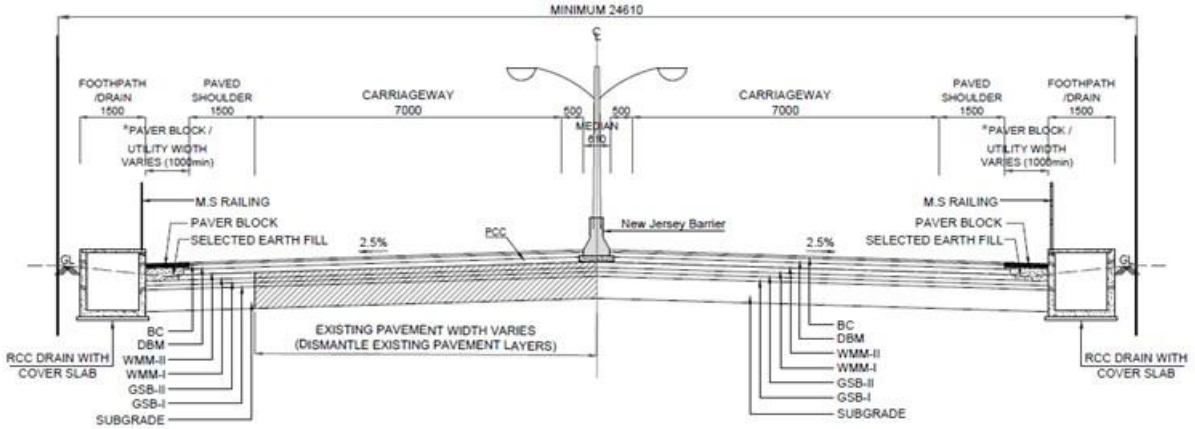
(iii)**Chithode to Erode Road (SH 15)**



Type-2 Typical Cross Section of 4 Lane Divided Carriageway in Urban Area (Realignment/New Construction)



Type-2A Typical Cross Section of 4 Lane Divided Carriageway in Urban Area (Concentric Widening)



Type-2B Typical Cross Section of 4 Lane Divided Carriageway in Urban Area (Eccentric Widening)

Summary of Cross section details for Chithode to Erode Road

Sl No	CS type	Length, m	Type of Widening
1	2	270	Curve improvement
2	2A	4265	Concentric
3	2B	3280	Eccentric right
4	2B	310	Eccentric left
Total		**8125**	

3.4.2 Realignment sections

(i) **Omalur to Mecheri Road (SH 222)**

Section between km 0/000 to km 1/150 involves realignment for proposed ROB which involves land acquisition and the same is taken up at later stage. However, the various realignment options that have been studied are discussed in the Alternative Analysis (refer Chapter 6) and thus, the project design is considered from km 1/150 to km 14/300. The proposed realignment section with three options are depicted in the following table.

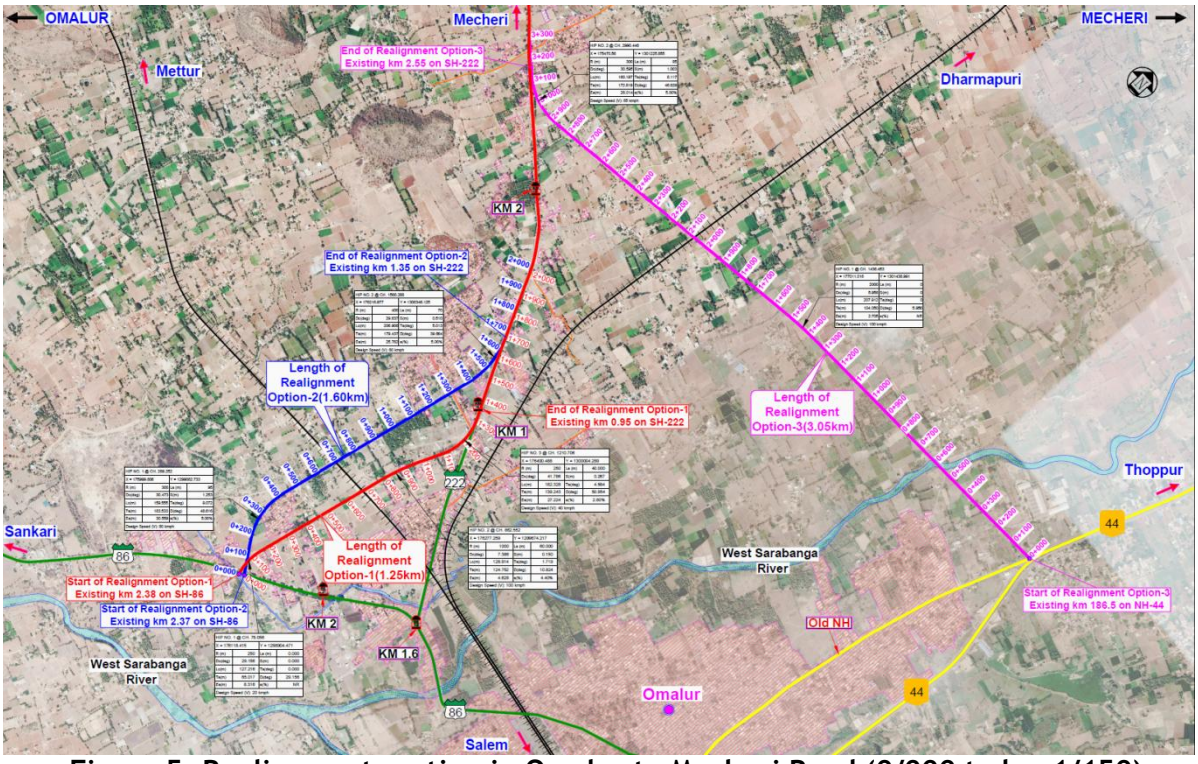


Figure 5: Realignment section in Omalur to Mecheri Road (0/000 to km 1/150)

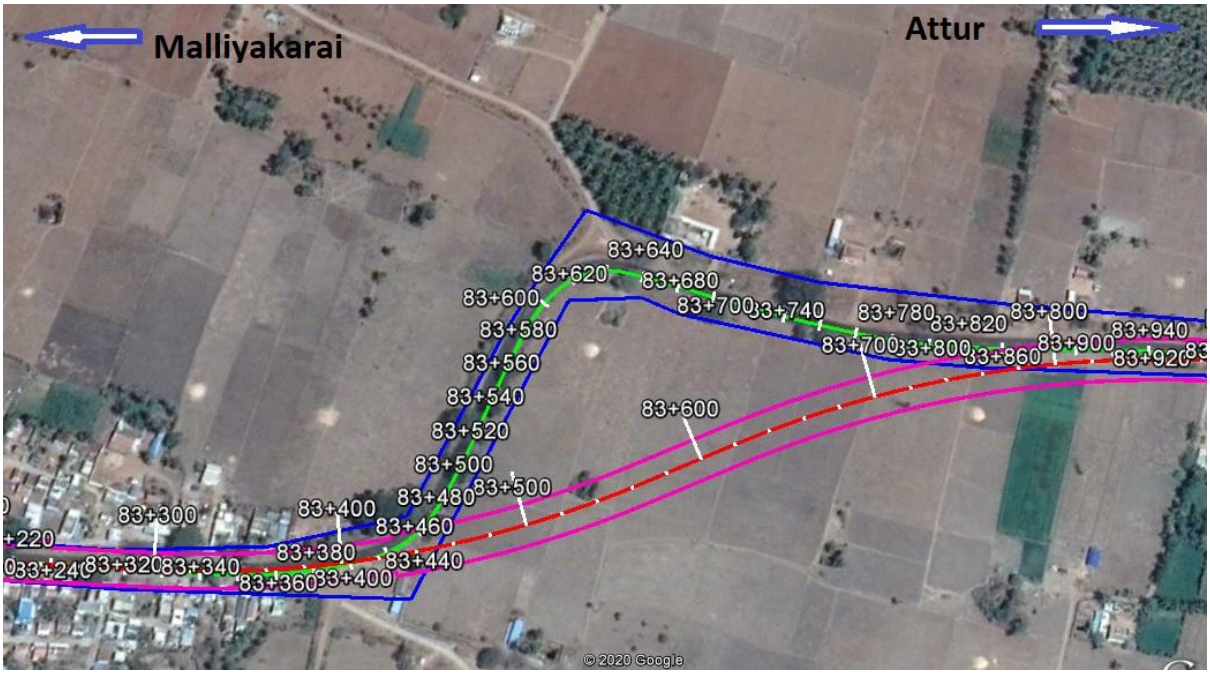
(ii) **Malliyakarai to Attur Road (SH 30)**

Based on the proposed design, the alignment has been changed at seven locations, out of which four are curve improvements and three are realignments. The design chainage has been given in the following table for the curve improvement and realignment sections.

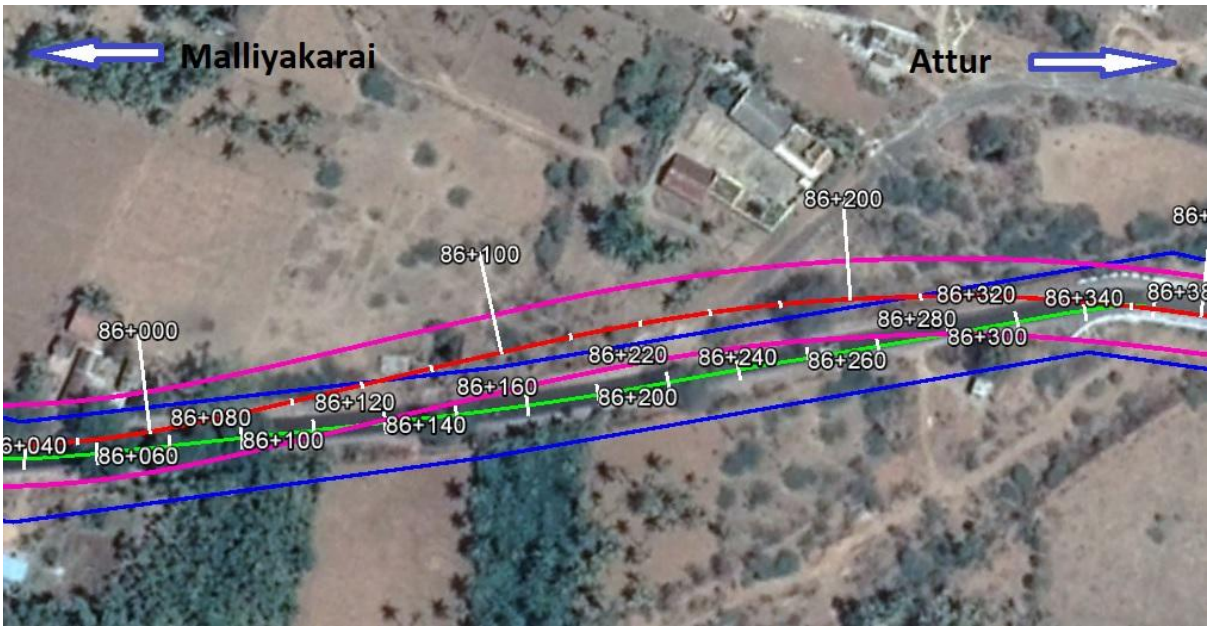
Sl. No	Design Chainage		Length, m	Type of Widening	Remarks
	From	To			
1	81/400	81/550	150	Curve Improvement	• Malliyakarai Village • To improve existing poor geometry and to avoid acquisition of more structures • Improvement within available land
2	82/700	82/820	120	Curve Improvement	• Eachampatti Village • To improve existing poor geometry • Improvement within available land
3	83/430	83/810	380	Realignment	• Eachampatti Village • Realignment starts after Built-up to improve existing poor geometry (existing Radius less than 100m) and to increase the sight distance • Additional land required
4	86/020	86/260	240	Realignment	• Chokkanathapuram Village • Realignment starts after Built-up to improve existing poor geometry and to utilize the newly constructed Minor Bridge
5	86/540	86/670	130	Curve Improvement	• Chokkanathapuram Village • To improve existing poor geometry • Improvement within available land
6	87/860	88/010	150	Realignment	• Thandavarayapuram Village • Realignment starts after Built-up to

Sl. No	Design Chainage		Length, m	Type of Widening	Remarks
	From	To			
					improve existing poor geometry (Sharp S-Curve) and to increase the sight distance • Additional land required
7	89/380	89/580	200	Curve Improvement	• Narasingapuram Village • To improve existing poor geometry • Improvement within available land

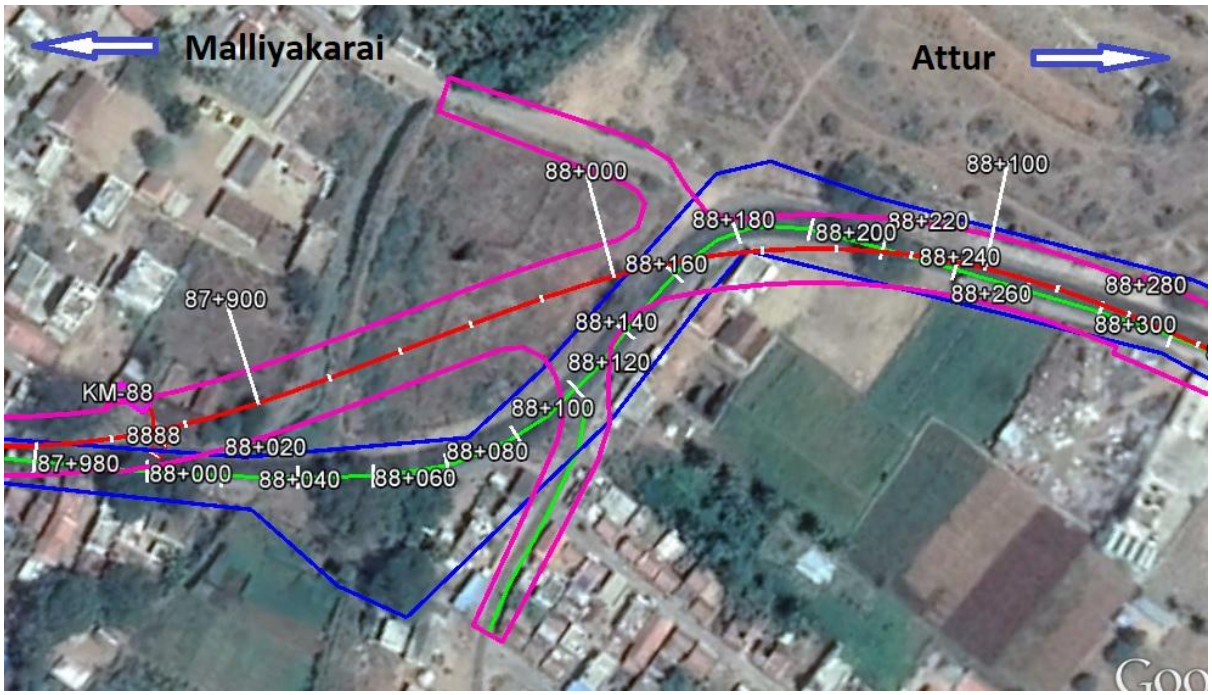
Source: DPR, 2020



Realignment Section between km 83/430 to km 83/810



Realignment Section between km 86/020 to km 86/260



Realignment Section between km 87/860 to km 88/010

(iii)**Chithode to Erode Road (SH 15)**

As per the assessment realignment is not required for this project corridor.

3.4.3 Culverts and Bridges

(i) **Omalur to Mecheri Road (SH 222)**

Along the project road, 23 box culverts and 32 cross road pipe culverts are proposed. 1 existing RCC slab culvert at design chainage 3/254 is proposed to be dismantled and in lieu of this culvert, a new RCC box culvert is proposed at design chainage 3/240. There are no Major and Minor bridges along the Omalur to Mecheri Road. Details of the proposed CD structures are given in the following table.

Table 14: Summary of Structure Proposals (Omalur to Mecheri Road)

Sl. No	Type of Structure	New Construction	Reconstruction	Widening	Total
1	Major Bridges	-	-	-	0
2	Minor Bridges	-	-	-	0
3	Box Culvert	1	20	2	23
4	Slab Culvert	-	-	-	-
Total no. of Structures		**1**	**20**	**2**	**23**
Cross road culverts		**6**	**-**	**-**	**6**

Note: 1 existing RCC slab culvert at D.Ch. 3/254 is proposed to be dismantled and a new culvert is constructed at Design. Chainage 3/240

(ii) **Malliyakarai to Attur Road (SH 30)**

All the pipe culverts (5 no's) are proposed for reconstruction with RCC box culverts. The pipe culvert located at Design Chainage 90/342 is proposed to be dismantled since it is falling on the approach of RUB. In lieu of this culvert, 1 Box culvert is proposed at Design Chainage 90/460. All the slab culverts (4 no's) proposed for reconstruction with RCC box culvert. Further, 18 crossroad culverts are proposed along major and minor junctions. A

minor bridge located at km 86/400 is proposed for widening on both sides. Proposed width is 18.00 m.

Table 15: Summary of Structure Proposals (Malliyakarai to Attur Road)

Description	Box Culvert	Cross road Culverts	Total
Retained with minor repairs / widening	-	-	-
Reconstruction	9	-	9
New Construction	1	16	17
Total Numbers	**26**		

Source: DPR, 2020

(iii) **Chithode to Erode Road (SH 15)**

In Chithode to Erode Road, it is proposed to have 3 Minor bridges, 18 Box culverts and 18 Cross road culverts. 2 New Culverts are proposed at design chainage 158/678 and 158/728 near Gani ravuthar kulam parallel to existing Pond on RHS. 3 Minor bridges are proposed along the project stretch of which 2 existing bridges are proposed for reconstruction to 4 lane width and 1 existing minor bridge is proposed for widening on both sides. Details of Structure proposals are given in **Table 16**.

Table 16: Summary of Structure Proposals (Chithode to Erode Road)

Sl. No.	Type of Structure	New Construction	Reconstruction	Widening	Total
1	Major Bridges	-	-	-	0
2	Minor Bridges	-	2	1	3
3	Box Culvert	2	16	-	18
4	Slab Culvert	-	-	-	0
Total no. of Structures		**2**	**18**	**1**	**21**
Cross road culverts		**18**	**-**	**-**	**18**

Source: DPR, 2020

3.4.4 Bus Bays with Passenger's Shelters

Bus bays with passenger shelters are provided with adequate paving of lay bye area, drainage and road markings confirming to IRC_80:1998. A raised footpath of 1.5 m wide is proposed for the safety of waiting passengers. Bus bay with Bus shelters are provided with Toilet facility. All Bus shelters/Bus bay with Bus shelter are provided with drinking water facility. In Built up area due to land constraints only Bus shelters are provided. Solar lighting is proposed in bus shelters.

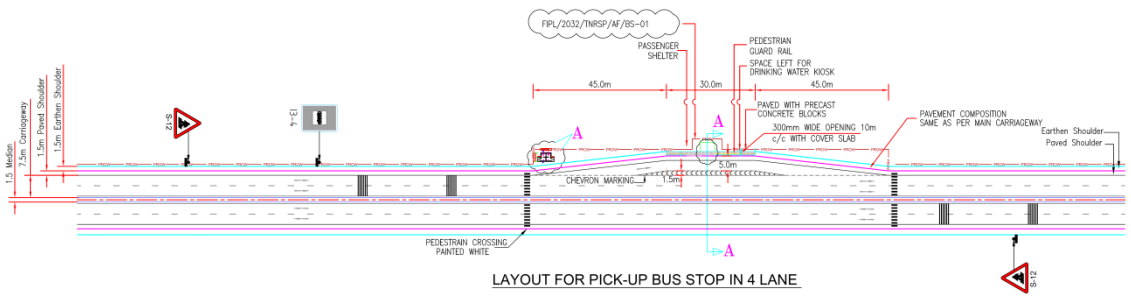


Figure 6: Typical Layout of a Bus Bay (5 m wide)

(i) **Omalur to Mecheri Road (SH 222):** Details of bus bay location are presented in following table.

Table 17: List of Bus Bay with Passenger's Shelter in Omalur to Mecheri Road

S. No	Design Chaiange (Km)	Side	Remarks
1	1/820	RHS	Bus bay with shelter
2	2/000	LHS	Bus bay with shelter
3	2/750	LHS	Bus bay with shelter
4	2/750	RHS	Bus bay with shelter
5	3/455	LHS	Bus bay with shelter
6	3/650	RHS	Bus shelter
7	3/855	LHS	Bus bay with shelter
8	3/980	RHS	Bus bay with shelter
9	4/900	LHS	Bus shelter
10	5/020	RHS	Bus shelter
11	6/040	RHS	Bus bay with shelter
12	6/360	LHS	Bus bay with shelter
13	7/040	LHS	Bus bay with shelter
14	7/040	RHS	Bus bay with shelter
15	7/660	RHS	Bus shelter
16	7/860	LHS	Bus shelter
17	8/950	RHS	Bus bay with shelter
18	9/070	LHS	Bus bay with shelter
19	11/160	LHS	Bus bay with shelter
20	11/400	RHS	Bus bay with shelter
21	12/250	LHS	Bus shelter
22	12/375	RHS	Bus shelter
23	14/200	LHS	Bus shelter
24	14/200	RHS	Bus shelter

Source: DPR, 2020

(ii) **Malliyakarai to Attur Road (SH 30):** Details of bus bay location are presented in following table.

Table 18: List of Bus Bay with Passenger's Shelter in Malliyakarai to Attur Road

Sl. No.	Des. Chainage (Km)	Side	Remarks
1	81/370	RHS	Bus bay with Shelter
2	81/440	LHS	Bus bay with Shelter
3	82/240	LHS	Bus bay with Shelter
4	82/240	RHS	Bus bay with Shelter
5	83/190	RHS	Bus shelter
6	83/240	LHS	Bus shelter
7	84/470	LHS	Bus bay with Shelter
8	84/680	RHS	Bus bay with Shelter
9	85/520	RHS	Bus bay with Shelter
10	85/600	LHS	Bus bay with Shelter
11	87/610	LHS	Bus shelter
12	87/650	RHS	Bus shelter
13	88/680	LHS	Bus bay with Shelter
14	88/960	RHS	Bus bay with Shelter
15	89/540	LHS	Bus bay with Shelter
16	89/710	RHS	Bus shelter
17	90/550	RHS	Bus shelter
18	90/600	LHS	Bus shelter

Source: DPR, 2020

(iii) **Chithode to Erode Road (SH 15):** Details of bus bay location are presented in following table.

Table 19: List of Bus Bay with Passenger's Shelter in Chithode to Erode Road

Sl. No.	Des. Chainage (Km)	Side	Remarks
1	154/100	LHS	Bus Shelter
2	154/320	RHS	Bus bay with Bus Shelter
3	155/520	LHS	Bus Shelter
4	155/500	RHS	Bus Shelter
5	156/240	LHS	Bus Shelter
6	156/425	RHS	Bus Shelter
7	156/960	LHS	Bus bay with Bus Shelter
8	157/000	RHS	Bus bay with Bus Shelter
9	157/380	LHS	Bus bay with Bus Shelter
10	157/380	RHS	Bus bay with Bus Shelter
11	157/950	LHS	Bus Shelter
12	158/080	RHS	Bus Shelter
13	158/400	LHS	Bus Shelter
14	158/550	RHS	Bus Shelter
15	159/380	RHS	Bus Shelter
16	159/520	LHS	Bus Shelter
17	160/220	LHS	Bus bay with Bus Shelter
18	160/300	RHS	Bus bay with Bus Shelter
19	160/810	LHS	Bus Shelter
20	160/800	RHS	Bus Shelter
21	161/500	LHS	Bus Shelter
22	161/495	RHS	Bus Shelter

Source: DPR, 2020

3.4.5 Truck Lay Bye

For Omalur to Mecheri Road, the Truck Lay Bye consists of a taper length 70.0m with central parking area of 100.0 m length and 7.0 m wide, with 1.0m wide raised kerb island separating carriageway & Lay bye. Truck Lay bye is provided with Toilet and Drinking water facility. Proposed locations of the truck lay byes are presented in following table

Sl. No.	Design Chainage	Side	Location
1	8/160	RHS	Near Kamaneri

Source: DPR, 2020

For other Phase – 1 corridors (Malliyakarai to Attur Road and Chithode to Erode Road) the requirement for truck lay bye is not envisaged and hence it is not proposed.

3.4.6 Pedestrian Crossings

Adequate pedestrian crossing facilities conforming to IRC_103:2012 are provided at all important intersections and such other locations where substantial conflict exists between vehicular and pedestrian movements. All pedestrian crossings are provided with Road studs and Prior Sign boards.

3.4.6.1 Crossings at Intersections

Controlled form of at-grade pedestrian crossings with zebra lines and road studs are provided at all major intersections with ample lighting to facilitate night vision at crossings. A separate signal phase is provided for pedestrian crossings at signalized junctions.

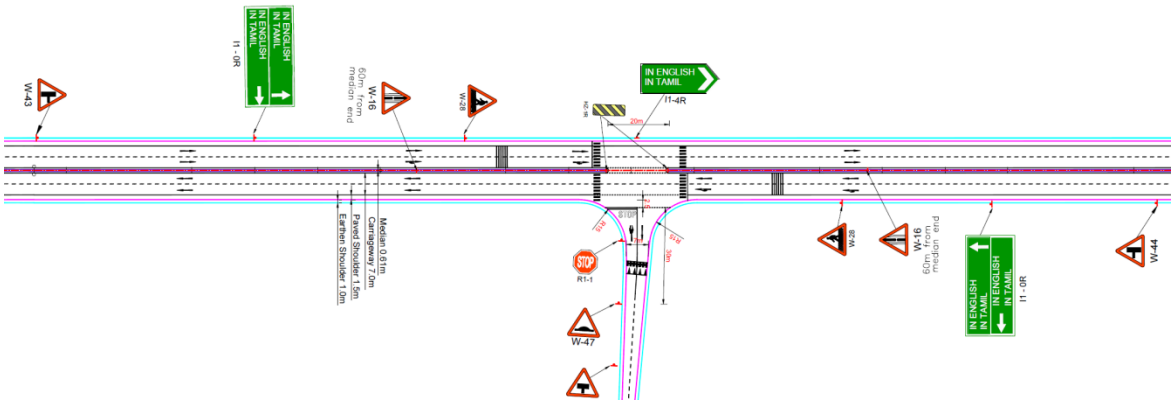


Figure 7: Type Design of three Arm Channelised Intersection

a) Pedestrian Crossing location in Omalur to Mecheri Road

Sl No	Chainage	Zebra Crossing Location	
1	1/660	Minor Junction	 Minor Intersection located at km 1/600
2	1/900	Minor Junction	
3	2/650	Minor Junction	
4	3/010	Minor Junction	
5	3/290	Minor Junction	
6	3/425	Minor Junction	
7	3/550	Minor Junction	
8	3/750	Hospital	
9	3/800	School	
10	4/060	Minor Junction	
11	4/200	Hospital	
12	4/580	Minor Junction	 **Minor Intersection located at km 4/960**
13	4/680	School	
14	4/960	Minor Junction	
15	5/340	Minor Junction	
16	6/215	MajorJunction	
17	6/970	Minor Junction	
18	7/815	Minor Junction	
19	7/965	Minor Junction	
20	8/560	Minor Junction	
21	8/840	Minor Junction	
22	9/020	College	
23	9/140	Minor Junction	

Sl No	Chainage	Zebra Crossing Location	
24	10/010	Minor Junction	
25	10/480	Minor Junction	
26	11/245	Minor Junction	
27	11/275	Minor Junction	
28	11/890	Minor Junction	
29	11/985	Minor Junction	
30	12/320	Minor Junction	
31	12/580	Minor Junction	
32	12/980	Minor Junction	
33	13/480	Minor Junction	
34	13/940	Minor Junction	**Minor Intersection located at km 10/480**

Source: DPR 2020

b) Pedestrian Crossing location in Malliyakarai to Attur Road

Sl No	Chainage	Zebra Cossing Location	
1	81/125	Junction	
2	81/510	Junction	
3	81/900	Junction	
4	82/040	Junction	
5	82/310	Junction	
6	82/760	Junction	
7	82/900	Junction	
8	83/135	Junction	
9	83/145	Junction	
10	84/185	Junction	
11	84/580	Junction	
12	84/500	Junction	**Minor Intersection located at km 83/145**
13	85/410	Junction	
14	85/600	Junction	
15	85/705	Junction	
16	86/550	Junction	
17	87/200	Junction	
18	87/365	Junction	
19	87/965	Junction	
20	88/035	Junction	
21	88/540	Junction	
22	89/140	Junction	
23	90/515	Junction	
24	90/760	Junction	**Minor Intersection located at km 87/365**
25	90/990	Junction	

Source: DPR 2020

c) Pedestrian Crossing location in Chithode to Erode Road

Sl No	Chainage	Zebra Cossing Location
1	154/045	Junction
2	154/215	Junction
3	154/330	College
4	155/380	School
5	155/472	Junction
6	155/580	Junction
7	155/925	Junction
8	156/327	Junction
9	156/658	Junction
10	156/800	School
11	156/864	Junction
12	157/247	Junction
13	157/278	Junction
14	157/453	Junction
15	158/443	Junction
16	158/493	Junction
17	159/260	Junction
18	159/405	Junction
19	160/188	Junction
20	160/250	College
21	160/520	School
22	160/580	School
23	160/690	Junction
24	161/030	School
25	161/400	College
26	161/725	Junction

Minor Intersection located at km 154/215

Minor Intersection located at km 159/405

Source: DPR 2020

3.4.6.2 Mid-Block Zebra Crossings

With reference to IRC_103:2012, mid-block zebra crossings are provided where distance between two consecutive intersections is more than 300m and simultaneously, there is a genuine demand for such facility i.e. at important crossing locations like schools, hospitals and bus stop locations. At such important crossing locations, provision is given for additional safety measures like raised footpath and railings along with zebra crossings and road studs with markings and cautionary signs.

3.4.7 Rainwater Harvesting interventions

As per the Central Groundwater Board studies (CGWB), the project districts namely Salem and Erode are categorised as “Over exploited Zone” and “Critical Zone” respectively. In view of that as an enhancement measure in this project. It is proposed to have Artificial Groundwater Recharge Well for the project areas. For which the CGWB officials have been consulted and appropriate designs has been obtained. Based on the share design, the estimation for the quantity and the cost has been worked out and included in the EMP

budget, which is one of the bill in the BoQ for immediate implementation. The details of the Artificial Groundwater Recharge Well is explained in the section 8.1.6.8.

3.4.8 Materials required for Phase-1 Road Construction

The construction materials required for Phase 1 Corridors is estimated as per the design specification and given in the following table

Material item	Tentative Quantity of materials	Unit	Source
Aggregates	424653	Cum	Existing Quarry
M - Sand	10413	Cum	Existing Quarry M-Sand
Cement	7424	MT	Local Supply
Bitumen (VG-40)	5595	MT	Manali Refinery- Chennai
Steel	1313	MT	Local Supply
Water	615	KLD	Surface/Ground water

3.5 Road Construction Standards, Norms and Guidelines

Codes of Practice of Indian Road Congress (IRC), particular to environmental issues, which are relevant to the proposed project, are presented as **Annexure 1**. These guidelines should be followed by the implementing agency during road construction.

4 LEGAL AND INSTITUTIONAL FRAMEWORK

4.1 National and State Rules and Regulations

To understand the extent of the environmental and social assessment for the proposed improvement works in the Phase – 1 Corridors, the applicable laws, legislation, and policies have been reviewed. The detailed note on the applicable rules and regulations are given in the **Annexure 2.** A summary of environmental legislation/regulations relevant to the project road is furnished in the following table.

Table 20: Applicable Acts, Rules and Regulation

Policy/ Acts/Rules	Year	Purpose	Responsible Institution	Applicability (Yes/ No)
Environment (Protection) Act.	1986	To protect and improve the overall environment	MoEF&CC	Yes, It is an umbrella act and it is applicable for the Phase – 1 Corridors
Environment Impact Assessment Notification and amendments	2006 2009 2013[5] 2015[6]	To provide environmental clearance to new development activities following the environmental impact assessment.	MoEF&CC & SEIAA	No[7], it is not applicable
Notification on use of fly ash (subsequent amendments)	2003 2009 2016	To mandate reuse of large quantities of fly ash from thermal power plants for development projects within a 300km radius.	MoEF&CC	Yes[8], Mettur Thermal Power plant is the nearest (within 300km) for SH-222, SH – 30 and SH -15
Wildlife Protection Act (subsequent amendments)	1972 2002	To protect wild animals and birds through the creation of National Parks / Sanctuaries and it also provides more stringent sections detailing punishments, includes the penalty for offenses under the Act.	MoEF&CC (Wildlife Division)	No, there is no National Parks / Sanctuaries/ Environmental sensitive locations within or in the Phase – 1 Corridors influence area.
Forest (Conservation) Act	1980	To protect and manage forests, to check deforestation by restricting the conversion of forest areas into non-forest areas	Forest department, GoTN/ MoEF&CC	No, there is no forest area abutting or near the Phase – 1 Corridors
Biological Diversity Act	2002	Disclosure of species survey or collection activities to the National	MoEF&CC	No, there is no National Parks / Sanctuaries/

[5]highway expansion projects require Environmental Clearance if, Expansion of National Highways greater than 100 km involving additional right of way or land acquisition greater than 40 m on existing alignments and 60m on re-alignments or by-passes

[6]Consideration of development projects located within 10km of National Park and Sanctuaries seeking environmental clearance under EIA Notification, 2006

[7]As per EIA Notification 2006 & subsequent amendments, Environmental clearance will be required if any State Highway project road under TNRSP –II is passing in hilly terrain (above 1,000 m AMSL) and or ecologically sensitive area

[8] The use of Fly Ash is subjected to its availability from the nearby Thermal Power Stations/Plants. A written communication from the North Chennai Thermal Power Station (NCTPS) is enclosed in the **Annexure 3**.

Policy/ Acts/Rules	Year	Purpose	Responsible Institution	Applicability (Yes/ No)
		Biodiversity Authority		Environmental sensitive locations within or in the Phase – 1 Corridors influence area
Water (Prevention and Control of Pollution) Act (and subsequent amendments)	1974	To provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.	CPCB/ TNPCB	Yes, for establishing Labour camps, Hotmix plants, batching plants crushers and quarries
Air (Prevention and Control of Pollution) Act (and subsequent amendments)	1981	To provide for the prevention, control, and abatement of air pollution, and for the establishment of Boards to carry out these purposes.	CPCB/ TNPCB	Yes, for establishing Labour camps, Hotmix plants, batching plants crushers and quarries
Noise Pollution (Regulation and Control) rules	2000	Noise pollution regulation and controls	CPCB/ TNPCB	Yes, as per the Environmental Protection Act 1986
Hazardous Waste (Management& Transboundary Movement) Rules and subsequent amendments	2008 2016 2019	Storage, handling, transportation, and disposal of hazardous waste	TNPCB	Yes, storage and handling of Hazardous waste during construction
The municipal solid waste management rules and subsequent amendments	2000 2016	Management and handling of solid waste	TNPCB, and concern ULB's/ corporation	Yes, for disposal of solid waste generated during construction
Batteries (Management and Handling) Rules	2001 2010 2016 2018	Safe recycling of lead-acid batteries	TNPCB	Yes
Public Liability and Insurance Act	1991	Protection form hazardous materials and accidents	Third-Party Insurance Company	Yes
Minor Minerals Conservation land Development Rules	2010 2017	For new quarry operations	District Collector	Yes
Explosive Act Explosive Rule	1984 2008	Safe transportation, storage and use of explosive material	Chief Controller of Explosives	Yes, for the use of explosives under unforeseen circumstance
Tamil Nadu Minor Mineral Concession Rules	2008 2016	For new quarry operations	Mining & Geology Department	Yes
Tamil Nadu Groundwater (Development and Management) Act	2003	To protect groundwater resources from over exploitation and to ensure its planned development and proper management in Tamil Nadu	Groundwater Department, GoTN	Yes, for the use of groundwater for construction purposes

Policy/ Acts/Rules	Year	Purpose	Responsible Institution	Applicability (Yes/ No)
Environmental Clearance (EC) under EIA notification (and subsequent amendments) for new Quarry areas	2006	For new quarry operations	SEIAA, TNPCB	Yes, for new quarry operations it is mandatory to obtain EC from the SEIAA
Central Motor Vehicle Act Central Motor Vehicle Rules	1988 1989 2019	To control vehicular air and noise pollution. To regulate the development of the transport sector, check and control vehicular air and noise pollution.	Transportation Department, GoTN	Yes, for all the vehicles used for construction purposes in the Phase – 1 Corridors
The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act	2010	To amend the Ancient Monuments and Archaeological Sites and Remains Act, 1958, including a declaration of regulated and prohibited areas around the monuments.	Department of Archaeology, GoTN, National Monuments authority	Yes, in case of chance-find
The Right to Fair Compensation and Transparency in Land Acquisition Rehabilitation and Resettlement Act, 2013 (Act 30 of 2013) (LARR)	2013	set out rules for fair compensation and acquisition of land	The revenue department, GoTN	Yes, it will be applicable as there will be a land acquisition for widening, geometric improvements and realignment
The Tamil Nadu Protection of Tanks and Eviction of Encroachment Act, 2007	2007	An Act to provide measures for checking the encroachment, eviction of encroachment in tanks which are under the control and management of the Public Works Department, protection of such tanks and for matters incidental thereto.	Water Resource Department (WRD), PWD	Yes, it will be applicable for the widening of roads near the water bodies
Tamil Nadu Highways Act, (TNHA)	2001	An Act to provide for the declaration of certain highways to be State highways, restriction of ribbon development along such highways, prevention and removal of encroachment thereon, construction, maintenance and development of highways, and levy of betterment charges and for matters connected	Tamil Nadu Highways Department, GoTN	Yes, it will be applicable as there will be a land acquisition for widening, geometric improvements and realignment

Policy/ Acts/Rules	Year	Purpose	Responsible Institution	Applicability (Yes/ No)
		therewith or incidental thereto		

Source: CPCB, MoEF&CC, TNPCB, and TNRSP

4.2 Other Legislation Applicable to Road Construction

Environmental issues during road construction stage generally involves equity, safety, and public health issues. The road construction agencies requires 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);
- **Payment of Wages Act, 1936** (it lays down as to by what date the wages are to be paid, when it will' be paid and what deductions can be made from the wages of the workers);
- **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 Labour (Prohibition and Regulation) Act; 1986** (the Act prohibits employment of children below 14 years of age in certain occupation and processes and provides for regulation of employment of children in all other occupation 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, traveling 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);
- **Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996** (this rule provides for operation of on-site and Off-site Emergency Plans during chemical disaster)

4.3 World Bank safeguard/ Operational policies

The World Bank policies and directives on environmental and social safeguards needs to be adhered for the project roads. The applicability of the relevant policies of the project roads that are undergoing up-gradation (strengthening and widening) are summarized in the following table.

Table 21: Applicable World Bank Operational policies

OP 4.01 Environmental Assessment	Help to ensure the environmental and social soundness and sustainability of investment projects. Support integration of environmental and social aspects of projects in the decision-making process
OP 4.04 Natural Habitats	Promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions.
OP 4.36 Forestry	Aims to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively for sustainable economic development and protect vital local and global environmental services and values of forests
OP 4.10 Indigenous People	Design and implement projects in a way that fosters full respect for indigenous peoples' dignity, human rights, and cultural uniqueness so that they i. Receive culturally compatible social and economic benefits, and ii. Do not suffer adverse effects during the development process. The outcome of the social survey confirms there are no Indigenous people identified/ observed along the AF project corridors and hence this OP 4.10 is not applicable for this project.
OP 4.11 Physical Cultural Resources (PCR)	Assist in preserving PCR and in avoiding their destruction or damage. PCR includes resources of archaeological, paleontological, historical, architectural, religious (including graveyards and burial sites), aesthetic, or other cultural significance.
OP 4.12 Involuntary	Avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or at least restoring their

Resettlement	livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing before the beginning of project implementation, whichever is higher.

4.4 Summary of Clearance Requirement

The clearance requirements to comply are listed in the **Error! Reference source not found.**. As part of the corridor specific ESMP, these requirements will be adequately integrated into the construction contract documents.

Table 22: Environmental Clearance/ NoC/Permission for the Contractor

Sl.no	Clearances	Acts	Approving Agency	Time Frame	Responsibility	
					Execution	Supervision
1.	Consent to Establish and Operate Hot mix plant, Crushers, Batching Plant and Labour Camps	Water (Prevention and Control of Pollution) Act 1974 Air (Prevention and Control of Pollution) Act. 1981	Tamil Nadu Pollution Control Board	3 months	Contractor	PIU/ Supervision Consultant
2.	Permission for removal of avenue tree within the RoW	Forest (Conservation) Act, 1980 and amendments and rules therein	Revenue Divisional Officer	3 - 6 months	Contractor	PIU/ Supervision Consultant
3.	Authorisation for Disposal of Hazardous Wastes	Hazardous Wastes (Management, Handling, and Transboundary Movement) Rules, 2016.	Tamil Nadu Pollution Control Board	2 months	Contractor	PIU/ Supervision Consultant
4.	Permission for Sand Mining from River bed	Mines and Minerals (Development and Regulation) Act, 1957 Environmental (Protection) Act 1986 Water (P& CP) Act 1974 and Air (P& CP) Act 1981	Commissioner of Geology and Mining, GoTN Environmental Clearance from SEIAA, Go TN CTE/CTO from TNPCB	2 – 6 months	Contractor	PIU/ Supervision Consultant
5.	Permission for Opening of New Quarry	Mines and Minerals (Development and Regulation) Act, 1957 Environmental (Protection) Act 1986 Water (P& CP) Act 1974 and Air (P& CP) Act 1981	Commissioner of Geology and Mining, GoTN Environmental Clearance from SEIAA, Go TN CTE/CTO from TNPCB	2 – 6 months	Contractor	PIU/ Supervision Consultant
6.	Storage of Hazardous Chemicals	Manufacturing Storage and Import of Hazardous	Chief Controller of Explosive,	3 months	Contractor	PIU/ Supervision Consultant

Sl.no	Clearances	Acts	Approving Agency	Time Frame	Responsibility	
					Execution	Supervision
	(Fuel Oils) and Explosives	Chemicals Rules 1989	Chennai			
7.	Permission for Withdrawal of Ground Water	Environmental (Protection) Act, 1986	Central/State Ground Water Board	3 months	Contractor	PIU/ Supervision Consultant
8.	Pollution Under Control Certificate	Central Motor Vehicles Act 1988	Transport Department (GoTN)	1 Month	Contractor	PIU/ Supervision Consultant
9.	Employing Labour	The Building And Other Construction Workers. (Regulation of Employment and Conditions of Service) Act, 1996	Labour & Employment Dept., GoTN	1 Week	Contractor	PIU/ Supervision Consultant
10.	Registration of Workers	Labour Welfare Acts.	Labour & Employment Dept., GoTN	1 Month	Contractor	PIU/ Supervision Consultant

Source: CPCB and MoEF&CC

5 BASELINE ENVIRONMENTAL STATUS

To assess the construction impacts, due to the implementation of the Phase – 1 Corridors to the surrounding environment, field visits and baseline environmental monitoring were conducted. As per the EIA guidance manual for Highways, published by the MoEF, a study area of 10km buffer from the RoW has been fixed as study area. The field visits include an inspection of sensitive locations, consultations with the locals/ communities and recording the visual observations. Secondary information was collected from the various stakeholders, government agencies, literature and publications (including internet information). Based on the secondary information, the data gap has been identified and it is fulfilled by collecting primary information, which includes baseline environmental monitoring for key environs and conducting FGD's, public consultation, etc. This chapter comprises of the following:

- Physical environmental components such as meteorology, geology, topography, soil characteristics, air quality, noise quality, surface, sub-surface water quality, etc;
- Biological environmental components such as terrestrial flora and fauna; and
- The socio-cultural and economic environment in terms of demography, land use, etc.,

Phase – 1 Corridors traverses through Salem and Erode districts, hence the secondary information on the environmental profile of the districts have been taken for discussion.

Sl.no	Project Roads	Project District
1	SH 222 (Omalur to Mecheri)	Salem
2	SH 30 (Malliyakarai to Attur)	Salem
3	SH 15 (Chitode to Erode) and	Erode

Source: TNRSP

5.1 Physical Environment

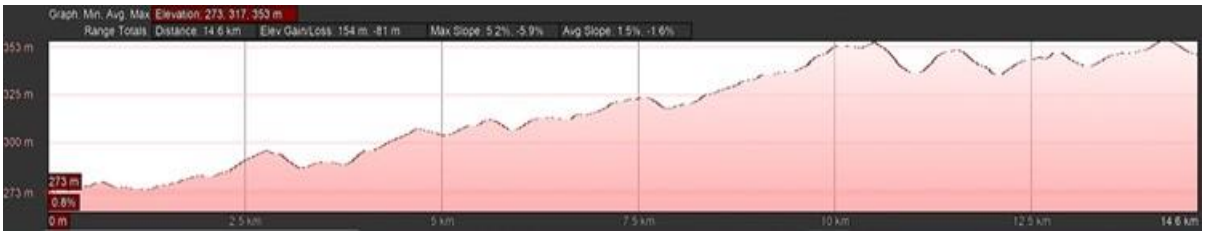
5.1.1 Topography

The elevation of landscape in Salem district generally ranges from 150 m to 400 m amsl with the exception of Yercaud, which is at 1500 m above MSL. Shervroy Hills and Kalrayan Hills adorn the district with natural beauty and forest wealth. The district forms part of the upland plateau region of Tamil Nadu with many hill ranges, hillocks and undulating terrain with a gentle slope towards east. Erode district represented by the Eastern and Western Ghats in the north-western direction, the Biligiri Rangan hills in the north, Bodamalai Betta hills in the north-western parts and Konbattarayan hills in the north central part of the district. Konbattarayan hill (1699 m above MSL) is the highest peak in the district. The plain area in the Erode district is characterised by an undulating topography with a general gradient due east and southeast.

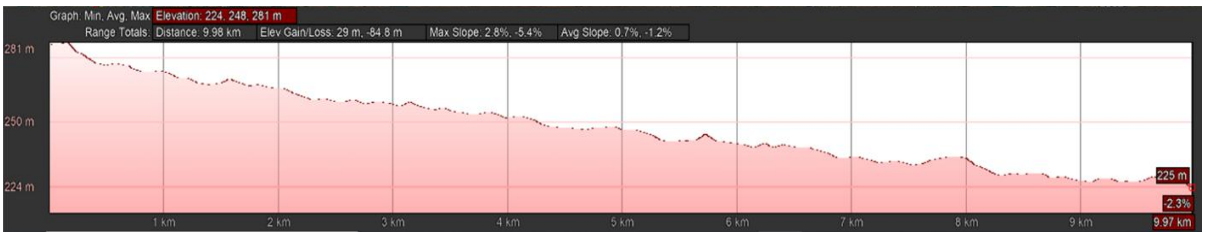
(i) **Omalur to Mecher Road (SH 222)**: The project stretch passes entirely through plain terrain. The elevation of the project road is varying from 273 m to 346 m AMSL with average of 318 m AMSL. It shows a gradual increase in elevation from the starting point of the project corridor near Omalur and reaches the highest value near Mecheri town.

(ii) **Malliyakarai to Attur Road (SH 30)**: The project stretch passes through plain terrain. Project road elevation varies between 225m to 280m AMSL with average of 252m AMSL. The elevation profile shows a steep slope with respect to the distance from Malliyakari to Attur.

(iii) **Chithode to Erode Road (SH 15)**: The project stretch has an undulating terrain, Chithode has 192m AMSL and Erode has 179m AMSL. The profile shows decrease in elevation toward Erode. The highest elevation was 194m AMSL.



Omalur to Mecheri Road (SH 222)



Malliyakarai to Attur Road (SH 30)

Chithode to Erode Road (SH 15)

Source: Google Earth, Image 2019

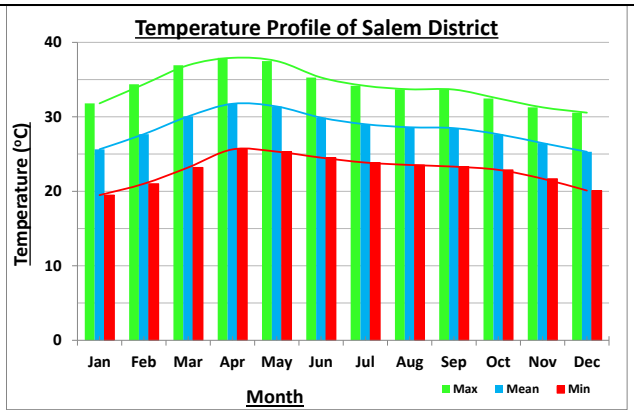
Figure 8: Phase – 1 Corridors Elevation Profile

5.1.2 Climate and Temperature

The project districts (Salem and Erode) experience semi-arid tropical climate wherein four distinct seasons viz., South west monsoon (June – Sep.), North East monsoon (Oct – Dec.), winter season (Jan. – Feb.) and summer season (April – May) are experienced.Maximum temperature is recorded in the months of March-May and minimum temperature is recorded in the months of November to February. Temperature pattern for Salem district is shown in the table. The monthly mean temperature varies from 25°C to 32°C. The highest humidity recorded in the month of October (~ 71%) and the lowest in the month of March (~ 46 %). Winds are generally light to moderate with some strengthening in monsoon season in Salem district. The region is influenced by winds from south-west and north-west during the period from May to September and from north-east and south-east during the period from October to April. For Erode district, the monthly mean temperature varies from 17°C to 22 °C (refer table 24). The wind pattern is very much similar to the Salem district.

Table 23: Temperature Profile of Salem District

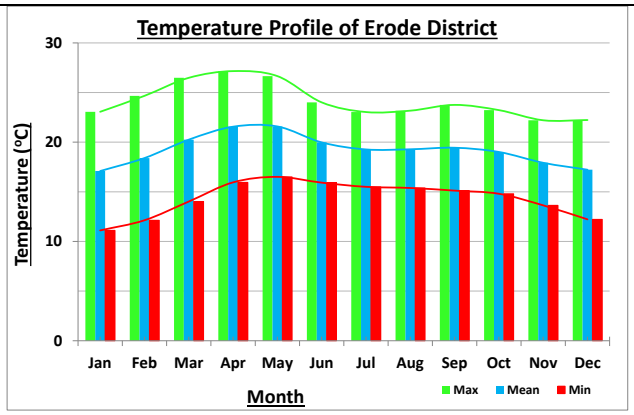
Month	Monthly Temperature Values (°C)		
	Maximum	Minimum	Mean
Jan	31.80	19.48	25.64
Feb	34.36	21.01	27.67
Mar	36.93	23.20	30.05
Apr	37.92	25.62	31.75
May	37.48	25.32	31.38
June	35.27	24.51	29.88
Jul	34.16	23.85	29.00
Aug	33.69	23.53	28.59
Sep	33.66	23.31	28.48
Oct	32.46	22.88	27.66
Nov	31.27	21.69	26.47
Dec	30.55	20.10	25.30
Avg	34.13	22.89	28.49



Source: Website of Department of Economics and Statistics, GoTN, 2018

Table 24: Temperature Profile of Erode District

Month	**Monthly Temperature Values (°C)**		
	Maximum	**Minimum**	**Mean**
Jan	23.06	11.11	17.09
Feb	24.66	12.13	18.40
Mar	26.48	14.02	20.25
Apr	27.16	15.95	21.56
May	26.65	16.50	21.58
Jun	24.01	15.92	19.97
Jul	23.03	15.50	19.26
Aug	23.17	15.38	19.28
Sep	23.75	15.12	19.44
Oct	23.23	14.80	19.01
Nov	22.20	13.63	17.92
Dec	22.23	12.22	17.22
Avg	**24.14**	**14.36**	**19.25**



Source: Website of Department of Economics and Statistics, GoTN, 2018

5.1.3 Rainfall

The project districts receives the rain under the influence of both southwest and northeast monsoons. However, the Northeast monsoon chiefly contributes to the rainfall. In Salem district, the normal annual rainfall varies from about 800 mm to 1400 mm. It is the minimum around Sankari (800 mm) in the south-western part of the Salem district. It gradually increases towards north, northeast and east and attains a maximum around Yercaud (1594.3 mm) in the northern part. Rainfall projection up to the year 2080 shows a decrease rainfall trend for Salem district to about 7%.

Table 25: Rainfall Information for Salem District (2006 to 2016)

Year	South west Monsoon(Jun to Sep)	North East Monsoon (Oct to Dec)	Winter season (Jan to Feb)	Summer Season (Mar to May)	Total
2006-07	371.3	347.4	0.6	88.6	807.9
2007-08	488	375.6	15	267.1	1145.7
2008-09	466.3	359	2.3	189.7	1017.3
2009-10	397.9	208.8	6.5	172.4	785.6
2010-11	548.8	564.2	8.7	211.4	1333.1

Year	South west Monsoon(Jun to Sep)	North East Monsoon (Oct to Dec)	Winter season (Jan to Feb)	Summer Season (Mar to May)	Total
2011-12	448.4	447.3	0	115.3	1011
2012-13	441	275.2	13	70.1	799.3
2013-14	491.7	255.6	1.1	154.1	902.5
2014-15	369.8	332.5	22	277	1001.3
2015-16	348.3	488	0	145.3	981.6

Source: Salem District Statistical Handbook 2015-16

In Erode District, the normal annual rainfall varies from about 600 mm to 1100 mm similar to Salem district the projected rainfall trend shows a decrease of about 7% by the year 2080.

Table 26: Rainfall Information for Erode District (2006 to 2016)

Year	South west Monsoon(Jun to Sep)	North East Monsoon (Oct to Dec)	Winter season (Jan to Feb)	Summer Season (Mar to May)	Total
2006-07	174.5	386.2	0.6	66.4	627.7
2007-08	203.9	446.7	27.0	215.9	893.5
2008-09	204.3	448.7	21.0	213.4	887.7
2009-10	209.3	324.5	.7	153.3	710.6
2010-11	305.3	495.4	9.9	59.6	1037.8
2011-12	229.8	314.6	16.1	142.4	702.9
2012-13	185.0	234.3	33.1	81.8	534.2
2013-14	233.1	210.0	0	80.8	523.9
2014-15	287.3	330.0	4.8	222.6	844.7
2015-16	204.5	370.9	0	56.9	632.4

Source: Erode District Statistical Handbook 2015-16

5.1.4 Seismicity

As per the seismic zone classification of India, Salem district is lying in Earthquake Zone hazard Zone III (Moderate Damage Risk Zone) and for Erode district, it is Earthquake Zone hazard Zone II (Low Damage Risk Zone). However, the whole project area falls in the vast volcanic basalt beds of Deccan plate, which is formed towards the end of Cretaceous period, between 65 and 67 million years ago. There is no recent seismic and volcanic activity reported along the project area. Given this, the project components including the structures (bridges,

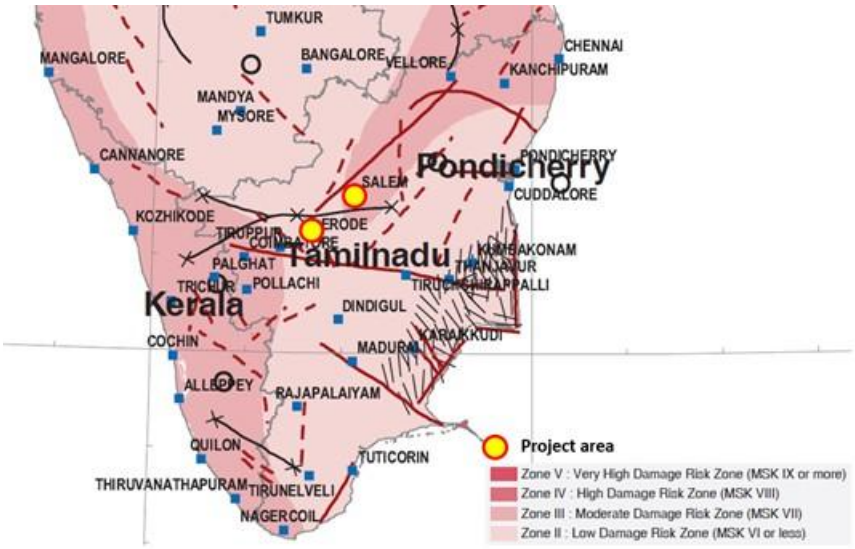


Figure 9: Earthquake Hazard Map

culverts) will be constructed to withstand the level of seismic activity as per ISI specifications for Zone – II and Zone III.

5.1.5 Soil Types

As per the CGWB information on soil characteristics, the soil in Salem district has been classified into 6 major soil types namely Red insitu, Red Colluvial Soil, Black Soil, Brown Soil, Alluvial and Mixed Soil. A major part of the district is covered by Red insitu and Red Colluvial soils. Similarly Erode district also has 6 major types of soils namely Red calcareous soil, Red non-calcareous soil, Black Soil, Alluvial and Colluvial soils, Brown soil and Forest soil. A major part of the Erode district is covered by red calcareous soil. From the outcome of the soil sample analysis for its physicochemical properties, it is evident that the soil samples are suitable for agricultural purposes. The key nutrients, NPK is observed to be high for the sample collected from Thandavarayapuram. However, the organic content in the soil is high for the sample collected from Chithode. High percent of sand and electric conductivity is also observed in the Chithode.

Table 27: Soil Sample Analysis for the Project Road

Sl.no	Parameters	Units	Salem District		Erode District	
			Near Pachanampatti	Thandavarayapuram	Chithode	Vasantha Nagar
1	Soil Texture	-	Sandy Loam	Sandy Loam	Loamy sand	Sandy Loam
2	Soil Texture i)Sand	%	60.28	59.28	80.25	44.62
3	Soil Texture ii)Silt	%	37.6	38.42	14.72	40.16
4	Soil Texture iii)Clay	%	2.12	2.3	5.03	15.22
5	pH (at 25°C) @ 10% Solution	-	9.75	8.64	9.02	8.35
6	Electrical Conductivity (at 25°C)	µS/cm	55.5	40.2	145.8	92.5
7	Cation exchange capacity	meq/ 100g	7.96	8.08	9.3	9.3
8	Moisture Content	%	6.9	7.71	10.42	5.02
9	Water holding capacity	%	31.6	29.6	8.71	30.28
10	Salinity	PSU	1.06	1.74	3.06	0.52
11	Particle Size Distribution	-	Passed through 850 micron	Passed through 850 micron	Passed through 850 micron	Passed through 850 micron
12	Potassium	mg/ kg	19.7	32.36	74.2	89.4
13	Phosphate	mg/ kg	12.32	62.3	4.53	35.98
14	Sodium	mg/kg	281.53	462.3	247.2	149.2
15	Porosity	%	31	29	8.7	30.26
16	Sodium Absorption Ratio	meq/kg	2.12	3.67	3.1	1.54
17	Nitrate as NO3	mg/kg	708.08	1445.67	4.06	6.38
18	Organic Content	%	0.82	0.78	2.76	1.24

Source: primary Environmental Monitoring, 2020

5.1.6 Hydrogeology

Salem district is underlained entirely by Archaean Crystalline formations with recent alluvial and Colluvial deposits. Weathered and fractured crystalline rocks and the Recent Colluvial deposits constitute the important aquifer systems in the district.The thickness of these aquifer's ranges from few meters to as much as 25 m. Groundwater occurs under phreatic conditions and is developed by means of dug wells. The depth to water level varies between 0.10 – 11.46 m bgl during pre-monsoon and 0.10 – 17.15 m bgl during post-monsoon. Erode district is underlained entirely by Archaean Crystalline formations with recent alluvial deposits occurring along the river and streams courses and colluvium of valley-fills. The depth to water level varies between 1.76 and 35.69 m bgl during pre-monsoon and 1.53 and 16.40 m bgl during post-monsoon. As per CGWB assessment, Salem district comes under Over Exploited zone and Erode district is under the critical zone.

Sl.no	Groundwater Potential (as per CGWB)	Salem	Erode
1.	Net Groundwater Availability (In MCM)	523.56	696.03
2.	Existing Gross Groundwater Draft For All Users (In MCM)	856.32	651.68
3.	Stage Of Groundwater Development (In %)	1.64	0.94
4.	Categorization Of District	Over Exploited	Critical

Source: CGWB, 2008

5.1.7 Land Use

Salem District: The land use pattern of Salem district is furnished in table-28. Majority of the land use is dominated by agriculture (40%), which is followed by forest area (24.2%). Uncultivable land and non-agriculture land put together constitutes about 19%.

Table 28: Landuse Pattern of the Salem District

Sl. No.	Classification	Area (ha)	%
1	Forest Land	125682	24.2
2	Barren and uncultivable lands	38894	7.5
3	Land put to non-agricultural uses	60972	11.5
4	Cultivable Waste	4947	1.0
5	Permanent pastures and other grazing lands	4200	0.8
6	Land under misc. tree crops and groves	2936	0.6
7	Current fallows	57824	11.1
8	Other fallow lands	16949	3.3
9	Net area sown	208126	40.0
10	Total geographical area	520530	100.0

Source: Website of Department of Economics and Statistics, GoTN, 2018

Erode District: The land use pattern is furnished in table-29. Majority of the land use is dominated by agriculture (36.9%), which is followed by forest area (28%). Uncultivable land and non-agriculture land put together constitutes to 10.8%.

Table 29: Landuse Pattern of the Erode District

Sl. No.	Classification	Area (ha)	%
1	Forest Land	228749	28.0
2	Barren and uncultivable lands	7074	0.9
3	Land put to non-agricultural uses	80708	9.9
4	Cultivable Waste	556	0.1
5	Permanent pastures and other grazing lands	187	0.0
6	Land under misc. tree crops and groves	1360	0.2
7	Current fallows	90697	11.1
8	Other fallow lands	105878	13.0

Sl. No.	Classification	Area (ha)	%
9	Net area sown	300982	36.9
10	Total geographical area	816191	100

Source: Website of Department of Economics and Statistics, GoTN, 2018

Landuse pattern along the Phase 1 Corridors.

(i) **Omalur to Mecheri Corridor**: The land use pattern along the project road SH 222 are built-up (55.1%), agricultural (39.7%) and barren land (5.1%), the predominant land use pattern is built-up. There is ribbon development along the road with small settlements at frequent intervals (Omalur (km 0/350), Paalikadai (km 3/350), Panjukalipatti (km 4/000),Chinthamaniyur aprivu (km 4/800), Tharamangalam (km 6/220), Chinnasattappadi (km 8/500), Sathapadi (km 9/000) and Mecheri (km 14/000).

(ii) **Malliyakarai to Attur Corridor:** The land use patterns along the project road SH 30 are agricultural (58.0%) and built-up (42.0%), the predominant land use pattern is agricultural. There is ribbon development along the road with small settlements at frequent intervals (Malliakarai (km 81/500), Eachampatti (83/160), Thandavarayapuram (km 87/340), Narasingapuram (km 91/100)).

(iii) **Chithode to Erode Corridor:** The land use pattern along the project road SH 15 are built-up (86.1%), Agriculture (7.3%), Barren (3.0%), Industries (1.2%) and water bodies (2.4%), the predominant land use pattern is built-up. High ribbon development observed along the existing road for the entire stretch (Chithode (km 153/900), Kongampalayam (km 156/600), Mamarathupalayam (km 156/900), Periyasemur (km 158/040), Maligainagar (km 159/320) and Veerappanchatram (km 161/000)).

5.1.8 Ambient Air Quality

Under the National Air Quality Monitoring Programme (NAQMP), secondary information on the ambient air quality for the Phase – 1 Corridors area or nearby locations are not available. To fill the gap, primary environmental monitoring has been conducted for the sensitive/ settlement locations along the Phase – 1 Corridors. The key objective of the baseline air quality study is to establish the existing ambient air quality of the study area. This will be useful for assessing the conformity to standards of ambient air quality during construction and operation phase. The outcome of the analysis is given in the **Error! Reference source not found.** (refer **Annexure 4**). From the observation, it is evident that the AAQ quality in the Phase – 1 Corridors are in good condition. The recorded values against the parameters are less in concentration when compared with the stipulated AAQ standard.

Table 30: Ambient Air Quality in the Project Road

Sl.no	Project Corridors	Sampling Locations	Ambient Air Quality Parameters (µg/m³)			
			Sulphur Dioxide (SO_x)	Nitrogen Dioxide (NO_x)	Particulate Matter Size Less than 10 µm	Particulate Matter Size Less than 2.5 µm
1	Omalur to Mecheri	Pachanampatti Village	12.86	22.76	57.39	27.48
		Mecheri village	14.56	24.28	53.65	25.1
		Sadhapadi Village	15.38	25.5	49.16	22.7
2	Malliyakarai to Attur	Eachampatti Village	13.45	24.1	57.62	28.11
		Attur- Top of SKN Lodge	12.41	22.39	54.1	25.76
3	Chithode to Erode	Chithode Village	10.45	18.47	46.82	17.63
		Erode- Commercial Area	10.74	20.35	47.58	19.63

Sl.no	Project Corridors	Sampling Locations	Ambient Air Quality Parameters (µg/m³)			
			Sulphur Dioxide (SO_x)	Nitrogen Dioxide (NO_x)	Particulate Matter Size Less than 10 µm	Particulate Matter Size Less than 2.5 µm
NAAQ Standards : 2009			**80 (24 hours)**	**80 (24 hours)**	**100 (24 hours)**	**60 (24 hours)**

Source: primary Environmental Monitoring, 2020

The project envisages improvement of Phase – 1 Corridors which will ease the traffic flow reducing emission of air pollutants. Since project road generally passes through agricultural lands, it is not expected to have any negative impact on air quality. Further, the topography of the project influence area supports dispersion of pollutants to a great extent.

5.1.9 Noise levels

Noise level monitoring were conducted at pre-selected locations based on the land use and presence of sensitive features. The objective of assessing baseline noise levels can be later used to assess the impact of the total noise generated by the proposed project activities. Noise level monitoring has been carried out continuously for 24 hours with one hour interval at each location during the study period, Hourly Leq values were computed by the noise integrating sound level meter and statistical analysis was done for measured noise levels at the pre-selected locations in the Phase – 1 Corridors. The outcome of the analysis shows a significant increase in the sound levels near the sensitive receptors, this may be due to the movement of vehicles in the Phase – 1 Corridors, where the receptors are located nearby. The monitoring results are shown in the **Error! Reference source not found.** (Refer **Annexure 4**). It is suggested to have noise barriers to safeguard the sensitive receptors, by reducing the intensity of noise levels.

Table 31: Ambient Noise Levels in the Project Road

Sl.no	Project Corridors	Sampling Locations	Area classification	Noise Levels in dB (A)	
				Day Time	Night Time
1	Omalur to Mecheri	Sri Balamurugan College	Sensitive area	61.6	52.8
		Chinnasathanpadi	Residential area	62.2	51.5
		Raja manickam Hospital	Sensitive area	59.3	54.7
		South Indian School	Sensitive area	60.8	54.4
		Paalikadai School	Sensitive area	73.6	62.9
		Nalam Hospital	Sensitive area	67.5	55.1
		Paali kadai Primary Health center	Sensitive area	62.9	52.3
2	Malliyakarai to Attur	Rasi matric higher secondary school	Sensitive area	66.6	58.4
		Panchayat union public school Echampatti	Sensitive area	61.5	52.3
		Thandavarayapuram village Agricultural office	Commercial area	64.3	58.1
		Thandavarayapuram first Aid medical center	Sensitive area	67.9	60.6
		Attur police station	Commercial area	72.1	65.7
3	Chithode to Erode	Chithode Govt school	Sensitive area	62.8	55.6
		Tamilnadu ITI	Sensitive area	65.5	57.2
		Erode Hindu kalvi nilayam	Sensitive area	60.2	54.9
		CN College Veerapanchathiram	Sensitive area	63.1	56.0
		Thanthai Periyar Hospital	Sensitive area	64.0	56.2
CPCB Norms		**Industrial Area**		**75**	**70**

Sl.no	Project Corridors	Sampling Locations	Area classification	Noise Levels in dB (A)	
				Day Time	Night Time
		Commercial Area		65	55
		Residential Area		55	45
		Silence Zone		50	40

Source: primary Environmental Monitoring, 2020

5.1.10 Surface Drainage along Phase – 1 Corridors

i. Omalur-Mecheri Road (SH 222) does not have a major drain crossing (including stream/ river). The earthen drain is present along the project road, at some locations (especially at built-up sections) RCC drains are provided. The location of the RCC drain is given in the following table. However, there are no dedicated drain facilities near the water bodies (a pond is located at km 7/800).

Sl No	Existing km		Drain	Side
	From	To		
1	0/130	0/255	RCC	LHS
2	1/000	1/150	RCC	RHS
3	3/572	3/699	RCC	Both Sides
4	3/699	3/921	RCC	LHS
5	3/921	4/145	RCC	Both Sides
6	5/900	5/968	RCC	RHS
7	8/210	8/515	RCC	RHS
8	14/500	14/600	RCC	Both Sides

Source: DPR 2020

Box Culvert at Km 3/700

Cut Stone Slab Culvert at Km 6/900

ii. Malliyakarai – Attur Road (SH 30) is having 2 minor bridges and a causeway is located at km 82/447 (Minor Bridge), km 86/430 (Minor Bridge (Crossing Kombai River)) and km 89/525 (Causeway (Vented Causeway). The earthen drain is present along the project road, at some locations (especially at built-up sections) RCC drains are provided. The location of the RCC drains are given in the following table

Sl. No	Existing km		Drain	Side
	From	To		
1	81/054	81/174	RCC	RHS
2	83/070	83/470	RCC	Both Sides
3	85/700	85/825	RCC	RHS
4	87/500	87/540	RCC	RHS
5	87/650	87/775	RCC	Both Sides
6	87/835	88/020	RCC	Both Sides
7	89/740	89/910	RCC	RHS
8	90/015	90/210	RCC	RHS
9	90/475	90/675	RCC	RHS
10	95/760	91/015	RCC	RHS

Sl. No	Existing km		Drain	Side
	From	To		
11	91/085	91/120	RCC	RHS

Source: DPR 2020

Minor Bridge at km 82/447

Minor Bridge at km 86/430

iii. Chithode to Erode Road (SH 15) is having 4 minor bridges located at km 153/360, km 156/230, km 159/215 and km 159/715. RCC drain is observed along the project stretch at built-up sections, also the earthen drain is present along the project road. The location of the RCC drain is given in the following table

Sl.no	Existing km	Drain	Side
1	154/653	RCC	Both Sides
2	154/870	RCC	Both Sides
3	155/370	RCC	RHS
4	160/690	RCC	RHS
5	160/808	RCC	Both Sides

Source: DPR 2020

Minor Bridge at km 159/215

Slab Culvert at km 154/870

5.1.11 Water Quality

5.1.11.1 Surface water Quality

The availability of the surface water bodies along the Phase – 1 Corridors are very much limited and they are seasonal. In Omalur to Mecheri road, a pond is located at km 7/900, other than this, the project road is free from surface bodies. In Malliyakarai to Attur road there are no surface water bodies along the alignment. In Chithode to Erode road, a pond is located at 158/420.

Table 32: List of surface water bodies along the Phase – 1 Corridors

Sl.no	Project Roads	Chainage	Water body
1.	Omalur to Mecheri (SH 222)	10/800 (RHS)	Water Pond
2.	Malliyakarai to Attur (SH 30)	-	No water bodies available within the Project influence area
3.	Chithode to Erode (SH 15)	158/420 (RHS)	Water Pond

Source: DPR 2020

However, for generating the surface water quality for the Phase – 1 Corridors, other surface water bodies within the project influence area (10km radius from the proposed RoW) has been chosen. The prime objective of the baseline surface water quality study was to establish the existing water quality of the study area to evaluate the anticipated impact of the proposed project and to suggest appropriate mitigation measures for implementation. This will also be useful for assessing the conformity to the standards of surface water quality during the construction and operation phase of the project. In Malliyakarai to Attur (SH 30) Road, the surface water bodies are completely dried and hence surface water samples are not collected. The monitoring results for surface water quality are presented in the Table 33 **Error! Reference source not found.** (Refer **Annexure 4**).

Table 33: Surface water Quality in the Project Area

S.No.	Parameters	Units	Omalur to Mecheri		Chithode to Erode	IS 2296:1982 Tolerance limit
			Kamaneri Village	Melaguvandanur village	Annai sathya Nagar	
1.	pH (at 25 °C)	-	7.63	8.42	8.28	6.5 to 8.5
2.	Temperature	°C	29.1	29.1	29.2	-
3.	Electrical conductivity	µS/cm	397	904	941	-
4.	Colour	Hazen Unit	BLQ(LOQ:1.0)	BLQ(LOQ:1.0)	BLQ(LOQ 1.0)	300
5.	Turbidity	NTU	35	2	1	-
6.	CalciumHardness as $CaCO_3$	mg/l	65	90	140	-
7.	Magnesium Hardness as $CaCO_3$	mg/l	70	120	180	-
8.	Total Hardness as $CaCO_3$	mg/l	135	210	320	-
9.	Calcium as Ca	mg/l	26.05	36.07	56.11	75.0
10.	Total Alkalinity as $CaCO_3$	mg/l	145	200	290	-
11.	Chloride as Cl	mg/l	31.84	112.68	93.08	600.0
12.	Total Dissolved Solids	mg/l	215	457	507	1500.0
13.	Sulphate as SO_4	mg/l	20.17	71.29	74.04	200.0
14.	Fluoride	mg/l	0.21	0.32	0.31	1.5
15.	Nitrate as NO_3	mg/l	6.8	2.4	2.4	-
16.	Iron as Fe	mg/l	1.04	0.15	0.04	50.0
17.	Zinc as Zn	mg/l	BLQ(LOQ:1.0)	BLQ(LOQ:0.1)	BLQ(LOQ 0.1)	15
18.	Chromium as Cr	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	BLQ(LOQ 0.01)	0.05
19.	Copper as Cu	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	BLQ(LOQ 0.01)	1.5
20.	Cadmium as Cd	mg/l	BLQ(LOQ:0.001)	BLQ(LOQ:0.001)	BLQ(LOQ 0.001)	0.01
21.	Lead as Pb	mg/l	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	BLQ(LOQ 0.05)	0.1
22.	Arsenic as As	mg/l	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	BLQ(LOQ 0.05)	0.2
23.	Sodium as Na	mg/l	15	54	44	-
24.	Potassium as K	mg/l	1	4	3	-
25.	Phosphate as PO_4	mg/l	0.19	0.08	0.42	-
26.	Total suspended solid	mg/l	78	5	3	-
27.	BOD,3 days 27°C	mg/l	8	4	9	3.0

S.No.	Parameters	Units	Omalur to Mecheri		Chithode to Erode	IS 2296:1982 Tolerance limit
			Kamaneri Village	Melaguvandanur village	Annai sathya Nagar	
	as O_2					
28.	Chemical oxygen demand as O_2	mg/l	56	32	64	-
29.	Oil and Grease	mg/l	BLQ(LOQ:4.0)	BLQ(LOQ:4.0)	BLQ(LOQ 4.0)	0.1
30.	Dissolved oxygen	mg/l	5.9	6.1	5.9	4.0
31.	Salinity	ppt	0.06	0.2	0.17	-
32.	Total Nitrogen as N	mg/l	6.9	2.5	2.6	-
33.	Total Coliform	MPN/ 100ml	<2	<2	<2	-
34.	Faecal coliform	MPN/ 100ml	<2	<2	<2	-

Source: primary Environmental Monitoring, 2020

From the analysis, it is evident that the pH of the water remains alkaline for the surface water samples. The BOD and DO were observed to be high, which indicates the presence of the organic pollution, this may be due to discharge of sewage water into the water body or through some anthropogenic activities (cleaning of domestic animals, surface runoff from the nearby agriculture field, algal bloom due to the use of fertilisers etc.,).

5.1.11.2 Groundwater Quality

Groundwater quality in the Phase – 1 Corridors has been assessed through collection of water samples from the representative wells/ bore wells and hand pumps. The key purpose is to check the suitability of the water for potable and domestic purpose for the use of labours. Other requirements includes to check the pollution level in the water and to set the information as a base and to record the water quality during the construction period to check the impacts. The outcome of the analysis is given in the **Error! Reference source not found.** (Refer **Annexure 4**).

Table 34: Groundwater Quality in the Project Area

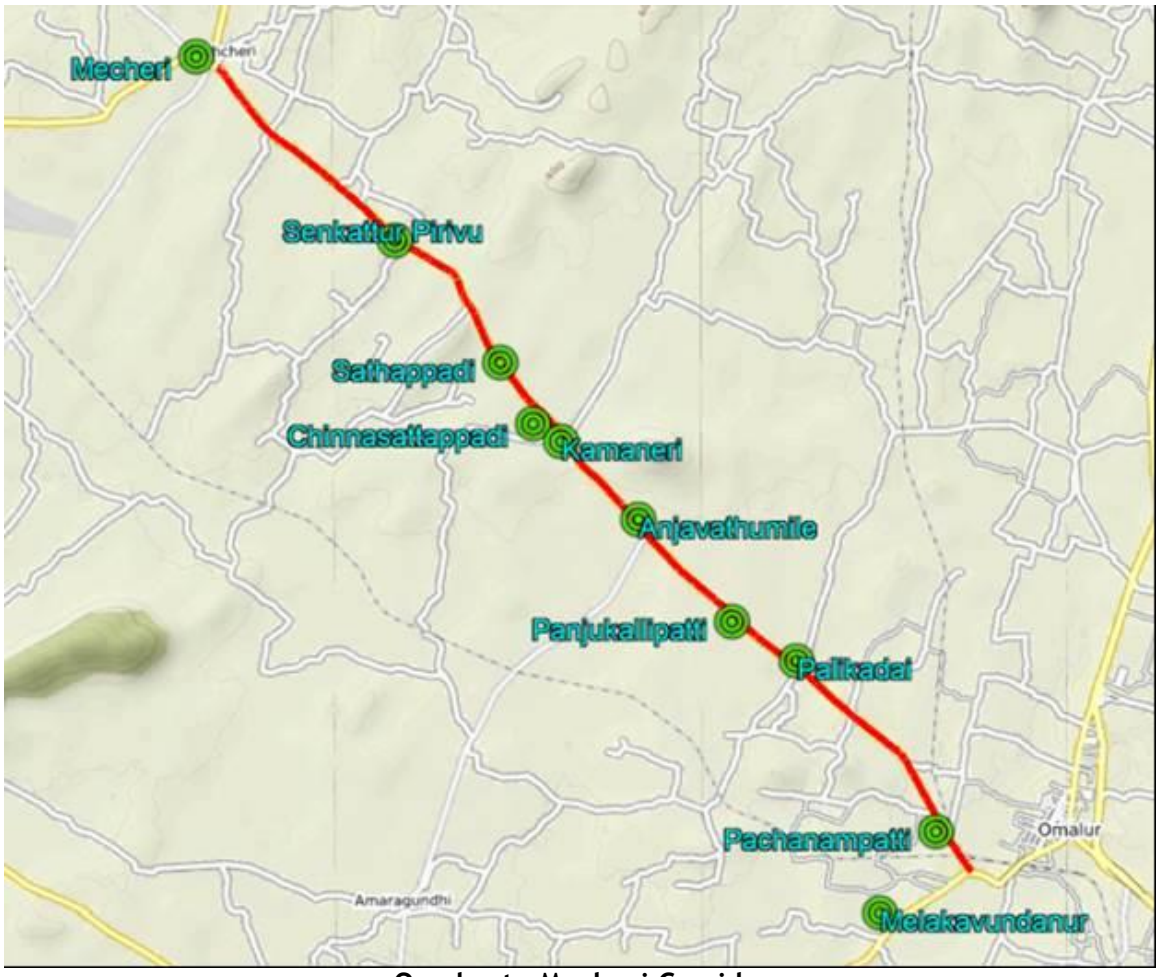
Sl. no	Parameters	Units	Pachanampatti Village	Anjavathu-Mile	Senkattur Pirivu Village	Eachampatti village	Attur - SKN Lodge	Erode Railway Station	IS:10500-2012 Permissible Limits
1	pH (at 25°C)	-	8.49	8.44	7.14	7.65	8.27	8.21	6.5 - 8.5
2	Colour	Hazen Unit	BDL	BDL	BDL	BDL	BDL	BDL	15
3	Turbidity	NTU	BDL	BDL	BDL	BDL	BDL	BDL	5
4	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
6	Total Hardness as $CaCO_3$	mg/l	330	530	680	950	116	240	600
7	Calcium as Ca	mg/l	64.12	92.18	128.25	204.4	24.04	60.12	200
8	Total Alkalinity as $CaCO_3$	mg/l	370	490	690	380	112	280	600
9	Chloride as Cl	mg/l	318.44	171.47	186.16	436.02	29.39	107.78	1000
10	Residual Chlorine	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	1
11	Magnesium as Mg	mg/l	41.31	72.9	87.48	106.92	13.6	21.87	100
12	Total Dissolved Solids	mg/l	1184	958	1168	1450	172	537	2000
13	Sulphate as	mg/l	341.39	178.58	197.15	198.18	11.04	75.84	400

Sl. no	Parameters	Units	Pachanampatti Village	Anjavathu -Mile	Senkattur Pirivu Village	Eachampatti village	Attur - SKN Lodge	Erode Railway Station	IS:10500-2012 Permissible Limits
	SO_4								
14	Fluoride	mg/l	0.49	0.41	0.39	0.45	0.2	0.38	1.5
15	Nitrate as NO_3	mg/l	6.4	35.8	37.4	39.2	2.4	10.08	45
16	Iron as Fe	mg/l	0	0.04	0.06	0.05	0	0.03	0.3

Source: primary Environmental Monitoring, 2020

The pH is observed to be in alkaline for all groundwater samples. The concentration of Total Hardness is recorded high for the groundwater samples collected at Eachampatti village (950 mg/l) and Senkattur Pirivu Village (680 mg/l). The concentration of Calcium (204.4 mg/l) is also observed to high at Eachampatti village. The Total Alkalinity concentration (690 mg/l) is observed to be high for the groundwater sample collected at Senkattur Pirivu Village. Based on the outcome of the analysis, the groundwater can be used for domestic purposes, however, for consumption, it has to be treated.

5.1.11.3 Environmental Monitoring Locations

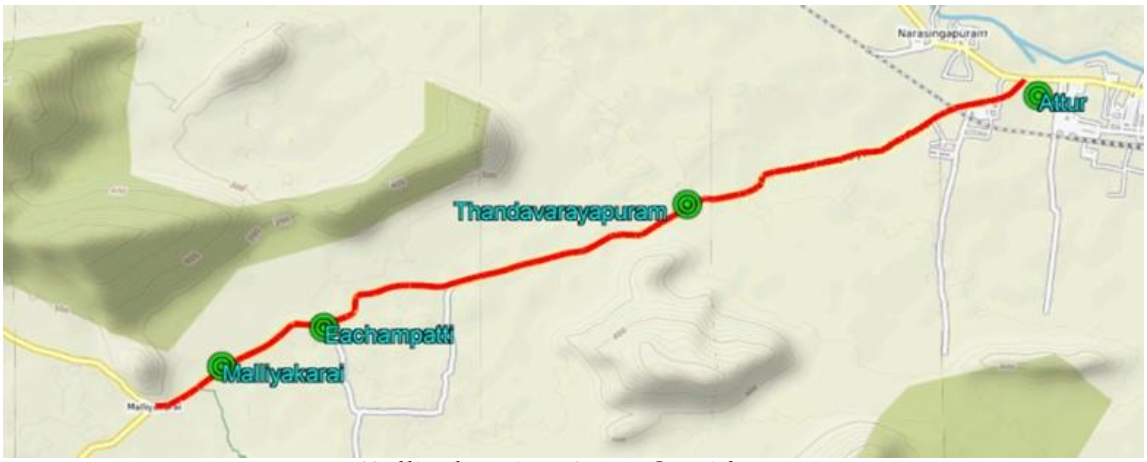


Omalur to Mecheri Corridor

Sl. No.	Monitoring Locations	Monitoring Conducted for				
		Air	Soil	Surface Water	Ground Water	Noise
1	Mecheri	Yes				Yes
2	Senkattur Pirivu				Yes	
3	Sathappadi	Yes				Yes
4	Chinnasathappadi		Yes			Yes

Sl. No.	Monitoring Locations	Monitoring Conducted for				
		Air	Soil	Surface Water	Ground Water	Noise
5	Kamaneri			Yes		
6	Anjavathumile				Yes	
7	Panjukallipatti					Yes (2 locations)
8	Palikadai					Yes (2 locations)
9	Pachanampatti	Yes	Yes		Yes	
10	Melakavundanur			Yes		

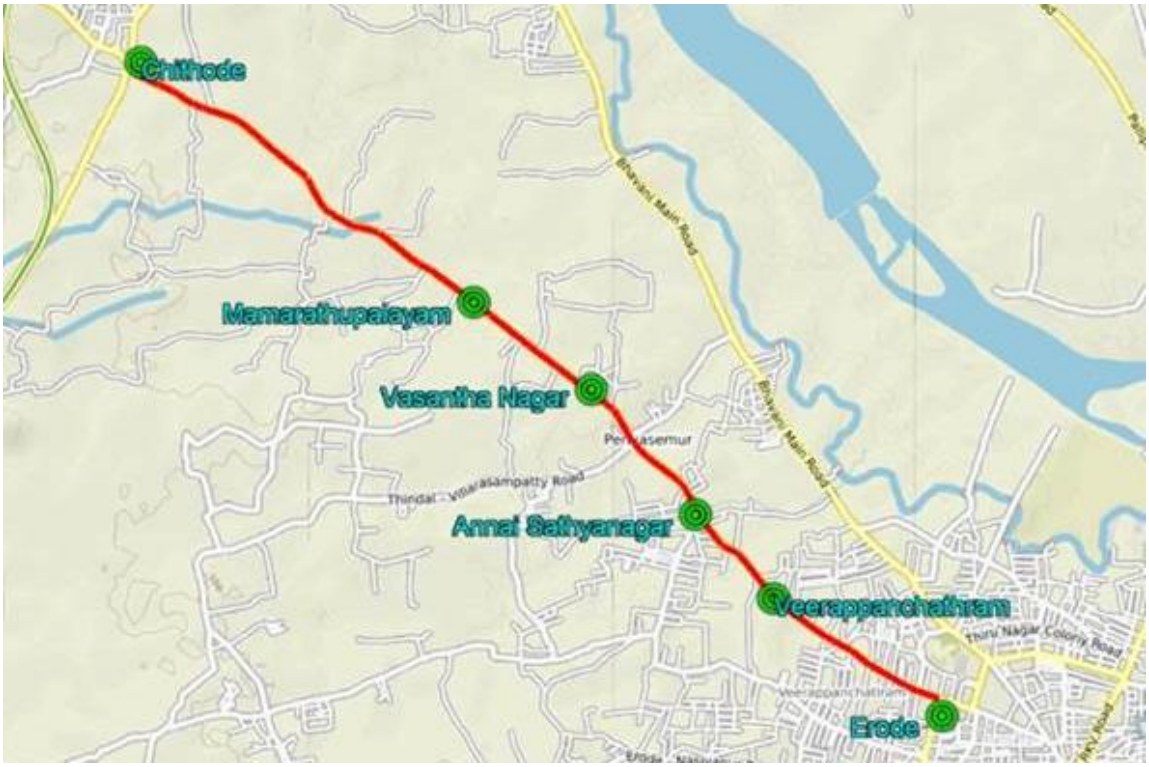
Source: primary Environmental Monitoring, 2020



Malliyakarai to Attur Corridor

Sl. No.	Monitoring Locations	Monitoring Conducted for				
		Air	Soil	Surface Water	Ground Water	Noise
1	Malliyakarai		Yes			Yes
2	Eachampatti	Yes			Yes	Yes
3	Thandavarayapuram		Yes			
4	Attur	Yes	Yes		Yes	Yes

Source: primary Environmental Monitoring, 2020



Chithode to Erode Corridor (SH 15)

Sl. No	Monitoring Locations	Monitoring Conducted for				
		Air	Soil	Surface Water	Ground Water	Noise
1	Chithode	Yes	Yes		Yes	Yes (2 locations)
2	Mamarathupalayam					Yes
3	Vasantha Nagar		Yes			
4	Annai Sathyanagar			Yes		
5	Veerappanchathram					Yes
6	Erode	Yes			Yes	Yes

5.2 Biological Environment

There are no protected natural habitats present within 10 km radius of the Phase – 1 Corridors.

5.2.1 Flora

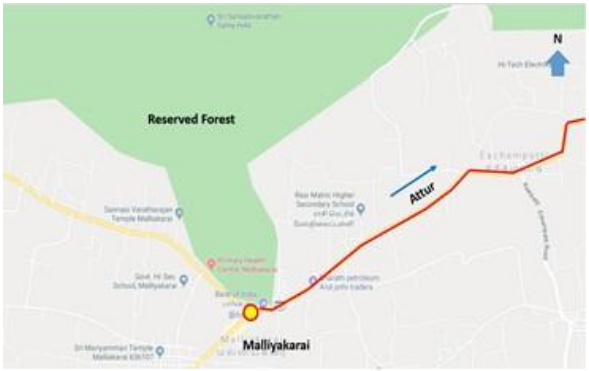
a) Forest cover in the project district

As per the State of Environment Report (SoER) of Tamil Nadu, the type of forests present in the project districts are Southern Dry Mixed Deciduous Forest, Hardwickia Forest and Southern Euphorbia Scrub. The project districts are having significant areas covered under the Forest. As per the Forest Survey of India (FSI), the Erode district has the highest forest area in comparison with Salem district. The project road is not abutting / crossing any forest areas

Sl.no	Project District	Geographic area	Very Dense Forest	Moderate Dense Forest	Open Forest	Total
1)	Salem	5237	198.62	756.76	514.46	1469.84
2)	Erode	5760	402.17	1128.56	763.73	2294.46

Source: Forest Survey of India (FSI), 2019

The project road SH – 30 (Malliyakarai to Attur Road) starts near a reserved forest it is also called as Sri Sanaasivarathan Samy Hills, no major wildlife activities have been observed or recorded. The hill has been accessed by the devotees to reach the temple located on top of the hill lock.



Reserve Forest near the start point of the SH -30 (Malliyakarai to Attur Road)

b) Project Roadside Flora

The baseline study of flora has primarily taken into account the flora along the Phase – 1 Corridors that are discussed in the following para.

- ***Omalur to Mecheri (SH 222)***, it was estimated to have 1833 avenue trees (909 trees in the RHS and 924 trees in the LHS). A well-maintained avenue plantation on both sides of project road was observed during the reconnaissance survey. Tamarind tree species was found in majority of the avenue plantation. Especially in some stretches which forms a continuous tree canopy, giving the effect of Green Tunnel. Chainage wise details of the green tunnel for the project road are given in

Sl. No.	Chainage(km)		Total Length in km
	From	To	

Sl. No.	Chainage(km)		Total Length in km
	From	To	
1	3/430	3/600	0.170
2	8/735	8/860	0.125
3	13/690	13/970	0.280
Total in km			**0.575**

Source: reconnaissance Survey, 2019

The common trees observed along the project road includes Arasu Maram (Pepal tree) - *Ficus religiosa*, Jambolan Tree - *Syzygium cumini,* Palm tree – *Borassus flabellifer*, Tamarind tree - *Tamarindus indica*, Neem Tree - *Azadirachta indica*, Pungan Tree - *Millettia pinnata*, Coconut Tree - *Cocos nucifera*, Kona puliyanga tree - *Pithecellobium dulce*, Mango tree - *Mangifera indica*, Teak Tree - *Tectona grandis* and Illupai Tree - *Madhuca longifolia*. None of the tree species are coming under RET species.

Avenue trees (Palm trees) in the SH -222 (km 12/100)

Avenue trees (Coconut trees) in the SH -222 (km 2/000)

- ***Malliyakarai to Attur Road (SH 30)***, it was estimated to have 831 avenue trees (419 trees in the RHS and 412 trees in the LHS). The common trees observed along the project road includes Tamarind tree - *Tamarindus indica,* Neem Tree - *Azadirachta indic,* Coconut Tree - *Cocos nucifera,* Pungan Tree - *Millettia pinnata,* Badam Tree - *Prunus dulcis*, Ala tree - *Ficus benghalensis*, Ashoka tree – Polyalthia longifolia, Mango tree - *Mangifera indica* and Palm tree – *Arecaceae*. None of the tree species are coming under RET species.

Avenue Plantation between km 82/000 to km 83/000

Avenue Plantation between km 89/000 to km 90/000

- ***Chithode to Erode Road (SH 15)***, it was estimated to have 825 avenue trees (428 trees in the RHS and 392 trees in the LHS). The common trees observed along the

project road includes Tamarind tree - *Tamarindus indica,* Neem Tree - *Azadirachta indic,* Coconut Tree - *Cocos nucifera,* Pungan Tree - *Millettia pinnata,* Badam Tree - *Prunus dulcis*, Mango tree - *Mangifera indica,* Palm tree – *Arecacea,* Portia tree - *Thespesia populnea* and Gulmohar tree - *Delonix regia*. None of the tree species are coming under RET species

Avenue Plantation between km 155/000 to km 156/000

Avenue Plantation between km 153/000 to km 154/000

Due to the proposed four laning and geometric improvements, trees in the proposed PRoW are likely to be removed at several locations. Chainage wise details of number of trees that are to be felled for the project road are presented in **Annexure 5.**

5.2.2 Fauna

The project districts (Salem and Erode) have rich faunal biodiversity (especially Avi Fauna) due to the Presence of Eastern Ghats (Predominant) and Western Ghats. This would result in presence of more bird species in the project area. Likewise, during the inventory, the following bird species have been witnessed.

Table 35: Bird species observed in the Project Roads

Sl.no	Common Name	Scientific Name	RET Status
1.	Indian Peafowl	*Pavo cristatus*	Least Concern
2.	Doves	*Columbidae*	Least Concern
3.	Paradise Flycatcher	*Terpsiphone*	Least Concern
4.	Bulbuls	*Pycnonotidae*	Least Concern
5.	Kingfisher	*Alcedinidae*	Least Concern
6.	Coppersmith	*Megalaima haemacephala*	Least Concern
7.	Barbet	*Megalaimidae*	Least Concern
8.	Drongos	*Dicruridae*	Least Concern
9.	Grey Francolin	*Francolinus pondicerianus*	Least Concern
10.	Golden oriole	*Oriolus kundoo*	Least Concern
11.	Common Iora	*Aegithina tiphia*	Least Concern
12.	White-rumped shama	*Copsychus malabaricus*	Least Concern
13.	House Crow	*Corvus splendens*	Least Concern

Source: reconnaissance Survey, 2019

For the animals, common monkey and mongooses are predominately seen near the agriculture areas. The presence of mongoose indicates a healthy population of snakes. Other than that, the project road does not have any sensitive/ declared protected areas within or in the vicinity. Hence the presence of wild animals is negligible.

5.3 Social Environment

5.3.1 Demographic and Administrative Profile of Project Areas for Phase – 1 Corridors

Demographic features of the project districts for Phase – 1 Corridor such as total population, literacy rate and working population are presented in the table 36.

Table 36: Demographic Profile of Project Districts

Name	Type	Population			Literacy			Working Population		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Omalur to Mecheri (SH 222)										
Mettur Taluk	Rural	125662	111876	237538	82561	54049	136610	77274	51145	128419
	Urban	92785	89564	182349	71447	57869	129316	54276	20824	75100
	Total	**218447**	**201440**	**419887**	**154008**	**111918**	**265926**	**131550**	**71969**	**203519**
Omalur Taluk	Rural	206000	186042	392042	134665	91680	226345	124152	72719	196871
	Urban	52922	49391	102313	38233	29326	67559	30635	15409	46044
	Total	**258922**	**235433**	**494355**	**172898**	**121006**	**293904**	**154787**	**88128**	**242915**
Malliyakarai to Attur Road (SH 30)										
Attur Taluk	Rural	44,902	43,851	88,753	32,521	25,254	57,775	27,871	24,196	52,067
	Urban	-	-	-	-	-	-	-	-	-
	Total	**44,902**	**43,851**	**88,753**	**32,521**	**25,254**	**57,775**	**27,871**	**24,196**	**52,067**
Chithode to Erode Road (SH 15)										
Erode taluk	Rural	20,346	20,102	40,448	14,757	11,758	26,515	13,365	8,610	21,975
	Urban	16,309	16,371	32,680	13,313	12,063	25,376	12,630	7,783	20,413
	Total	**36,655**	**36,473**	**73,128**	**28,070**	**23,821**	**52,891**	**25,995**	**16,393**	**42,388**

Source: Census 2011

The following sections give a comparative picture of the various demographic and socio-economic indicators (as per census 2011) for the project areas

(i) **Omalur to Mecheri Road (SH 222):** The project corridor passes through six villages of Omalur taluk and 5 villages of Mettur taluk. Major settlements along the project corridor are Indira Nagar, Pachanampatti, Thimirikottai, Karuppanampatti Thittu, Paalikadai, Panjunkallipatti, Akkarayanoor, Olaipaati, Kamaneri, Sathapaadi, Selakalthittag, Sengattur Pirivu, Parakkaloor, Chandrama Kadai and Mecheri.

- Omalur taluk: Omalur has a population of 494,355 with 258,922 males and 235,433 females. There were 907 women for every 1000 men. The taluk had a literacy rate of 60.1%. Child population in the age group below 6 was 25,502 Males and 23,203 Females.
- Mettur taluk: Mettur has a population of 419,887 with 218,447 males and 201,440 females. There were 922 women for every 1000 men. The taluk had a literacy rate of 63.91%. Child population in the age group below 6 was 19,653 Males and 17,652 Females

(ii) Malliyakarai to Attur Road (SH 30): The project corridor passes through five villages of Attur taluk. Major settlements along the project corridor are Malliyakarai, Echampatti, Mottur, Thandavarayapuram, Narasingapuram, Karinginagar, and Attur. According to 2011 census, Attur had a population of 88,753 with a sex-ratio of 1,021 females for every 1,000 males, much above the national average of 929. A total of 6,147 were under the age of six, constituting about 3,209 males and 2,938 females.

(iii) Chithode to Erode Road (SH 15): The project corridor passes through five villages of Erode taluk. Major settlements along the project corridor are Chithode, Kumilamparappu, Suriampalayam, Ganapuram, Periasemur and Erode town. According to the 2011 census, the taluk of Erode had a population of 73,128 with 36,655 males and 36,473 females. There were 1000 women for every 1000 men. The taluk had a literacy rate of 73.5%.

Table 37: Administrative Profile of the Project Area

Sl No	Road Name	District	Taluk	Village/ Settlement
1	Four laning and strengthening of Kanchipuram-Cheyyar (SEZ) (SH 116) (km.2/915 – km. 14/112) including Vandavasi Byepass, connecting SH 116 & SH 05 (km 36/457 to km 39/829)	Kancheepuram and Tiruvannamalai	Kancheepuram Cheyyar and Vandavasi	• Sevilimedu • Punchaiyarasunthangal • Apdhullapuram • Ayyangar Kutu Road • Dhusi • Mamundur • Dharmapuram • Santhaimedu • Narasamangalam • Narasamangalam • Mankal X-Road
2	Four laning and strengthening of Omalur - Mecheri (SH222) (km 0/000 – km 14/600)	Salem	Omalur and Mattur	• Omslur • Pschsnspstti • Karuppanapatti • Tindamangalam • Kalipatti • Kattaperiyampatti • Olaippatti • Aranguanur • Chinnasattappadi • Mecheri
3	Strengthening and widening of Attur - Malliyakarai road(SH30) (km 81/054 – km 89/250)	Salem	Attur	• Malliyakarai • Eachampatti • Chokkanathapuram • Thandavarayapuram • Narasingapuram

5.3.2 Cultural Resources

There are noticeable numbers of religious structures found along the Phase – 1 Corridors. Details of the same are depicted below.

Table 38: Details of the Religious Structures along the Phase – 1 Corridors

Sl No	Name of the Structure	Chainage	Side	Distance from the Centre line	Name of the Village
Omalur to Mecheri Road (SH 222)					
1.	Amman Temple	0/380	LHS	14	Inidranagar
2.	Ganesha Temple	0/750	LHS	7	Ganapathinagar
3.	Amman Temple	1/010	LHS	11	Pachanam Patti
4.	Sri Sengali Amman Temple	1/650	LHS	13	Pachanam Patti
5.	Vinayagar Temple	3/520	LHS	14	Pallikadai
6.	Amman Temple	3/535	RHS	39	Pallikadai
7.	Ayyanar Temple	3/600	RHS	11	Pallikadai
8.	Amman Temple	4/000	RHS	30	Panjikali Patti
9.	Dhavathu Temple	5/100	RHS	30	Chinthamaniur
10.	Shakthi Mariamman Temple	6/220	LHS	14	Ayintham mail
11.	Road side temple	7/100	RHS	9	Kamanery

Sl No	Name of the Structure	Chainage	Side	Distance from the Centre line	Name of the Village
12.	Temple	8/050	LHS	40	Kamanery
13.	Sivan Temple	8/460	RHS	40	Chinasathapadi
14.	Sivan Temple	8/480	LHS	16	Chinasathapadi
15.	Church	9/910	LHS	14	Vedankaruduthittu
16.	Ayyanar Temple	10/360	RHS	35	Thilaru Thittu
17.	Ayyappa Temple (Hill)	11/210	RHS	35	Sankatturpirivu
18.	Amman Temple	12/230	RHS	35	Chandirammal Kadai
19.	Small temple with tree	14/035	RHS	3.6	Kolkaranoor
Malliyakarai to Attur Road (SH 30)					
1.	Amman Kovil	82/950	LHS	6	Eachampatti
2.	Temple	83/650	LHS	10	Chockkanathapuram
3.	Temple	87/390	RHS	15	Thandavarayapuram
4.	Church	88/060	RHS	15	Thandavarayapuram
5.	Temple	89/990	LHS	10	Narasingapuram
6.	Temple	91/020	LHS	3	Narasingapuram
7.	Temple	91/180	LHS	7	Narasingapuram
Chithode to Erode Road (SH 15)					
1.	Nachiyar Amman Temple	153/520	LHS	15	Chithode
2.	Vinayagar Temple	153/810	RHS	11	Chithode
3.	Vinayager temple	154/510	LHS	7	Chithode
4.	Vinayagar Temple	155/230	RHS	16	Kongam Palayam
5.	Ayyanarappan Temple	156/410	RHS	38	Mamarathu Palayam
6.	Amman Temple	156/470	RHS	19	Mamarathu Palayam
7.	Arulmigi Sri Kaliyamman Temple	156/640	RHS	11	Mamarathu Palayam
8.	Vinayagar Temple	156/790	RHS	11	Mamarathu Palayam
9.	Saya buram Maariamman Temple	157/040	LHS	8	Mamarathu Palyam
10.	Vinayagar Temple	157/110	RHS	9.5	Thaneer Pandal Palayam
11.	Kovil	158/040	LHS	8	Kaliravuthar kulam
12.	Kovil	158/040	LHS	15	Kaliravuthar kulam
13.	Kovil	158/090	LHS	12	Kaliravuthar kulam
14.	Ayyanarappan Temple	160/520	RHS	12	Erode
15.	Temple	160/750	RHS	20	Erode
16.	Temple	160/800	RHS	10	Erode

Source: reconnaissance Survey, 2019

5.3.3 Presence of Sensitive Receptors

In addition to the built-up areas, there are educational institutions and hospitals present along the Phase -1 Corridors. All these features are socially very sensitive and needs critical care in preserving them for road widening. Locations of these sensitive structures are listed in following table

Sl No	Name of the Structure	Chainage	Side	Distance from CL (m)	Name of the Village
Omalur to Mecheri Road (SH 222)					
1	Library (Govt. Building)	3/525	RHS	19	Pallikadai
2	Middle School, Compound Wall Structure	3/805	RHS	9	Panjikali Patti
3	South India Matriculation High Sec. School	4/620	LHS	14	Panjikali Patti
4	Sri Balamurugan College (Arts & Science)	9/000	RHS	8	Sathapadi
Malliyakarai to Attur Road (SH 30)					
1.	Rasi Metric Higher Secondary School	81/970	LHS	9	Malliakarai
2.	Government School	82/950	RHS	9	Eachampatti

Sl No	Name of the Structure	Chainage	Side	Distance from CL (m)	Name of the Village
3.	Government Veterinary Hospital	81/070	LHS	11	Malliakarai
4.	First Aid Medical Center	88/450	LHS	9	Kamraj Nagar
Chithode to Erode Road (SH 15)					
1.	Government Veterinary Hospital	153/450	LHS	16	Chithode
2.	Government ITI College	154/240	RHS	15	Rayapalayam
3.	SUN Matriculation Higher Secondary School	155/200	RHS	15	Kongam Palayam
4.	Erode Hindu Kalvi Nilayam School	156/700	RHS	11	MamarathuPalayam
5.	SR Hospital	159/520	RHS	18	Sullai
6.	CN College	160/070	RHS	15	Erode
7.	Sree Janani Nursery and Primary School	160/420	LHS	22	Erode
8.	Government Veterinary Hospital	160/450	RHS	12	Erode
9.	Machinery School	160/940	RHS	12	Erode

Source: reconnaissance Survey, 2019

5.3.4 Cultural Heritage Sites and Archaeological Monuments

There are no cultural heritage sites and archaeological monuments located along the Phase – 1 Corridors. The nearest ASI monument is the Attur Fort which is located at a distance of 1.65km from the end point of the Malliyakarai to Attur Road (SH 30). Hence the ASI regulatory requirements of prohibited zone (100m from the monument) and the Regulatory zone (300m from the monument) will not be applicable.

6 PUBLIC CONSULTATION

Public Consultations were conducted to assess the perception of the people about the proposed project. The consultations were conducted based on the following objectives

- Overall features of the project and to collect the feedback from the people.
- Social and Environmental concerns and suggestion to improve safety and environmental protection

6.1 Focus Group Discussion (FGD)

The overall goal of FGD programme is to disseminate project information and incorporate PAPs views in the road design and resettlement plan and also to document the existing environmental profile of the project influence area (PIA), hence it is conducted before project design. In order to document the issues raised by PAPs, public interactions were conducted at nodal points of towns and villages during December 2019. A large number of persons who would be potentially affected expressed their views about the proposed project. Details of location wise FGDs and issues for the project road are presented in **Table 39**.

Table 39: Details of Location-wise Focus Group Discussion and Issues Discussed

(i) **Omalur to Mecheri Road (SH 222)**

Consultation Location	People perception/demands/suggestion	Remarks
Omallur Date: 10/12/2019 36 people attended the meeting which include 4 women	• People demanded for ROB at railway level cross • Foot path may be provided along the built-up locations. • Landowners should get market rate for loss of land (Land value 2 lac/cent.) • Dedicated bus bay and bus stop should be provided at built up locations to avoid traffic block • Median to be provided at built up locations • Job may be provided during construction. • Proper signage may be provided to avoid accidents.	• Various options have been studied for the ROB and the pros and cons has been listed in analysis of alternatives (refer Chapter 7). • Provision for foot path is provided in the built up sections (refer TCS Chapter 3 section 3.4) • For land value, as per the RAP (Consent award), The project will offer an additional 25 percent on the compensation determined in accordance with the provisions of RFCTLARR Act • As requested, Bus Bays are provided (refer Table 17) • Being a 4 lane proposal, median is provided as per the standard (refer TCS Chapter 3 section 3.4) • It is suggested in the ESMP (Labour Requirements) to recruit local labours during the project construction • Adequate signages are proposed.
Panchukalipatti Date: 10/12/2019 54 people attended the meeting which include 7 women	• Dedicated bus bay and bus stop should be provided at built-up locations • Income restoration program should be provided for workers also, especially daily wage laborers of power looms • Proper safety measures may be taken to avoid accidents	• As requested, Bus Bays are provided (refer Table 17 to table 19) • Income restoration program will be conducted by the NGO's and suitable assistance for income restoration is provided in the Entitlement Matrix • Road safety measures are included in the design. For urban areas, stretched railing has been provided

Consultation Location	People perception/demands/suggestion	Remarks
	• Landowners should get market rate for loss of land (Land value 3 -4 lac/cent.) • Child laborers should not be allowed during the construction • Public facilities, like toilets and drinking water, may be provided based on the requirements • People are aware of the road improvement works	pedestrian crossing, footpath cum drain provision are provided (refer TCS Chapter 3 section 3.4) • Use of child labour is strictly prohibited, which is indicated as one of the conditions in the bid document. • Selected bus bays are provided with toilet facilities and drinking water provision.
Mecheri Date: 10/12/2019 8 people attended in the meeting	• Participants were not aware of the road widening • Present road conditions are very poor, and the road width is very less. No proper road facilities are available now, it should be included in the new design • Most of the people are working as daily labors and doing small businesses • There are no public toilet facilities or public drinking water facility available • Traffic safety awareness program may be included in the project and all the school students, farmers, tractor drivers and people using bull carts	• The entire stretch has been consulted and pamphlets has been distributed regarding the project information. • The whole corridor is proposed for 4 lane upgrdation and hence the existing poor condition of the road will be improved • For the PAP's livelihood restoration programs will be conducted as per the provision of the Entitlement Matrix (refer Appendix -6 RAP) • Selected bus bays are provided with toilet facilities and drinking water provision • It shall be organised during the project construction by the NGO's

(ii) Malliyakarai to Attur Road (SH 30)

Consultation Location	People perception/demands/suggestion	Remarks
Echampatti Date: 10/12/2019 12 people attended the meeting which include 4 women	• People are aware of the road widening • Provide proper safety measures near the school. • Participants demanded Proper footpath cum drainage • People requested to provide drinking water facility • Provide a median for the roads to	• Raised pedestrian is provided near the sensitive locations, including schools (refer section 3.4.6) • Provision for foot path is provided in the built up sections (refer TCS Chapter 3 section 3.4) • Selected bus bays are provided with toilet facilities and drinking water provision

Consultation Location	People perception/demands/suggestion	Remarks
	avoid accidents • Mainly their livelihood is from agriculture (Paruthi, Cholam), it should be compensated • People demanded Market Value for their land (Land Value Rs.6.5 Lakhs/Cent) • Some participants proposed Bypass for easy traffic	• Being a 2 lane proposal, median is not possible (refer TCS Chapter 3 section 3.4) • For the PAP's livelihood restoration programs will be conducted as per the provision of the Entitlement Matrix (refer Appendix -6 RAP) • It has been studied, however, it is not feasible
Thandavarayapuram. Date: 10/12/2019 23 people attended in the meeting which include 1 woman	• Few participants are aware of the proposed road widening. • People demanded bypass or realignment. • People requested to construct bus bays outside junction. • People demanded junction improvement. • Landowners demanded market value for loss of land (Land value Rs.2000/Sq.feet) • Participants requested to construct a Public comfort station. • Participants requested to reduce land acquisition for road widening.	• For realignment, various options are explored, however, it was not feasible and hence it is decided to restrict the RoW from 18m to 15m and accordingly the road has been designed. • As requested, Bus Bays are provided (refer Table 18) • For land value, as per the RAP (Consent award), the project will offer an additional 25 percent on the compensation determined in accordance with the provisions of RFCTLARR Act • Selected bus bays are provided with toilet facilities and drinking water provision • Best possible road designs are recommended for reducing the LA (refer TCS Chapter 3 section 3.4)
Pukkampatti Date: 10/12/2019 10 people attended in the meeting and shared their views about the project	• People proposed Railway Over Bridge to reduce traffic issues. • Agriculture is the main income of the people; hence proper compensation was requested for loss of land. • Participants requested to construct footpath and drainage. • Provide proper design in curve areas to avoid accidents. • They demanded proper land value (Land Value Rs 1.5 Lakhs/Cent).	• It is proposed to have RUB (refer TCS Chapter 3 section 3.4) • For land value, as per the RAP (Consent award), The project will offer an additional 25 percent on the compensation determined in accordance with the provisions of RFCTLARR Act as well as livelihood restoration programs will be conducted as per the provision of the Entitlement Matrix (refer Appendix -6 RAP)

(iii) Chithode to Erode Road (SH 15)

Consultation Location	People perception/demands/suggestion	Remarks
Kongupalayam Date: 11/12/2019 26 people attended the meeting which include 3 woman	• Proper signages needs to be provided in the accident-prone area. • No pedestrian crossing are available in the built-up locations, proper pedestrian crossing marking with signal lighting may be provided. • Bus bay and bus stop should be provided • Median to be provided at built-up locations • Proper signage may be provided to avoid accidents. • Power loom, agriculture is their main source of income. • No public usage facilities like toilets or drinking water are available. • Participants are aware of road widening.	• Adequate signages are proposed in the accident prone areas • Raised pedestrian is provided near the sensitive locations, including schools (refer section 3.4.6) with appropriate road safety measures including traffic signage's as per IRC standard. • As requested, Bus Bays are provided (refer Table 19) • Being a 4 lane proposal, median is provided as per the standard (refer TCS Chapter 3 section 3.4) • Adequate traffic signage's along with traffic calming measures are suggested • For the PAP's livelihood restoration programs will be conducted as per the provision of the Entitlement Matrix (refer Appendix -6 RAP) • Selected bus bays are provided with toilet facilities and drinking water provision • The entire stretch has been consulted and pamphlets has been distributed regarding the project information.
Mamarathupalayam Date: 11/12/2019 31 people attended the meeting which include 4 woman	• Proper safety measures may be taken to avoid accidents • Public facilities, like toilets and drinking water, may be provided based on the requirements. • People are not aware of the improvement. • Sakthi Species Company has its factory and hospital for differently-abled people in this hamlet. Around 200 differently-abled workers and 100 differently-abled patients are using this bus stop daily, where no facilities are available. A bus waiting shed suitable to differently-abled persons may be provided at this location. • Streetlights and signboards are required	• Adequate traffic signage's along with traffic calming measures are suggested • Selected bus bays are provided with toilet facilities and drinking water provision • The entire stretch has been consulted and pamphlets has been distributed regarding the project information. • Foot over bridge with lift facilities are proposed, however it is in discussion o apart from that speed breakers with zebra crossing (Raised speed breakers) with Amber signal o motorable drain is proposed o Provision for ramp to footpath cum drain (1 in 10 slope) o Dedicated parking slots - 2 wheelers • Streetlights and adequate signboards will be provided (refer TCS Chapter 3 section 3.4)
Bharathi Nagar Date: 11/12/2019 32 people attended the meeting which include 23 woman	• Participants are aware of road widening. • Present road conditions are very poor, there are no speed breakers or pedestrian crossing • This hamlet is an accident-prone area.	• The whole corridor is proposed for 4 lane upgrdation and hence the existing poor condition of the road will be improved • Adequate signages are proposed in the accident prone areas and traffic calming measures are suggested

Consultation Location	People perception/demands/suggestion	Remarks
	• Proper measures may be taken to avoid accidents.	

The PAFs demanded for market value for their losing assets and asked to explore more options to minimise the negative impact. However, public raised very few queries/suggestions on environmental components such as felling of tree should be minimum, Speed breaker should be provided built-up at locations to avoid the accidents etc.

6.2 Public Consultation (With Prior Notice)

1	**Project Road**	:	**Omalur to Mecheri Road (SH 222)**
	Consultation date and time	:	15th February 2020 (10.30 Am to 2 Pm)
	Venue	:	KSV Mahal, Kamineri, Omalur Taluk Salem District, Tamil Nadu 636455
	TNRSP Members and DPR Consultants	:	Mr. Mahendra Varman, Divisional Engineer TNRSP Salem, Mr. Murugesan Asst. Divisional Engineer TNRSP, Salem, Mr. Bhaskar, Junior Engineer, TNRSP Salem and Mr.Vishvanathan, Spl. Tahasildhar.TNRSP LARRU Salem, Mr. Suresh Kumar OG, Social Expert, Feedback Infra, Mr. Rajkumar, Design Engineer, Feedback Infra, Mr. Lokesh Manager Environmental Feedback Infra
	No of Public Participants	:	136 Project Affected Persons including 9 women attend the meeting
	Information to the PAP's	:	All the affected families were invited to the meeting through a public notice (**Annexure 6**)

Distribution of notices to PAPs and residents along the stretch

- Divisional Engineer has given an introduction about the TNRSP (II) project, specifically development of Omalur – Mecheri road, to the participants. In his opening speech he discussed about the objective of the meeting and requested participants to share their views.
- After Divisional Engineer's (DE) speech, consultant explained the project in detail. The PowerPoint presentation covered; importance of the project, draft design (showing the existing and proposed ROW), details about bus bays, bus shelters, drainage, traffic facilities, safety measures, facilities provided for pedestrians, likely environmental impacts, mitigation and enhancement measures etc.

Project Explantion by TNRSP officals

- The people were aware about the road widening since survey activities, alignment marking etc., are in progress. However, they were not aware about the land acquisition methods, road alignment, compensations etc. The major queries were with respect to the alignment and compensation. The queries of the people and the reply is summarised in below table.


PAPs clarifying their doubts during PowerPoint Presentation

- The people were aware about the road widening since survey activities, alignment marking etc are in progress. However, they were not aware about the land acquisition process, road alignment, compensations etc. The major queries were with respect to the alignment and compensation. The queries of the people and the reply is summarised in below table.

Table 40: Queries raised by public in the meeting and reply given by project team for Omalur to Mecheri Road (SH 222)

Sl.No.	Public's Demand/concern	Response from TNRSP and DPR Consultants
1	Is the alignment and yellow marking done on the road and building final?	Yes, however this may be further reviewed.
2	Why can't government construct road without land acquisition?	The existing ROW has been utilised to the maximum in the proposed design. However, at certain locations land acquisition is inevitable whenever the right of way is narrow, curved etc.
3	Why government is improving this road, what is the importance?	Importance of the road and traffic details etc are explained to the public.
4	If a building is getting 20% affected and is a very old building will full compensation be paid?	Depending on the viability of the structure a qualified engineer in consultation with the building owner will consider the full valuation of the building.
5	When giving full valuation for the partially affected building, will the government acquire land also?	No additional land will be acquired in the case of partially affected buildings as full building valuation will be carried out. The owner must demolish the whole building after receiving full valuation amount.
6	What is the assurance, that government will pay additional assistances?	Government is bound to pay all compensation and additional assistances as per the RFCTLARR Act 2013.
7	Will the owners without patta receive any compensation?	As per ACT and World Bank guidelines title holders and non-title holders will be compensated for their impact
8	Median opening is required at least in every Km interval	It is provided as per standards
9	Bus bays may be provided	It is provided as per standards
10	Traffic signals and signboards may be provided	It is provided as per standards

Sl.No.	Public's Demand/concern	Response from TNRSP and DPR Consultants
11	What are the arrangements for tree cutting and plantation?	Trees will be planted 1:10 ratio and civil contractor will maintain the same for 7 years.
12	Bus shelters and bus stations should be developed suitable to differently abled persons.	Ramps are provided.
13	Noise barrier may be provided near to the school, hospital etc.	Shall be considered.

2 Project Road : Mallaiakarai – Attur Road (SH 30)

Consultation date and time : 27th February 2020 (2.30 Pm)
Venue : Santhosh Hall, Mottur
TNRSP Members and DPR Consultants : Mrs. Thamaraiselvi Assistant Divisional Engineer TNRSP, Salem,
Mr. Vanitha, Assistant Engineer, TNRSP Salem,
Mr. Praveen, Design Engineer, Feedback Infra,
Mrs. Chitra, Environmental Engineer, Feedback Infra,
Mr. Girishkumar Social expert, Feedback Infra
No of Public Participants : 113 project affected persons including 11 women attended the meeting
Information to the PAP's : All the affected families were invited to the meeting through a public notice

Notice distribution regarding the public meeting

- Assistant Divisional Engineer has given an introduction about the TNRSP (II) project, specifically development of Attur – Mallaiakarai road, to the participants. In her opening speech she discussed about the objective of the meeting and requested participants to share their views.

Project Explantion by TNRSP officals

PowerPoint Presentation by the consultant

- After Assistant Divisional Engineer's (DE) speech, consultant explained the project in detail. The PowerPoint presentation covered; importance of the project, draft design (showing the existing and proposed ROW), details about bus bays, bus shelters, drainage, traffic facilities, safety measures, facilities provided for pedestrians, likely environmental impacts, mitigation and enhancement measures etc.

Table 41: Queries raised by public in the meeting and reply given by project team for Mallaiakarai – Attur Road (SH 30)

Sl. No	Public's Demand/concern	Response from TNRSP and DPR Consultants
1	Realignment may be provided to avoid impact to residential buildings at Thandavarayapuram	Realignment is not possible as it will invite huge acquisition of agricultural land.
2	Demanded to limit the widening within the existing ROW at Thandavarayapuram	Minimum acquisition has been proposed
3	Bus bays may be provided	7 Bus bays with bus shelters are provided
4	Traffic signals and signboards may be provided	Traffic signage is provided for the entire stretch as per Manual. As there are no major traffic junction along the project highway, traffic signals are not provided.
5	What are the arrangements for tree cutting and plantation?	2889 trees are likely to be cut for the project only Revenue Department will be issuing for trees to be cut outside forest area. As per the Madras High Court Order, 10 trees are proposed to be planted for each tree to be cut. It is proposed to plant the trees in the EROW where the land available as well as in the Govt Offices, Schools etc.
6	Noise barrier may be provided near to the school, hospital etc.	Compound wall facilities are available in the schools and hospitals in the project area. Even then, it is proposed to plant trees like *Polyalthia longifolia* along the Compound Wall to further reduce the noise impact
7	In school area there are no sign	Sign boards along with pedestrian crossing

Sl. No	Public's Demand/concern	Response from TNRSP and DPR Consultants
	board, zebra crossing and speed breakers.	are proposed
8	There is no hygiene toilet or drinking water facility in public places	Busbay with Bus shelters Locations are provided with toilet and drinking water facility.
9	There are no proper streetlights, they recommend for reliable streetlight.	Street lighting are proposed in urban areas
10	People demanded for ROB at railway level cross	RUB is proposed based on geometry of the road
11	Foot path may be provided along the built-up locations.	Raised footpath cum drain is proposed at built up areas
12	Landowners should get market rate for loss of land (Land value 2 lac/cent.)	Compensation for Land acquisition shall be as per Land acquisition act
13	Dedicated bus bay and bus stop should be provided at built up locations to avoid traffic block	Based on availability of land, Bus shelter with/without bus bays are proposed
14	Job may be provided during construction.	
15	Proper signage may be provided to avoid accidents.	Proper road signages are proposed all along the project road as per Manual.
16	Child labours should not be allowed during the construction	Measures will be taken by TNRSP not to allow child labours during construction
17	Present road conditions are very poor, and the road width is very less. No proper road facilities are available now, it should be included in new design.	Proposed road will be 2-Lane+PS without median and Road facilities such as Bus bays with bus shelter drinking water and toilet facility, road signages, lighting facility in built up etc., are proposed.
18	There are no public toilet facilities or public drinking water facility available	Busbay with Bus shelters Locations are provided with toilet and drinking water facility.
19	Traffic safety awareness program may be included in the project and all the school students and tractor drivers and bull cart maintaining farmers.	Safety Awareness program shall be conducted during the project construction and operation phases through some institutions/ experts for school students and road users.

3 Project Road : Chithode to Erode Road (SH 15)

Consultation date and time : 10th March 2020 (10.00 am)
Venue : Amman Mahal Hall, Kanthayanthottam, Erode
TNRSP Members and DPR Consultants : Mr. Madeswaran, Divisional Engineer TNRSP, Erode,
Mr. Mathiarasan, Assistant Divisional Engineer TNRSP, Erode,
Mr.Gokul, Assistant Engineer, TNRSP Erode,
Mr.Bhoopathi, Special Tahsildar, Tirupur,
Mr. Praveen, Design Engineer, Feedback Infra,
Mrs. Chitra, Environmental Engineer, Feedback Infra,

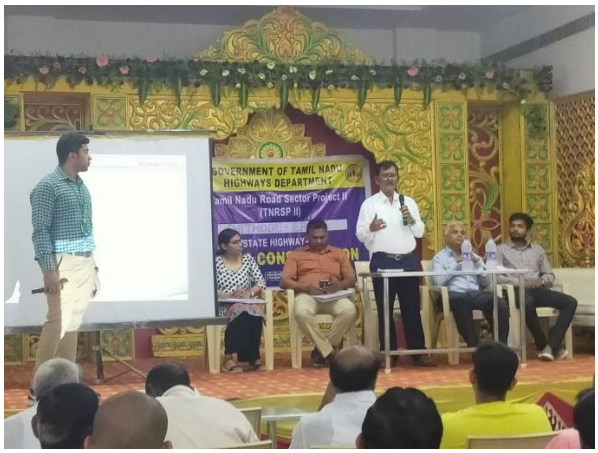
		Mr. Amruth Kumar BG, Social Expert, Feedback Infra
No of Public Participants	:	71 project affected persons including 20 women attended the meeting
Information to the PAP's	:	All the affected families were invited to the meeting through a public notice

Notice distribution for public consultation meeting

- Mr. Amruth Kumar Social Expert welcomed all the participants and briefed about the importance of Public consultation meeting. After that Mr. Raj Kumar, consultant given a power point presentation to the participants which covered the project, draft design (showing the existing and proposed ROW), details about bus bays, bus shelters, drainage, traffic facilities, safety measures, facilities provided for pedestrians, likely environmental impacts, mitigation and enhancement measures etc.

Power Point Presentation by the consultant to the PAPs

- Mr.Madeswaran, Divisional Engineer, Erode explained the design and alignment details to the audience, Mr.Bhoopathi, Special Tahsildar, Tirupur explained the Land Acquisition details to the Participants.



TNRSP officals explaining about the Project


PAPs attending Public Consultation Meeting

Key Points from the Consultation

- The people were aware about the road widening since survey activities, alignment marking etc are in progress. However, they were not aware about the land acquisition methods, road alignment, compensations etc. The major concern of the PAPs was about the width of the road widening. The road will develop up to the blue mark already marked by the Highway department or more land will be acquired. Some of them asked about the compensation for buildings affected and for the affected squatters. They expressed their difficulty in crossing the road and requested for Bus shelters.
- After the Power point presentation discussions were initiated. Participants asked their doubts regarding road alignment, Compensation method and Land acquisition. The point discussed and mitigation measures are presented the following table.

Table 42: Queries raised by public in the meeting and reply given by project team for Chithode to Erode Road (SH 15)

Sl No	Public's Demand/concern	Design change / Mitigation measures proposed / Reason rejection etc.
1	At present we are facing heavy Traffic Block. So, request for a solution	New road alignment is designed to avoid traffic blocks
2	PAPs requested to inform in advance about the Land and structure to be acquired	Prior intimation will give before measuring land and building.
3	Whether the road widening will	The alignment is designed to minimise the

Sl No	Public's Demand/concern	Design change / Mitigation measures proposed / Reason rejection etc.
	be managed with the existing Government land or acquire additional land	impact on both sides. The private land will be acquired only under unavoidable circumstances
4	Bus bays may be provided	Sufficient Bus bays and Bus shelter is included in the design.
5	In school area there are no sign board, zebra crossing and speed breakers.	Sign boards along with pedestrian crossing are proposed
6	There is no hygienic toilet or drinking water facility in public places	Toilet and drinking water facilities are provided at Bus bay with Bus shelters Locations.
7	TASMAC will be affected due to road widening. So propose for Two lane.	Design is already finalised for four lane. Alternate arrangements will be made to shift the TASMAC
8	People demanded for six lane to avoid heavy traffic	At present the road is designed for four line with paved shoulders, considering the traffic after the traffic survey studies.
9	There are no proper streetlights, they recommend for reliable streetlight.	Street lighting are proposed in urban areas
10	Job may be provided during construction.	Provision shall be done in the bid documents
11	Proper signage may be provided to avoid accidents.	Proper road signages are proposed all along the project road as per Manual.
12	Child labours should not be allowed during the construction	Measures will be taken by TNRSP not to allow child labours during construction
13	People requested to avoid the impact on CPR	Alignment will be reverified and will inform accordingly.

6.3 Design inclusions based on the Consultations

a) Integration of public demand in the design for Omalur Mecheri Road (SH 222)

Sl No	Public's Demand/concern	Design change / Mitigation measures proposed / Reason rejection etc.
1	Median opening is required at least in every Km interval	17 Median Openings are proposed in 13.17 km length of project road
2	Bus bays may be provided	15 Bus bays are provided
3	Traffic signals and signboards may be provided	Traffic signage is provided, as there are no major trafficated junction along the project highway. Traffic signals are not provided.
4	What are the arrangements for tree cutting and plantation?	Compensatory tree plantation is proposed
5	Bus shelters and bus stations should be developed suitable to differently abled persons.	Incorporated in Bus bay location at approach.
6	Noise barriers may be provided near to the school, hospital etc.	Based on the assessment, noise barriers shall be provided at schools and hospitals
7	There are no safety for girls in isolated bus waiting areas.	Bus shelters are provided with lighting arrangements and separate Toilet facility is provided at bus shelters with busbays

Sl No	Public's Demand/concern	Design change / Mitigation measures proposed / Reason rejection etc.
8	At least in main bus shelters CCTV camera may be placed	CCTV are proposed
9	Ladies mostly use two wheelers, whereas the vehicles generally over speed and overtake in wrong side which creates difficulty and creates a fear to drive. Prefer separate lane for two wheelers.	Paved shoulder of 1.5 m is provided on either side of the main carriageway, which can be used for 2-wheelrer traffic.
10	In school area there are no sign board, zebra crossing and speed breakers.	Sign boards along with pedestrian crossing are proposed
11	There is no hygienic toilet or drinking water facility in public places	Busbay with Bus shelters Locations are provided with toilet and drinking water facility.
12	Since there is a railway crossing in the proposed road, train crossing time should be displayed	Realignment has been proposed for Omalur with Proposal of ROB and at existing railway line, limited height subway will be proposed in separate phase.
13	Displaying of helpline numbers, bus time schedule in bus shelters and public places should be made compulsory.	helpline numbers, bus time schedule will be provided in Bus shelter location
14	There are no proper streetlights, they recommend for reliable streetlight.	Street lighting are proposed in Builtup areas, Major and Minor Junction
15	In Kamineri village there is no bus bay or bus shelter. Bus drivers doesn't stop in a permanent place. It is very difficult for female passengers.	Near Kamineri Village Bus bay with bus shelter is proposed and all the bus shall stop at the proposed bus bay
16	People demanded for ROB at railway level cross	Realignment has been proposed for Omalur with Proposal of ROB and at existing railway line, limited height subway will be proposed in separate phase.
17	Foot path may be provided along the built-up locations.	Raised footpath cum drain is proposed at built up areas
18	Landowners should get market rate for loss of land (Land value 2 lac/cent.)	Compensation for Land acquisition shall be as per Land acquisition act
19	Dedicated bus bay and bus stop should be provided at built up locations to avoid traffic block	Based on availability of land, Bus shelter with/without bus bays are proposed
20	Median to be provided at built up locations	Median is proposed
21	Job may be provided during construction.	Contractors shall be advised to recruit local labours for the construction works.
22	Proper signage may be provided to avoid accidents.	Proper road signages are proposed all along the project road.
23	Child labours should not be allowed during the construction	Measures will be taken by TNRSP not to allow child labours during construction
24	Present road conditions are very	Proposed road will be 4-Lane divided

Sl No	Public's Demand/concern	Design change / Mitigation measures proposed / Reason rejection etc.
	poor, and the road width is very less. No proper road facilities are available now, it should be included in new design.	carriageway with paved shoulder and signages are proposed as per manual
25	There are no public toilet facilities or public drinking water facility available	Busbay with Bus shelters Locations are provided with toilet and drinking water facility.
26	Traffic safety awareness program may be included in the project for all the school students and tractor drivers and bull cart maintaining farmers.	Safety Awareness program shall be conducted during the project construction and operation phases through some institutions/ experts for school students and road users.

b) Integration of public demand in the design for Malliyakarai to Attur Road (SH 30)

Sl. No	Public's Demand/concern	Design change / Mitigation measures proposed / Reason rejection etc.
1	Realignment may be provided to avoid impact to residential buildings at Thandavarayapuram	Realignment is not possible as it will invite huge acquisition of agricultural land.
2	Demanded to limit the widening within the existing ROW at Thandavarayapuram	Minimum acquisition has been proposed
3	Bus bays may be provided	7 Bus bays with bus shelters are provided
4	Traffic signals and signboards may be provided	Traffic signage is provided for the entire stretch as per Manual. As there are no major trafficated junction along the project highway, traffic signals are not provided.
5	What are the arrangements for tree cutting and plantation?	889 trees are likely to be cut for the project. Submission of tree cutting permission from Forest Department is under preparation. As per the Madras High Court Order, 10 trees are proposed to be planted for each tree to be cut. It is proposed to plant the trees in the EROW where the land is available as well as in the Govt Offices, Schools etc.
6	Noise barrier may be provided near to the school, hospital etc.	Compound wall facilities are available in the schools and hospitals in the project area. Even though, it is proposed to plant trees like Polyalthia longifolia along the Compound Wall to further reduce the noise impact
7	In school area there are no sign board, zebra crossing and speed breakers.	Sign boards along with pedestrian crossing are proposed
8	There is no hygienic toilet or drinking water facility in public places	Busbay with Bus shelters Locations are provided with toilet and drinking water facility.
9	There are no proper streetlights, they recommend for reliable streetlight.	Street lighting are proposed in urban areas
10	People demanded for ROB at railway level cross	RUB is proposed based on geometry of the road

Sl. No	Public's Demand/concern	Design change / Mitigation measures proposed / Reason rejection etc.
11	Foot path may be provided along the built-up locations.	Raised footpath cum drain is proposed at built up areas
12	Landowners should get market rate for loss of land (Land value 2 lac/cent.)	Compensation for Land acquisition shall be as per Land acquisition act
13	Dedicated bus bay and bus stop should be provided at built up locations to avoid traffic block	Based on availability of land, Bus shelter with/without bus bays are proposed
14	Job may be provided during construction.	
15	Proper signage may be provided to avoid accidents.	Proper road signages are proposed all along the project road as per Manual.
16	Child labours should not be allowed during the construction	Measures will be taken by TNRSP not to allow child labours during construction
17	Present road conditions are very poor, and the road width is very less. No proper road facilities are available now, it should be included in new design.	Proposed road will be 2-Lane+PS without median and Road facilities such as Bus bays with bus shelter drinking water and toilet facility, road signages, lighting facility in built up etc., are proposed.
18	There are no public toilet facilities or public drinking water facility available	Busbay with Bus shelters Locations are provided with toilet and drinking water facility.
19	Traffic safety awareness program may be included in the project and all the school students and tractor drivers and bull cart maintaining farmers.	

7 ANALYSIS OF ALTERNATIVES

During the entire stage of the project preparation, comprising of screening and detail design preparation, various alternatives were identified and analyzed to help in decision making.

7.1 With and Without project alternatives

The "With" project scenario with positive/beneficial impacts on the traffic conditions shall vastly improve the environment resulting in the betterment of social and economic development of the region. In comparison, the "Without" project scenario shall further deteriorate the present traffic conditions and adversely affect the environmental conditions and quality of life. Other factors like infrastructure development, economic analysis and other project benefits were also taken into consideration for analysing with and without project scenarios.

7.2 Highway design alternatives

During the project design stage for Phase – 1 Corridors, the road alignment and cross-section options have been identified based on applicable design standards related to traffic growth, pavement strength, design requirements, consideration of safety aspects, etc. For Omalur to Mecheri Road (SH 222), there is a requirement for major realignment for about1.5km. In Malliyakarai to Attur Road (SH 30), three realignments have been suggested to avoid sharp curves located at (i) km 83/460 to km 83/750, (ii) km 86/030 to km 86/300 and (iii) km 87/870 to 88/200. In Chithode to Erode Road (SH 15), realignment options are not required, the road geometry is observed to be good.

7.2.1 Realignment Alternatives

Omalur to Mecheri Road (SH 222) starts at Omalur (km 0/000) from the SH 86 and ends at Mecheri (km 14/600), immediately at km 0/250, there is a level crossing (LC 10). As per the discussion held with the TNRSP, it is proposed to construct a Rail Over Bridge (RoB) in that location, however, based on the inventory it is anticipated to have significant social impacts concerning the structures as it is a commercial area and a major junction is located within 150m from the level crossing. Hence to avoid the impacts, realignment options have been explored. 3 best options have been studied. The outcome of the analysis is discussed in the following sections

- **Option 1:** It is a Greenfield alignment for 1.3 km (Realignment starts at existing km 2/450 of SH 86 and ends at km 0/950 of SH 222 near Pachanamapatty village), it is proposed to have 4 box culverts, 1 ROB and 1 VUP/VOP. The existing land use in the realignment section is mostly agriculture, followed by scattered built-up and the total number of structures that are likely to be affected is 25 (12no's RCC buildings, 4 no's sheet, 2 no's Tiled buildings, 4 no's Huts, 2 no's pump house, 2 no's open wells and one temple). It is proposed to have 45m to 50m RoW. Total land acquisition for the realignment option is estimated to be 6.99 ha.

Merits	Demerits
• Provides better connectivity and smooth passage to through traffic and trucks. • Length of Alignment is comparatively less, • Extent of Land Acquisition is less • Project cost is comparatively less • ROB is proposed across railway line which eases the movement of traffic	• 25 no's of Buildings are getting affected due to scattered built up • As the alignment passes through highly cultivated farms and built-up sections, it involves the acquisition of a large extent of highly fertile farmland.

RCC Building at Ch 0/160 – Option 1

RCC Building at Ch 0/965– Option 1

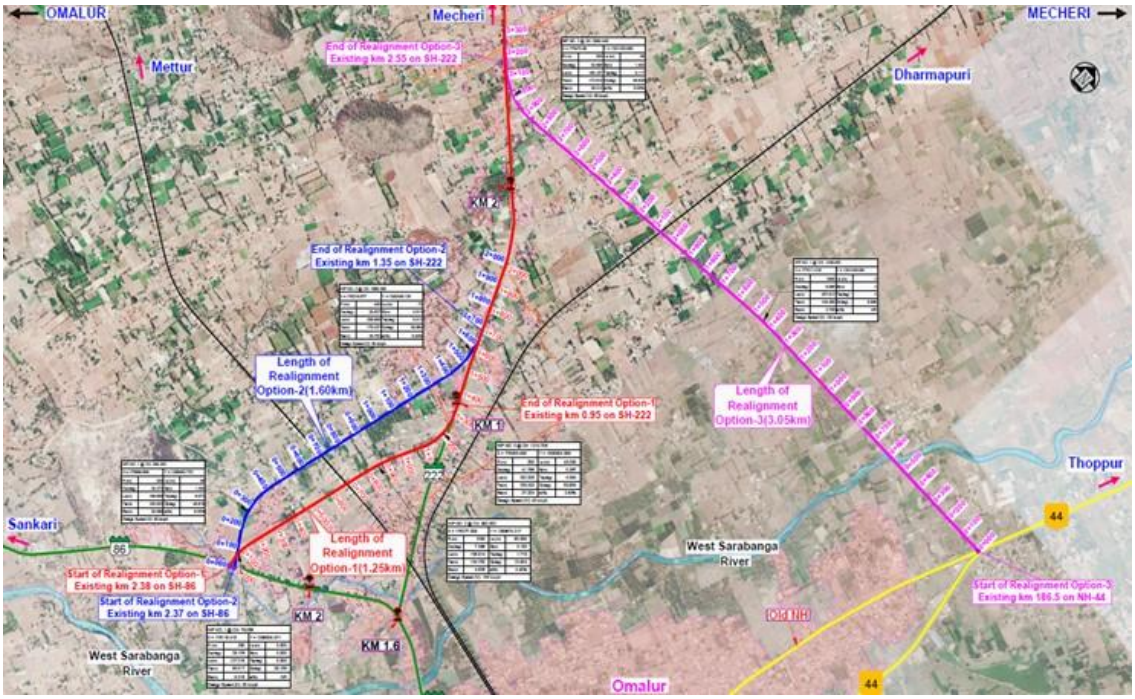


Figure 10: Realignment Options for SH -222

- **Option 2:** It is a Greenfield alignment for a distance of 1.66 km, proposed to have 4 box culverts, 1 minor bridge, 1 ROB, and 1 VUP/VOP. The existing land use in the realignment section is mostly agriculture and the total number of structures that are likely to be affected is 16 (2 no's RCC Buildings, 6 no's sheet, 8 no's Tiled buildings, one grave yard, one pump house, 2 no's open wells). It is proposed to have 45m to 50m RoW. Total land acquisition for the realignment option is estimated to be 8.77 ha.

Merits	Demerits
• Provides better connectivity and smooth passage to through traffic and trucks. • Less number of buildings are getting affected compared to other options • ROB is proposed across railway line which eases the movement of traffic	• Alignment crosses a Pond (Tank) for a length of 40m approximately, Minor Bridge has to be proposed. Getting clearance from Irrigation department will delay the execution of project. • Alignment is affecting Grave yard, Social impact will be high • Length of alignment is high in comparison withOption 1, civil cost and LA cost is more.

RCC Building at Ch 0/620 - Option 2

RCC Building at Ch 1/330 – Option 2

- **Option 3:** It is proposed to widen in an existing MDR for a distance of 3.05 km and proposed to have 1 major bridge, 15 Box culverts, 1 ROB and 1 VUP/VOP. The existing land use in the realignment section is mostly agriculture and partly dry land. The total number of structures that are likely to be affected is 29 (9 no's RCC Buildings, 3 no's sheet, 7 no's Tiled buildings, 8 no's huts, 2 no's pump house, 4 no's open wells). It is proposed to have 45m to 50m RoW. Total land acquisition for the realignment option is estimated to be 15.65 ha.

Merits	Demerits
• Provides better connectivity and smooth passage to through traffic and trucks. • ROB is proposed across railway line which eases the movement of traffic • Direct Connectivity to NH-44 traffic, Thus through traffic is avoided entering Omalur town	• Length of alignment is more in comparison with other two options. Hence LA cost and Project Cost is High • As the alignment passes through highly cultivated farms and built-up sections, it involves the acquisition of a large extent of highly fertile farmland. • As this option connects NH-44 with project road, the traffic from and to Omalur has to use the existing road from start till end of the realignment (i.e., Km 0/000 to Km 2/550 of SH 222) and has to cross railway level crossing. • More number CD Structures are required

Tiled House at Ch 0/070 – Option 3

RCC Building and Sheet House at Ch 1/025 – Option 3

Based on the analysis, Option-1 was chosen for implementation (Details of the comparison are enclosed in **Annexure 7**). However, all the analysed options are having significant social impact with respect to land acquisition and hence as per the discussion had with the TNRSP, it was decided to take up the section between km 0/000 to km 1/150 involving

realignment in the second phase. Hence, the project design is considered from km 1/150 to km 14/300.

7.3 Minimizing Involuntary Resettlement

In order to avoid/minimize the land acquisition identification of ROW was taken up at the outset of the study. Out of the 31.18 km length of the project stretch widening is limited to existing ROW for around 10.50 km. Out of the total length around 18.98 km is concentric widening around 10.56 km is eccentric widening, and remaining length (1.64 km) is curve improvement and realignments. The widening options were adopted to avoid/minimize the adverse social impacts of the project. Due to this exercise around 1000 structures are saved from demolition (comparison is done with screening survey data). Existing road at Thanvarayapuram hamlet of Attur - Malliyakarai is narrow and ribbon developed, the widening is limited to 15 meters instead of 18 meters (standard PROW adopted in other built up locations in the project) around 18 houses have been saved due to this intervention.

7.4 Scope for Reclaiming and Reuse Material from Existing Road Pavement

The existing pavement type is observed to be flexible and having several destresses, which may be the result of insufficient pavement layers, improper design and also change in vehicular traffic type. During crust cutting carried out along the Phaase-1 Corridors, it was observed that the pavement layer thickness is insufficient. Thus, it was suggested to reconstruct the pavement as per the design carried out based on the latest IRC codes. The estimated road construction debris likely to be generated is given in the following table.

Sl.no	Item	Unit	Quantity		
			SH 222	SH 30	SH 15
1	Bituminous Material	Cum	16101	14622	16233
2	Pavement Crust	Cum	63572	56784	19114
3	Stone Masonry	Cum	641	Nil	1370
4	RCC	Cum	292	34657	3833
5	Hume Pipes	m	189	Nil	130

The details of reclaiming and reuse of materials from existing pavement layers are as follows,

- The existing road will be dug till the end of the proposed subgrade bottom and the existing subgrade will be used as filling material in the widened portion of the road as embankment, however, it is subjected to the suitability of the material and need.
- The base course in the existing roads may be considered to be used for the construction of diversion roads, raising the crossroads, as a soling layer below cross drainage structures if the soil is weak.
- The surface course which is of bituminous type may be broken and separated from the bitumen coating and based on gradation, the aggregates can be used in base/sub base layers. It can also be used for the construction of bituminous layers in low-intensity traffic roads such as village roads. Suitability of the material for use in different pavement layers shall be properly assessed before using it in any layer. However, the cost and time involved in the reuse of the bituminous layer are high and tedious. This option maybe explored.

The quantity of reusable materials are shown below

Sl.no	Item	Unit	Quantity		
			SH 222	SH 30	SH 15
1	Bituminous Material	Cum	Nil	Nil	Nil
2	Pavement Crust	Cum	32006	16306	19114
3	Stone Masonry	Cum	Nil	Nil	Nil
4	Cutting Material	Cum	25188	8934	Nil
5	Subgrade	Cum	18994	1990	Nil

8 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

8.1 Environmental Impact Assessment

8.1.1 Project Impacts and Issues

The project impacts and issues, related to environment and social due to implementation of widening and strengthening of Phase – 1 Corridors has been structured as per the discussions in Chapter 4: Baseline Environmental Status. The environmental impacts could be direct as well as indirect. The direct area of influence includes the Corridor of Impact (CoI) and the construction sites for the project. The indirect area of influence includes areas with potential indirect impacts, for example areas impacted from sediment-loaded runoff or areas impacted due to location of labour camps. The impacts on various environmental components can occur at any of the following stages of the project planning and implementation: (i) Planning and design stage; (ii) Construction stage; and (iii) Operation stage. The description and magnitude of impacts for the various environmental components of the project are presented in the following sections

8.1.2 Project Intervention

8.1.2.1 Removal of Pavement

Existing pavement is flexible, general condition of the pavement varies between good to very Poor. Pavement is observed with alligator cracking, longitudinal cracking, edge drop & patching along the carriageway. Earthen shoulders are observed throughout on either side, the width of earthen shoulder varies from 0.5m to 1.5m and the condition of the earthen shoulder is good to poor. Based on the visual observations, in Omalur to Mecheri Road (SH 222), 52% of the pavement is observed to be in good condition, 32% is in fair condition and 16% of the pavement is in poor condition. For Malliyakarai to Attur Road (SH 30), around 36.92% of the pavement was observed to be in good condition and in Chithode to Erode Road (SH 15), nearly 44% of the pavement is in good condition. However, as per the crust cutting analysis, it was observed that the pavement layer thickness is insufficient as per IRC standards. Also, the existing subgrade compaction is observed to be less than 97% of MDD. It was observed that at some locations, the CBR of subgrade soil is less than the design CBR. Thus, it was suggested to reconstruct the pavement as per the IRC design standards with materials and construction procedures complying with MoRTH 5th revision specifications. Hence removal of pavement for the entire stretch for construction purpose will not impose any major impact. But can cause temporary hindrance to the local populace.

Alligator cracks at km 2/000 (SH 222)

Potholes at km 86/550 (SH 30)

8.1.2.2 Removal of Trees and Vegetation

Right of Way for the Phase – 1 Corridors must be cleared of vegetation for the road construction. These will involve cutting of the trees within the proposed RoW. The trees felling in this region will have significant impact on the environment. However, mitigation measures will be taken with almost care. In the long term, the proposed plantation will have direct positive impact on the ecological resources. As per detailed assessment, 1833 trees are observed within the RPoW for Omalur to Mecheri Road, 831 trees are observed in the Malliyakarai to Attur Road and 825 trees are observed in the Chithode to Erode Road. However, based on the road design, the actual number of tress getting affected is discussed in the section 8.1.8.3 (tree cutting).

Sl.no	Phase – 1 Corridors	RHS	LHS	Total
1	Omalur to Mecheri Road (SH 222)	909	924	1833
2	Malliyakarai to Attur Road (SH 30)	419	412	831
3	Chithode to Erode Road (SH 15)	428	392	825

The common trees observed along the Phase – 1 Corridors includes Arasu Maram (Pepal tree) - *Ficus religiosa*, Jambolan Tree - *Syzygium cumini,* Palm tree – *Borassus flabellifer*, Tamarind tree - *Tamarindus indica*, Neem Tree - *Azadirachta indica*, Pungan Tree - *Millettia pinnata*, Coconut Tree - *Cocos nucifera*, Kona puliyanga tree - *Pithecellobium dulce*, Mango tree - *Mangifera indica*, Teak Tree - *Tectona grandis* and Illupai Tree - *Madhuca longifolia*.

Avenue trees (Palm trees) in the SH -222 (km 12/100)

Avenue trees (Tamarind trees) in the SH - 30 (km 82/00)

8.1.2.3 Machinery and plant for Construction Activity

The following **Table 43** presents the quantum of vehicles & machinery required for project intervention and their influence area. These machineries will have its bearing on surrounding environment especially on the air quality, subject to emission level of machinery and Noise Environment. However, strict guideline has 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 5 years.
- Vehicles/ equipment will be regularly subjected for emission tests and will have valid “Pollution under Control (PUC)” certificate.
- All vehicles deployed for material haulage will be spill proof.
- Water tankers with suitable sprinkling system will be deployed along the haulage road and in the work site.

Table 43: Machinery and plant for Construction Activity (Per Corridor)

Sl. No.	Construction Machinery	Quantity (no's)	Influence area
1	Dumpers	15	Quarry approach and Project roads
2	Excavators	2	Quarry sites & Project Roads
3	Road Rollers	4	Project roads
4	Graders/ Pavers	2 to 4	each Project Roads
5	Stone Crusher /BT Plant	1 each	Plant sites

8.1.2.4 Manpower for Construction Activity

It is proposed that 25% of earth work will only be carried out manually and the rest 75% will be done by machinery. According to preliminary estimates, approximately 250 to 280 workers would be required for each of the project corridors in the Phase – 1, of which 30% to 50% may be brought in from other states. However, it is expected that large force of such labourers are available in the vicinity of the project areas.

Type of Labour Force		Omalur to Mecheri	Malliyakarai to Attur	Chithode to Erode
Skilled	BT Labour	20	20	20
	WMM Labour	20	20	20
	Operators (DBM, WMM, Batching Plant)	10	10	10
	Weighbridge Operators	2	2	2
	Computer Operator	5	5	5
Semi-Skilled	Concreting	50	30	40
	Drivers	20	20	20
Unskilled	For Highways, Structures and safety departments	100	100	70
Technicians	Lab Operators	5	5	5
Managers	PM	1	1	1
	DPM	2	2	2
Engineers	Sr. Highway Engineers	8	8	8
	Structural Engineers	4	8	6
	Highway Engineers	10	10	8
	Junior Engineers	20	20	15
Total		**277**	**261**	**232**

Source: DPR 2020

8.1.3 Land Environment

8.1.3.1 Impact on Topography

Construction phase starts from taking possession of the site. The work in this phase comprises of site clearance, land development, building of infrastructural facilities and all construction work till commissioning. Duration of this phase is dependent on many factors such as finance, size of the project, location and infrastructural support, etc. The project implementation involves construction of office buildings, labour camps, mixing plants etc. during construction period. This may result in a change in the local landuse. However, these impacts are marginal and exist only during the construction phase.

Disposal of the construction waste can also affect the local topography of the area if accumulated or indiscriminately dumped in the project area. However these excavated waste will be tested for their CBR values and if found suitable will be used for the

construction of diversion roads, raising the crossroads, as a soling layer below cross drainage structures if the soil is weak or disposed off in identified designated dumping site and low lying areas to avoid major impacts. This shall be taken-up in consultation with the ULB's/ local panchayat or in consultation with the communities/ villagers. Summary of Disposal quantities excluding reusing quantity are given below

Sl No	Pavement Layer	Omalur to Mecheri	Malliyakarai to Attur	Chithode to Erode
1	Bituminous Layer	16101	11929	16233
2	Granular Layer	Nil	Nil	Nil
3	Subgrade	25,317	22470	Nil
4	Concrete	292	490	3833
5	Stone Masonry	641	77	1370

Source: DPR 2020

8.1.3.2 Impact on Geology

As the proposed phase – 1 corridors passes through flat terrain in Omalur to Mecheri Road (SH 222) and Malliyakarai to Attur Road (SH 30) and an undulating terrain to some extent in Chithode to Erode Road (SH 15).There are no significant impacts on geology that is anticipated from activities involved in construction of proposed road. However, road construction from activities will require supply of road building materials, which should be collected from approved quarry sites. Likely impact on the geology is due to the uncontrolled blasting in the quarries supplying aggregates for construction at these sites. As these quarries are licensed, the prevalent rules on blasting will be adhered to. Hence, the impact on general geology of the region is insignificant. At the construction sites, no blasting is envisaged.

8.1.3.3 Impact on Seismology

The proposed phase – 1 corridors attracts under seismic zone II (Low Damage Risk Zone) for Chithode to Erode Road (SH 15) and zone III (Moderate Damage Risk Zone) for Omalur to Mecheri Road (SH 222) and Malliyakarai to Attur Road (SH 30). Hence, the project components including the structures (bridges, culverts) will be constructed to withstand the level of seismic activity as per ISI specifications for Zone-II and III. Thus, the impact on Seismology of the region is insignificant.

8.1.3.4 Impact on Land

The available right-of-way (RoW) shall fully be optimized for the proposed improvements. The exact alignment of the RoW is being determined using village FMB (Field Measurement Book) maps. In many areas, the existing RoW is not enough to meet the design requirements of the cross-sections. As per the analysis, the available land area in the Existing Right of Way (EROW) is 68.36 Ha, the additional land required for the proposed improvements are worked out to be 12.51 Ha (11.75 Ha of private land and transfer of 0.76 Ha of government land). The estimated area is exclusive of the realignment section proposed in the Omalur – Mecheri Road (SH 222). As per the land records the category of all the affected land is "DRY" and hence no major impact is anticipated. However, the acquired land will be permanently converted to road surface. Hence, the impact on the land is irreversible.

Quarries and borrow pits

The excavation of quarries and borrow pits used for obtaining soil and aggregate materials for road construction can cause direct and indirect long-term adverse impacts on the environment. The proposed up-gradation works (strengthening and widening) envisage use

of significant quantities of earth, stone and grit and sand along with bitumen. The principal construction materials required for the corridor includes:

- Quarry materials, used in asphalt and aggregate for upper pavement layers
- Sand, gravel, laterite, clay and other materials for fill and lower pavement layers

Contract documents specify the materials to be used, but not specific quarries, pits or borrow sites for obtaining the various materials. The contractor shall identify the source of materials and use them with the consent of the Engineer in charge. The sources of construction material that the contractor needs to tap include:

- Quarry materials from licensed existing quarries
- Sand from riverbeds (purchase directly from GoTN website www.tnsand.in)
- Clays from tanks, many of which are near the project area
- Laterites available in the vicinity of project area

8.1.3.5 Contamination of Soil

In this project, the 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 MEASURES

8.1.3.6 Change in Topography

As indicated in the section 8.1.3.1 Impact on topography, there is not much impact on topography though some of the section in the Chithode to Erode Road (SH 15) has undulating terrain. As per the assessment, Blasting activities are not anticipated in any of the Phase – 1 corridors. However, under unforeseen situation, suitable mitigation measures are suggested in the ESMP.

8.1.3.7 Change in Geology

Though no major impacts on geological profile of the project areas are anticipated, requirement of construction material from quarries will induce pressure on the local geological deposits. The contractor has to ensure procurement of the construction material from licensed quarries only. It is envisaged that no new quarries will be proposed.

The quarries that would be used for procuring construction material should be established under “Tamil Nadu Minor Mineral Concession Rules, 1959 and its amendments”. The rules lay down guidelines for establishing quarries and obtaining quarry lease. It also specifies the conditions to be maintained for operating the quarry or for obtaining renewal of

quarry lease. In lieu of quarrying in environmentally sensitive areas, certain restrictions have been imposed to avoid any detrimental impact due to irresponsible quarrying. The rules lay down various precautionary measures that needs to be abided during blasting, measures needed towards safety of workers, management measures within quarries, approval of the village heads / panchayat prior to material leaving the village, to avoid spillage during transport of quarry materials.

The Contractor is free to choose the quarries from amongst the list of quarries (refer DPR) or any other existing quarry, which is already operational with the relevant clearances and compliance to environmental requirements.

8.1.3.8 Change in Seismology

As discussed in section 8.1.3.3 and section 4.1.4 the project corridor falls under zone-II (Low Damage Risk Zone) and III (Moderate Damage Risk Zone) and it is not vulnerable to earthquake. Hence, no impacts are anticipated due to proposed widening and strengthening of phase – 1 corridors.

8.1.3.9 Change in Land Environment

As far as possible the land acquisition has been kept to the minimum, by restricting the geometric improvement within the proposed right of way. The same can be seen as only 12.51 Ha land is required for project road upgradation. However, the land acquisition will be done at sections having width, insufficient to accommodate the approved cross-section & geometric improvements. For Land acquisition sections,please refer RAP (Chapter 2 Land Acquisition and Compensation).

Quarries and borrow pits

Specific locations of borrow areas to be used will be identified by Contractor. The selection and recommendations for borrow areas will be based on environmental as well as engineering considerations. Location and source of material for embankment or sub-grade and the procedure for excavation or transport of material will be in compliance with the environmental requirements of the MoEF&CC, MoRTH and as specified in IRC: 10-1961 areas to mitigate the impacts will be the responsibility of the Contractor. For the redevelopment of the borrow area, the contractor shall evolve site-specific redevelopment plan for each borrow area location, which shall be implemented after the approval of the Engineer–incharge (CSC).

Precautionary measures as the covering of vehicles will be taken to avoid spillage during transport of borrow materials. The unpaved surfaces used for the haulage of borrow materials will be maintained properly. The haul roads and borrow areas will be managed and maintained by the Contractor. Since dust rising is the only impact along the haul roads sprinkling of water will be carried out twice a day along such roads during their period of use.

Borrowing of earth shall be avoided on productive lands and within or 1 km of settlement areas. However, in the event of borrowing from productive lands, under circumstance as described above, topsoil shall be preserved in stockpiles. At such locations, the depth of borrow pits shall not exceed 45 cm and it may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside. At locations, where private owners desire their fields to be levelled, the borrowing shall be done to a depth of not more than 2 m or up to the level of surrounding fields.

The estimated construction material required for each road is shown below

(i) **Omalur to Mecheri Corridor**

Sl. No.	Material Item	Unit	Approximate Quantity	Source
1	Aggregates	Cum	216798	Existing Quarry
2	M - Sand	Cum	5009	Existing Quarry M-Sand
3	Cement	MT	2646	Local Supply
4	Bitumen (VG-40)	MT	3445	Manali Refinery- Chennai
5	Steel	MT	429	Local Supply
6	Water	KLD	230	Surface/Ground water

(ii) **Malliyakarai to Attur Corridor**

Sl. No.	Material Item	Unit	Approximate Quantity	Source
1	Aggregates	Cum	87926	Existing Quarry
2	M - Sand	Cum	1802	Existing Quarry M-Sand
3	Cement	MT	1610	Local Supply
4	Bitumen (Emulsion)	MT	90	Manali Refinery- Chennai
5	Bitumen (VG-40)	MT	1632	Manali Refinery- Chennai
6	Steel	MT	339	Local Supply
7	Water	KLD	155	Surface/Ground water

(iii)**Chithode to Erode Corridor**

Sl. No.	Material Item	Unit	Approximate Quantity	Source
1	Aggregates	Cum	119929	Existing Quarry
2	M - Sand	Cum	3602	Existing Quarry M-Sand
3	Cement	MT	3168	Local Supply
4	Bitumen (Emulsion)	MT	130	Manali Refinery- Chennai
5	Bitumen (VG-40)	MT	2060	Manali Refinery- Chennai
6	Steel	MT	545	Local Supply
7	Water	KLD	230	Surface/Ground water

8.1.3.10 Contamination of soil

Soil contamination is likely due to the possible leakage of fuel/lubricants and dumping of construction wastes during construction stage. The contractor will be required to initiate measures to reduce/prevent waste generation from all activities. The measures would include

- Identifying landfill sites for disposal of debris and a plan for disposal needs to be prepared by the Contractor with approval of Engineer–in charge (CSC)
- Undertake measures for minimization of waste and recycling of surplus materials for use by local communities
- Methods of collection and disposal of domestic waste
- Follow established procedures for storage of hazardous goods and chemicals
- Prepare plans for clean-up of any accidental spillage
- Checks for ensuring erosion control structures are in place before earthworks are started

8.1.3.11 Soil Quality – Mitigation

All arrangement for transportation during construction including provision, maintenance and clearing debris, where necessary will be considered incidental to the work and should be planned and implemented by the Contractor as approved and directed by the Engineer-in charge (CSC). Disposal of all waste materials is responsibility of the Contractor and provisions to this effect are provided in the engineering budget/civil cost.

At various construction sites, the vehicles and equipment will be maintained and refuelled in such a fashion that oil/diesel spillage does not contaminate the soil. It will be ensured that the fuel storage and refuelling sites are kept away from drainage channels and water bodies. At the wash down and refuelling areas, "oil interceptors" shall be provided. All spills and petroleum products shall be disposed off in accordance to the TNPCB, Guidelines. Fuel storage and fuelling areas will be located at least 300m from all cross drainage structures and significant water bodies. In all fuel storage and refuelling areas located on agricultural lands or productive lands, the topsoil preservation shall be carried out.

To minimize the dumping of construction wastes from the project, the debris generated due to excavation and site preparation shall be suitably reused in the proposed construction, subject to the suitability of the material and the approval of the Engineer-in charge (CSC).

Unusable debris material shall be suitably disposed off by the Contractor at pre-designated disposal locations, subject to the approval of the Engineer-in charge (CSC). The bituminous wastes shall be dumped in secure landfill sites only, at such locations dumping will be carried out over a 60 mm thick layer of rammed clay so as to eliminate any chances of leaching. The identification of such landfill sites shall be carried out by the Contractor (before start of construction activity) and duly approved by the Engineer-in charge (CSC) and the PIU's. If the secure landfill sites are not available, then the bitumen waste shall be utilised to strengthen the nearby village roads in consultation with the local people/ panchayat.

During the operation stage, the probability of contamination of soil is only from the road runoff. The design of the road has been worked out such that the runoff is directed into nearest water bodies through well-designed drains. Impacts are anticipated only in case of accidents involving large spill over hazardous materials or petroleum products. Monitoring shall be done at the locations where these have occurred and further course of action to reduce the pollution shall be worked out.

Productive Agriculture lands

As part of the finalization of the design for the project, efforts have been made to minimize the intake of productive lands. The borrow areas; construction camp locations; traffic detours and other construction sites shall be selected carefully in consultation with the Engineer-in charge (CSC) to minimize the agricultural land acquisition. To conserve the productive topsoil of all areas affected due to project, the following measures have been proposed:

- The topsoil from all areas to be permanently covered shall be stripped to a specified depth of 150mm and stored in stockpiles. At least 10% of the temporarily acquired area shall be earmarked for storing topsoil
- The stockpile shall be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile will be restricted to 2m

- Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum and shall be covered with gunny bags or tarpaulin
- It shall be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles
- To prevent any compaction of soil in the adjoining productive lands, the movement of construction vehicles, machinery and equipment will be restricted to CoI

The stored topsoil will be utilized for:

- Covering all disturbed areas including for the redevelopment of borrow areas
- Top dressing of the road embankments and to fill slopes
- Filling up of tree pits, proposed as part of compensatory plantation

The contractor shall be responsible for working out haul roads with the minimal loss of productive soils, in consultation with the Engineer-in charge (CSC).

8.1.4 Air Environment

8.1.4.1 Meteorological factors and climate

Project activities in all stages of the project planning, construction (or) operation do not involve major or long term impacts on the macro climate and meteorology of the project area. Temporary changes in these aspects during the project operation would mostly be attributed to micro climatic changes due to addition of hard surfaces and related induced development. This would contribute to marginal rise in temperature in the vicinity of the Phase -1 Corridors and is a permanent impact.

Air quality Emissions

As discussed in the section 4.1.8 ambient air quality, the existing air quality in the Phase-1 Corridors are in good condition. However, with the implementation of the project, there will be emissions from the traffic as well as emissions from developmental activities in addition to the domestic emissions resulting in increased pollution level. Major contributor to the air pollutants in the area during project operation would be the road traffic. Emissions from asphalt hot-mix plants, transportation of construction materials and vehicular movement along the stretch which will have temporary but significant impact on air quality during the construction stage. Likely contribution of the vehicular traffic to the pollutant concentrations is estimated using prediction models as the CALINE-4[9] for the operation period. Modelling exercise has been undertaken considering the Traffic scenario in Year 2042-43.

Table 44: Traffic and Emission Rate used for the Model

Section	Chainage (km)		Length (km)	Projected Traffic 2042-43 (AADT)	CO Emission Factor (gm/mile)
	From	To			
Omlur -Machery Road (SH 222)	0/000	14/320	14.320	64759	2.52
Malliakarai -Atur Road (SH 30)	81/125	91/000	9.87	25567	2.84
Chithode - Erode Road (SH 15)	81/125	91/000	8.50	110275	2.43

Source: DPR, 2020

[9]CALINE4 is a line source air quality model developed to assess air quality impacts of Carbon Monoxide (CO) near roadways

The concentration so worked out are presented in the following table.

Table 45: Predicted Ground Level Concentration

Location	CO Incremental Concentration (mg/m^3)									
	5m	10m	15m	20m	25m	30m	35m	40m	45m	50m
Omlur- Machery Road (SH 222)	1.35	0.87	0.75	0.69	0.62	0.56	0.55	0.54	0.52	0.50
Malliakarai - Atur Road (SH 30)	0.40	0.25	0.20	0.18	0.16	0.15	0.14	0.14	0.14	0.13
Chithode - Erode Road (SH 15)	3.22	2.07	1.725	1.61	1.38	1.38	1.265	1.15	1.15	1.15

Source: CALINE 4 model output

The modelling result shows high concentration of CO in the Chithode - Erode Road (SH 15), the maximum concentration of 3.22 mg/m^3 has been recorded at a distance of 5m. However, in comparison with the NAAQ standards, the observed values are less than stipulated 4 mg/m^3 for CO (hourly monitoring). Hence, predicted CO concentration across the Phase-1 Corridors are remain well within the National Ambient Air Quality Standards for the projected years 2042-43.

MITIGATION MEASURES

8.1.4.2 Meteorological Factors and Climate

Marginal changes in micro climatic conditions of the project area as increase in temperature due to introduction of additional pavement surfaces etc. will be offset through developing roadside plantation in the road RoW. Plantation scheme adopted for the phase- 1 corridors is discussed in subsequent sections 7.8.7 of the report. Tree plantation will bring about lowering of temperature levels by offsetting any rise in temperature that would result due to introduction of pavement surface and other constructions.

8.1.4.3 Air Quality Emissions

During construction stage, the asphalt plants, crushers and the batching plants will be sited at least 1 km in the downwind direction from the nearest residential areas/ settlement. All precautions to reduce the level of dust emissions from the hot mix plants, crushers and batching plants and other transportation of materials will be taken up including:

- Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered to reduce spills on existing roads.
- Water will be sprayed on earthworks, temporary haulage and detour roads on a regular basis. During and after compaction of the sub-grade, water will be sprayed at regular intervals to prevent dust generation.
- The hot mix plant will be fitted with dust extraction units. It shall be ensured that the dust emissions from the crusher and vibrating screen from the stone quarries do not exceed the standards.

To ensure the control of exhaust gas emissions from various construction activities, the contractor shall take up the following mitigation measures:

- An adequate cyclone/scrubber to control emissions from the stack of hot mix plants will be provided in the event of the emissions exceeding the TNPCB norms.
- To ensure the efficiency of the mitigation measures suggested, air quality monitoring shall be carried out at least once every season during the period for which the plant is in operation.

- All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the TNPCB norms. A vehicle management schedule prepared by the Contractor and approved by the Engineer-in charge (CSC) shall be adhered to.

Some of the measures during Operation Stage would be to plant pollution resistant species. The pollution resistant species, which can grow in high pollutant concentrations or even absorb pollutants, can be planted in the first row. Broad-leaved tree species can help settle particulates with their higher surface areas along with thick foliage, which can reduce the distance for which particulates are carried from the road itself.

To ensure workers and road users safety during the project construction and at the construction site, the Contractor shall

- Comply with IFC EHS Guidelines on Occupational Health and Safety
- Develop comprehensive site-specific health and safety (H&S) plan. The overall objective is to provide guidance to Contractors on establishing a management strategy and applying practices that are intended to eliminate, or reduce, fatalities, injuries and illnesses for workers performing activities and tasks associated with the project.
- Include in H&S plan measures such as:
    - type of hazards in the construction site;
    - corresponding personal protective equipment for each identified hazard;
    - H&S training for all site personnel (including labours);
    - procedures to be followed for all site activities; and
    - Documentation of work-related accidents.
- Provide medical insurance coverage for workers.

Other measures: 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. The project could assist implementation of these programmes only by putting up signboards and drawing attention to air pollution problems.

Apart from provision of the mitigation measures, their effectiveness and further improvement in designs to reduce the pollutant levels with an increase in traffic shall be monitored. A monitoring plan to this affect has been prepared (**Table 59**).

8.1.5 Noise Environment

During the construction phase of the road, the major sources of noise pollution are vehicles transporting the construction material to the construction yard and the noise generating activities at the yard itself. Mixing, casting and material movement are primary noise generating activities in the yard and will be uniformly distributed over the entire construction period. Construction activities are expected to produce noise levels in the range of 80 - 95 dB (A). The construction equipment will have high noise levels, which can affect the personnel operating the machines. Use of proper Personal Protective Equipment (PPE) such as ear muffs will mitigate any adverse impact of the noise generated by such equipment.

The noise levels in the working environment are compared with the standards prescribed by Occupational Safety and Health Administration (OSHA-USA) which in-turn are being

enforced by Government of India through model rules framed under the Factories Act. The acceptable limit for each shift being of 8-hour duration; the equivalent noise level exposure during the shift is 90 dB (A). Hence, noise generated due to various activities in the construction camps may affect workers, if equivalent 8-hour exposure is more than the safety limit.The noise likely to be generated during excavation, loading and transportation of material will be in the range of 90 to 105 dB (A) and this will occur only when all the equipment operates together and simultaneously. This is, however, is a remote possibility. The workers in general are likely to be exposed to an equivalent noise level of 80 to 90 dB (A) in an 8-hour shift, for which all statutory precautions should be taken into consideration. Potential construction noise impacts are discussed in the following table

Sl. No.	Phase	Source of Noise pollution	Impact categorization
1	Pre-construction	• Man, material & machinery movements • Establishment of labor 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 (due to improved facility)	Significant permanent impact on sensitive noise receptors.

8.1.5.1 Impact on Sensitive Receptors

Phase-1 Corridors passes through residential settlements, sensitive receptors such as schools, colleges, hospitals and religious institutions located along the project roads and people in these places will be exposed to high noise levels. Sensitive receptors along the Phase-1 Corridors are presented in the **Table 46**.

Table 46: Sensitive Receptors located along the Phase- 1 Corridors

Sl.no	Location / Existing km	Description	Side	Distance from CL (m)
Omalur to Mecheri Road (SH 222)				
1.	3/300	Government Primary Health Center	RHS	60
2.	3/400	Government School	RHS	30
3.	3/810	Government School	RHS	15
4.	3/810	Government Veterinary Hospital	LHS	23
5.	4/200	Nalam Hospital	RHS	20
6.	4/620	South Indian Matriculation High Secondary School	LHS	100
7.	9/000	Sri Balamurugan College (Arts and Science College)	RHS	90
Malliyakarai to Attur Road (SH 30)				
8.	81/070	Government Veterinary Hospital	LHS	24
9.	81/970	Rasi Metric Higher Secondary School	LHS	40
10.	82/950	Government School	RHS	18
11.	88/450	First Aid Medical Center	LHS	10
Chithode to Erode Road (SH 15)				

Sl.no	Location / Existing km	Description	Side	Distance from CL (m)
12.	153/450	Government Veterinary Hospital	LHS	16
13.	154/240	Government ITI College	RHS	15
14.	155/200	SUN Matriculation Higher Secondary School	RHS	15
15.	156/700	Erode Hindu Kalvi Nilayam School	RHS	11
16.	159/520	SR Hospital	RHS	18
17.	160/070	CN College	RHS	30
18.	160/420	Sree Janani Nursery and Primary School	LHS	22
19.	160/450	Government Veterinary Hospital	RHS	12
20.	160/940	Machinery School	RHS	12

MITIGATION MEASURES

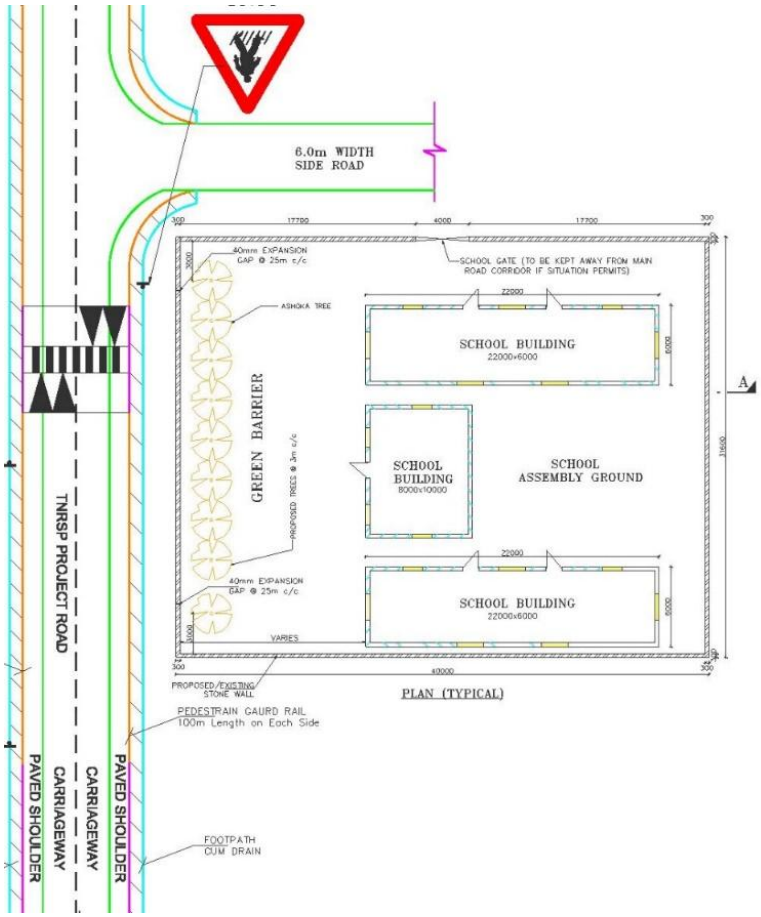
Environmental noise particularly highway traffic noise, is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency as well as type of vehicles. Suggested mitigation measures are listed in the following table

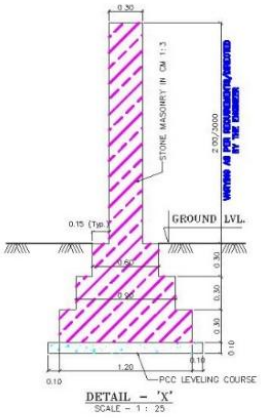
Sl. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
1	Sensitive receptors	Direct impact	Increase in noise pollution	• Noise barrier to be provided • Traffic calming devices to be used. • No Horn Zone sign Post.
2a	Noise Pollution (Pre-Construction Stage)	Direct impact, short duration	• Man, material & machinery movements • Establishment of labor 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. • Temporary as the work zones will be changing with completion of construction
2c	Noise Pollution (Operation Stage)	Marginal Impact	Due to increase in traffic (due to improved facility)	Will be compensated with the uninterrupted movement of heavy and light vehicles till the facility reaches the level of service.
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.

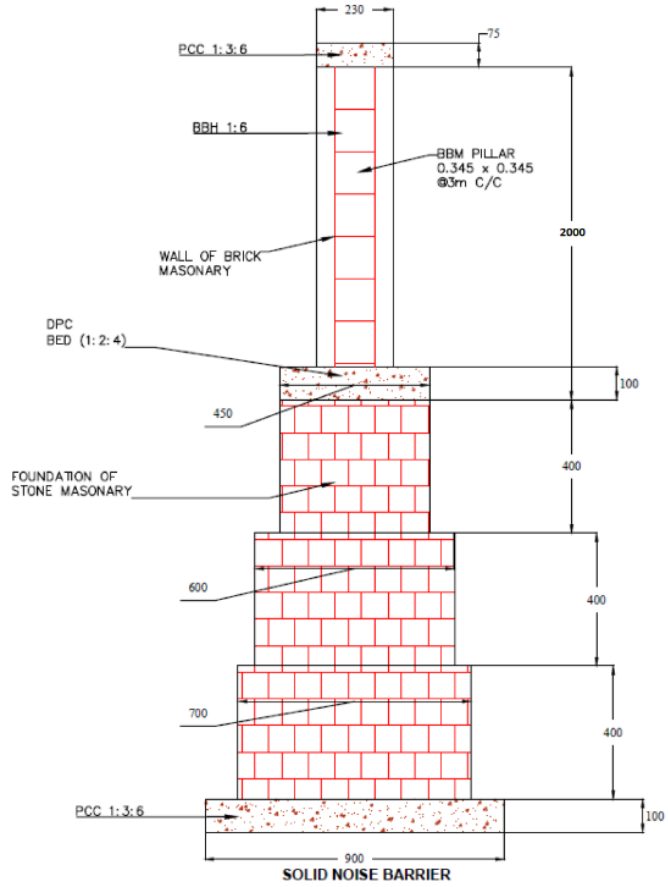
8.1.5.2 Sensitive Receptors Mitigation Measures

All schools, hospitals and cultural properties along the Phase-1 Corridors have been identified and those that are located near to the corridors will require a noise barrier (2 m concrete wall and plantation of mast trees (*Polyalthia longifolia*) at 1.5m interval behind the wall) to accommodate the long-term impact of the improved road. Use of horns should be restricted at sensitive locations like schools and hospitals by using appropriate signboards along the road. Use of air horns should be minimized during night. As per the assessment, Noise barrier has been proposed for the following sensitive receptors. Plantation has been suggested for other sensitive receptors (refer **Table 46**).

Sl,no	Sensitive Location	Chainage	Side	Remarks
Omalur to Mecheri Road (SH 222)				
1.	Government Primary Health Center	km 3/300	LHS	No Compound Wall. Hence Noise Barrier is proposed.
2.	Government School in Panchayath Office Compound	km 3/530	RHS	No Compound Wall. Hence Noise Barrier is proposed.
3.	Library (Govt. Building)	km 3/525	RHS	No Compound Wall. Hence Noise Barrier is proposed.
Chithode – Erode Road (SH 15)				
4.	Government ITI College	154/240	RHS	It is having Wire fencing and hence Noise Barrier is recommended. Tree plantation proposed as part of Compensatory Plantation







Typical Cross estion for the Noise barrier

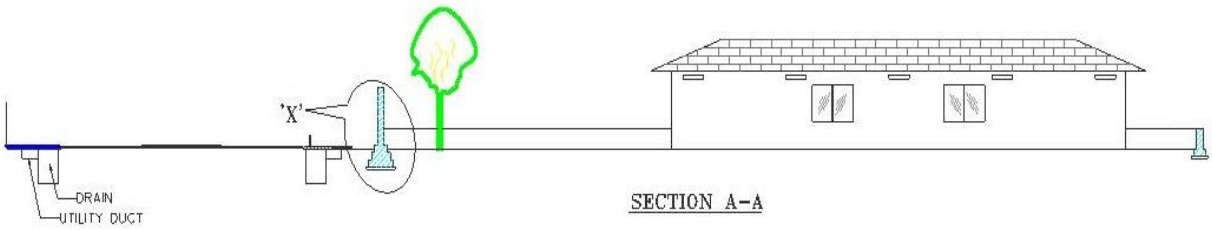


Figure 11: Conceptual Drawing for Noise Barrier

8.1.5.3 Noise mitigation during Construction and Operation phase

- Careful planning of machinery selection, operations and scheduling of operations can reduce noise levels.
- Construction contract should clearly specify the use of equipment emitting noise of not greater than 90 dB(A) for the eight-hour operation shift.
- The citing of construction yards should be done leaving at least 100m distance from any residential areas, which will allow noise to attenuate.
- The main noise producing sources such as the concrete mixers, generators, grader etc. should be provided with noise shields around them. The noise shields can be any physical barriers, which is effective in adequate attenuation of noise levels. A

3 m high enclosure made up of brick and mud with internal plastering of a non-reflecting surface will be very effective in this regard.

- For protection of construction workers, earplugs should be provided to those working very close to the noise generating machinery.
- To avoid significant impacts on human health, it is being recommended to avoid construction work at certain sections during night times and ensure that only minimum required machinery is deployed on the site. At construction sites within 150 m of human settlements, noisy construction should be stopped between 10:00 pm and 8:00 am
- The proposed avenue plantation and other noise mitigation measures are expected to minimize the impacts on the immediate influence area of the project road.
- Development of greenbelt comprising selected species of trees with high canopy along the project road for attenuation of noise.
- Noise level monitoring should be conducted as per Environmental Monitoring Plan given in ESMP.

8.1.6 Water Environment

8.1.6.1 Loss of Water Bodies

The typical impacts on water quality during road construction are summarized in the **Table 47**

Table 47: Impacts on Water Resources Due to Construction Activities

Sl.no	Impacts Due to Construction	Indicators
1	Impact on water bodies	Offset distance from the CoI from the edge of the embankment
2	Loss of other water supply sources	Number of wells, hand pumps (if any) affected
3	Alteration of drainage, run off, flooding	No. of cross drainage channels
4	Depletion of Ground Water recharge	Area rendered impervious
5	Contamination from fuel and lubricants	Nature and quantum of contaminators
6	Contamination from improper sanitation and Waste Disposal in Construction Camps	Area of camp / disposal site and proximity to water bodies / channels
7	Use of Water Supply for Construction	Quantum of water used

Surface water resources

As per the inventory survey conducted for the project roads, the following surface water bodies (**Table 48**) are identified. Most of the water bodies are seasonal and the water has been used for irrigation purposes. Likely impacts on water bodies include:

- Water bodies entirely lost
- Water bodies partly filled
- Water bodies whose storage capacity is not impacted but embankment is cut across
- Water bodies not directly impacted but vulnerable to siltation from construction runoff

Table 48: List of Water Bodies Getting Affected along the Phase-1 Corridors

Sl.no	Project Roads	Chainage	Water body
1.	Omalur to Mecheri (SH 222)	10/800 (RHS)	Water Pond
2.	Malliyakarai to Attur (SH 30)	-	No water bodies available within the PROW and Project influence area
3.	Chithode to Erode (SH 15)	158/420 (RHS)	Water Tank

Source: DPR, 2020

8.1.6.2 Alteration of Cross Drainage

Impacts of road construction, which lead to alteration of drainage, are generally due to construction of bridges (Major or Minor) and cross drainage (CD's) locations. The Phase – 1 Corridors traverse through several culverts and irrigation canals. The details of the CD's are given in the following table

Table 49: Summary of Structure Proposals (Phase – 1 Corridors)

Sl. No	Type of Structure	New Construction	Reconstruction	Widening	Total
Omalur to Mecheri Road (SH 222)					
1	Major Bridges	-	-	-	0
2	Minor Bridges	-	-	-	0
3	Box Culvert	1	20	2	23
4	Slab Culvert	-	-	-	-
Total no. of Structures		1	20	2	23
Cross road culverts		32	-	-	32
Malliyakarai to Attur Road (SH 30)					
5	Major Bridges			-	0
6	Minor Bridges			-	3-
7	Box Culvert	1	9	-	10
8	Slab Culvert			-	0
Total no. of Structures		1	9	-	10
Cross road culverts		18	-	-	18
Chithode to Erode Road (SH 15)					
9	Major Bridges	-	-	-	0
10	Minor Bridges	-	2	1	3
11	Box Culvert	2	16	-	18
12	Slab Culvert	-	-	-	0
Total no. of Structures		2	18	1	21
Cross road culverts		18	-	-	18

Note: 1 existing RCC slab culvert at design Chainage. 3/254 in Omalur to Mecheri Road is proposed to be dismantled and a new culvert is constructed at Design. Chainage 3/240

Construction of the minor bridges and culverts along the watercourses is to be carried out in the lean flow periods. The construction activities will not necessitate any major diversion of the waterways. The construction and rehabilitation of bridges along the Phase – 1 Corridors will however involve some minor temporary diversion of waterways, which can impact the existing aquatic habitat during the monsoon season. By these temporary diversions the waterway will be constricted, thereby increasing velocity downstream of the bridge. This will mean increase sediment load with the flow, thereby allowing less sunlight to penetrate into the water and can reduce growth of micro flora. The impact will last as long as construction continues.

Cross road Drains. Covered rectangular drains are proposed under footpath on both sides in urban and built-up sections. The clear vent size of the drain should be 1.2m X 1.0m (depth below the carriageway level). The location of the drains are depicted in the following table

S. No	Design Chainage		Length, m	Side	Total Length, m
	From	To			
Omalur to Mecheri Road (SH 222)					
1	1/150	2/060	910	Both	1820
2	2/500	2/800	300	Both	600

S. No	Design Chainage		Length, m	Side	Total Length, m
	From	To			
Omalur to Mecheri Road (SH 222)					
3	3/300	5/200	1900	Both	3800
4	5/980	6/500	520	Both	1040
5	6/800	8/000	1200	Both	2400
6	8/350	9/250	900	Both	1800
7	9/950	10/100	150	Both	300
8	11/150	11/700	550	Both	1100
9	12/020	13/100	1080	Both	2160
10	13/450	14/320	870	Both	1740
Total			**8380**		**16760**
Malliyakarai to Attur Road (SH 30)					
Drain along Main Carriageway					
1	81/125	81/550	425	Both	850
2	82/890	83/430	540	Both	1080
3	87/240	88/140	900	Both	1800
4	90/140	90/226	86	RHS	86
5	90/480	91/009	529	Both	1058
Total			**2480**		**4874**
Drain along Slip Road					
6	89/819	90/160	341	Both	682
7	90/206	90/226	20	Both	40
8	90/226	90/480	254	Both	508
9	90/226	90/440	214	Both	428
Total			**829**		**1658**
Chithode to Erode Road (SH 15)					
1	153/600	161/725	8125	Both	16250

Source: DPR 2020

8.1.6.3 Run-off and Drainage

One of the unavoidable aftermaths of road construction is the increased surface runoff. The addition of hard paved shoulders, which essentially increase paved impervious surface, will cause increased surface runoff along the roadsides. Increase in surface run-off is due to the creation of impervious surfaces that prevent the flow of water into the ground. The increased runoff from the project has been worked out as follows:

Increase in runoff (cum.) = increase in runoff co-efficient due to construction * annual rainfall in the area (m) * area of the newly constructed surface.

The increase of the black top width has been considered as per the cross section proposed. The runoff coefficient used for the calculations are 0.2 for red sandy and reddish brown loam, 0.15 for recent sandy and 0.55 for black cotton soil. The black top has a run-off coefficient of 0.95. Increase in the runoff co-efficient has been worked out as the difference between the runoff co-efficient of black top surface and different soil types. The increased run-off so calculated is estimated to be 4,29,067 cum for Omalur to Mecheri Road (SH 222), 1,39,857 cum for Malliyakarai to Attur road (SH 30) and 1,31,743 cum for Chithode to Erode road (SH 15).Impacts due to surface runoff include increased soil erosion and local flooding or water logging. However, the Phase – 1 Corridors has been designed with adequate drains (as indicated in the **Table 49**) to take care of runoff, surface runoff shall be drained to the nearest cross drainage structure.

8.1.6.4 Water requirement for project

The water requirement for construction depends on the climatic conditions, type of equipment, type of material available, mix design, type of construction plant and number

of people working on the project. With the following assumptions the approximate water quantity required for each corridor in the Phase – 1 has been calculated.

- 8-10% of weight of soil for the embankment construction
- 7-8% of weight of soil for sub grade construction
- 5-6% of weight of GSB materials for GSB and WMM
- 150 liters/ cum for concrete

The water requirement has been assumed based on past project experiences and on the strict quality control basis. Domestic requirement of 150 liters per worker has been assumed. For this project about 280 labours have been considered for initial stage activities. Based on the fluctuation in the labour strength, the water requirement shall be recalculated. Details of the water requirement assessed for the project are presented in **Table 50**.

Table 50: Water Requirement for Construction works

Sl. No	Water Requirement	Cum/day
1	Permanent works (cum/day)	40
2	Dust Suppression at work zone in (cum/day)	60
3	Curing (cum/day)	20
4	Laboratory (cum/day)	14
5	Haul Roads (cum/day)	30
6	Crusher (cum/day)	20
7	Plant Cleaning and workshop washing in (cum/day)	16
8	Domestic Purpose in (cum/day)	42
	Total Requirement(cum/day)	**242**

Daily water requirement for the permanent works has been calculated assuming the construction period of 2 years.

8.1.6.5 Water Quality

Most of the surface water bodies along the Phase- 1 corridors are seasons and hence no direct impact on the water quality is envisaged. However, during the rainy season, the construction activities will temporarily deteriorate surface water quality in terms of its turbidity. Proper drainage measures will be taken along the Phase-1 corridors like:

- Drainage arrangements to be in tune with the site condition and include forming of drainage layer, longitudinal, cross and toe drains on either side of formation
- During construction period, suitable barriers/ silt traps will be used to protect the adjoining water bodies from the falling earth materials and dust raised to avoid sedimentation
- Water from river/lake and streams will not normally be used to meet the water requirement for construction purposes

MITIGATION MEASURES

8.1.6.6 Loss of Water Bodies

As indicated in the **Table 48**, there are two surface water bodies located along the Phase – 1 corridors (SH 222 and SH 15). In Omalur to Mecheri Road (SH 222), the observed water body (pond) is seasonal and the proposed alignment do not have any impact on the water body. In Malliyakarai to Attur road (SH 30), there are no surface water body along the project corridor. In Chithode to Erode road (SH 15), at the time of reconnaissance survey, the surface water body (Gani Ravuthar Kulam/ Pond) is observed with water and the embankment of the pond is located on the edge of the PROW. Retaining wall for the pond

has already been constructed, hence it is decided to plan for the drain near the retaining wall. Other than that, the streams and canals are observed to be seasonal, however, the impact shall be minimized by doing the construction activity in the lean flow period provided with bank protection measures. The loss to the pond shall be compensated by excavating an equal volume of earth from elsewhere of the water body. When the excavation is undertaken in the wet area of the water body, the banks will be protected, such that the slopes are not steeper than 1 vertical to 2 horizontal. Other measures for improvements for the water bodies include

- Desilting of tank bed
- Clearing and shaping inlet and outlet channels
- Reconditioning sluice or weir (if any)
- Renovating steps or bathing ghat (if any)

Future development that may involve the filling up of water bodies or adversely impacting the water quality of these resources shall be discouraged. As part of the monitoring plan, water quality monitoring of various surface water bodies has been proposed at several locations along the Phase – 1 corridors.

As per the CGWB information on the groundwater availability/ status, the project corridors SH 222 and SH 30 are falling under Overexploited areas, which is followed by SH 15 (critical area), hence to enhance the groundwater recharge capacity, Artificial Groundwater Recharge Well is proposed at km 10/800 (water pond) in Omalur to Mecheri Road (SH222) and at km 158/420 (water tank) in Chithode to Erode Road (SH 15). Due to the absence of surface water bodies along the Malliyakarai to Attur Road (SH 30), it is suggested to have 4 recharge wells, which shall be installed by the contractor in discussion with the Engineer-Incharge, PIU and PMU. The cost for the same has been included in the EMP budget (refer Chapter 13, ESMP Budget, item no 1.3).

8.1.6.7 Alteration of cross drainage structures

- All cross drainage structures have been designed to handle a 50-year peak flood level. A detailed hydrological study had been carried 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.

8.1.6.8 Runoff and drainage

Detailed drainage surveys and hydrological investigations have been undertaken and suitable design of minor bridges and culverts have been proposed to ensure that the Phase-1 corridors does not obstruct the existing course of the surface water flow and alter the hydrological setting. Existing cross-drainage structures will be upgraded and additional cross-drainage structures will be provided at locations where the flow is obstructed at present. In many places, a wider waterway has been proposed. Adequately sized cross road culverts will ensure that the ponding on the roadside after a storm event

is reduced to a minimum. The cross drainage works have been designed to handle discharge from a 50-year peak flood event.

The Contractor will remove obstructions that may cause temporary flooding of local drainage channels, during construction. In sections along water courses, and close to cross-drainage channels, earth, stone or any other construction materials must be properly disposed off so as not to block the flow of water. All necessary measures will be taken to prevent earthwork, stonework and other debris from impeding cross-drainage at rivers, streams and water canals. Covered drains will be provided, which can also be utilized as foot path. Provision of cost for cross drainage structures and road side structures are included as part of engineering cost. Water recharging pits for road side drains will be provided in the following locations.

Rainwater Recharge pit location in the Phase – 1 Corridors

S. No	Design Chainage	Side
Omalur to Mecheri Road (SH 222)		
1	1/270	LHS
2	2/100	BHS
3	3/200	BHS
4	4/400	BHS
5	5/220	BHS
6	5/870	BHS
7	6/610	LHS
8	9/300	BHS
9	9/800	BHS
10	11/000	BHS
11	11/060	BHS
12	11/950	BHS
13	13/150	BHS
Malliyakarai to Attur Road (SH 30)		
1	81/620	LHS
2	82/120	RHS
3	82/710	RHS
4	83/500	LHS
5	83/970	RHS
6	84/560	LHS
7	85/040	RHS
8	85/520	LHS
9	86/100	RHS
10	86/640	LHS
11	87/110	RHS
12	88/210	RHS
13	88/720	LHS
14	89/240	LHS
Chithode to Erode Road (SH 15)		
1	153/870	LHS
2	154/700	RHS
3	157/950	RHS

S. No	Design Chainage	Side
4	158/850	LHS
5	159/720	LHS
6	159/850	RHS
7	160/800	RHS

Groundwater Recharge Well

Based on the Central Groundwater Board (CGWB) findings with respect to the groundwater availability, Salem district comes under Over Exploited zone and Erode district is under the critical zone. Out of 3 phase – 1 corridors, the Omalur to Mecheri Road (SH 222) and Malliyakarai to Attur Road (SH 30) are coming under salem district and Chithode to Erode Road (SH 15) comes under the Erode district. As an enhancement measure, groundwater recharge well has been proposed to be installed in the water bodies located along the Phase- 1 corridors. From the assessment, there are no surface water bodies available in the Malliyakarai to Attur (SH 30) and hence it is suggested to have 4 recharge wells, which shall be installed by the contractor in discussion with the Engineer-Incharge, PIU and PMU. For Omalur to Mecheri (SH 222) and Chithode to Erode (SH 15) the recharge wells are proposed at km 10/800 (water pond) in Omalur to Mecheri Road (SH222) and at km 158/420 (water tank) in Chithode to Erode (SH 15). The cost for the same has been included in the EMP budget (refer Chapter 13, ESMP Budget, item no 1.3). Typical cross section drawing of such structure is presented in **Figure 12** and **Figure 13**.

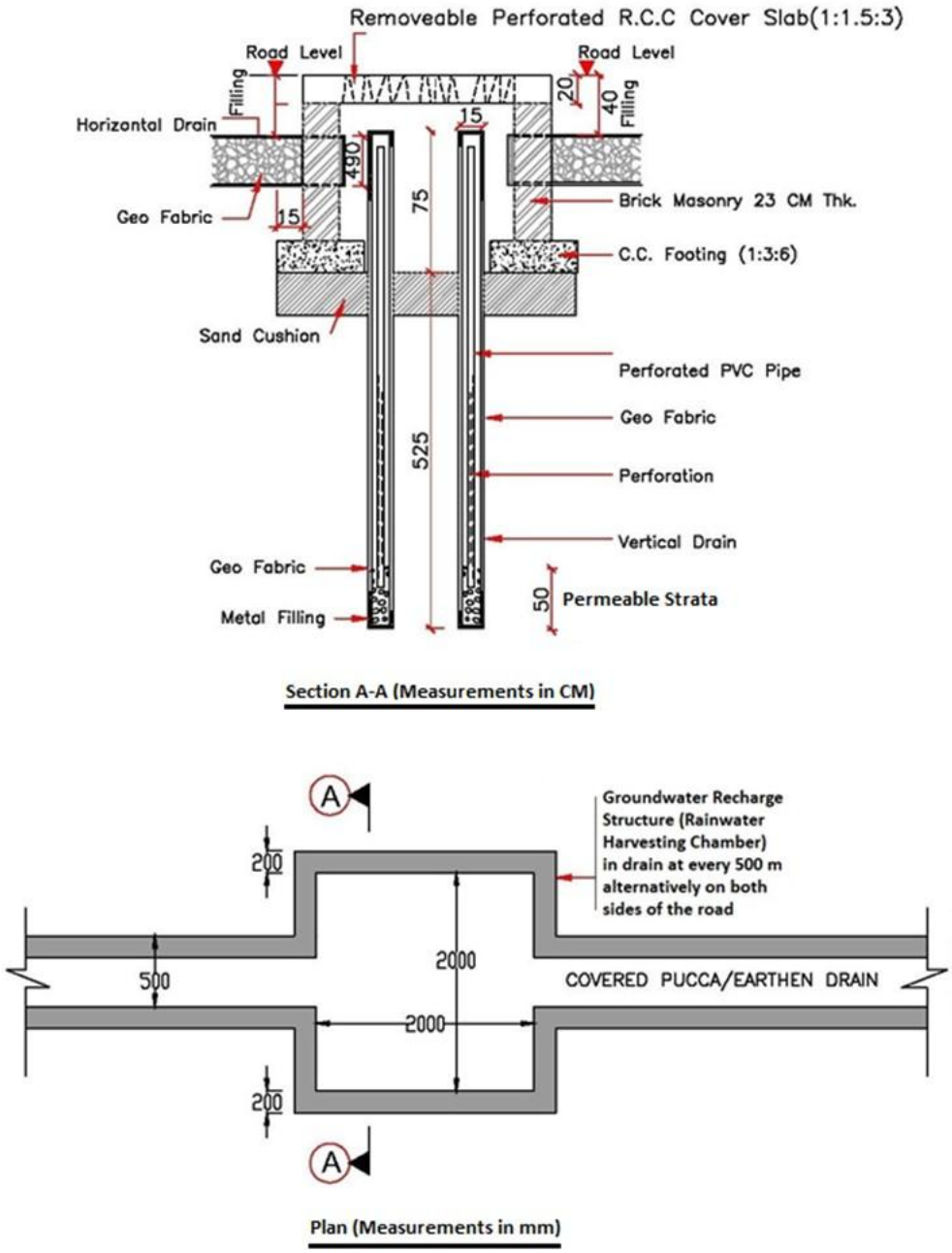


Figure 12: Conceptual Plan of Artificial Groundwater Recharge Structures in Drains

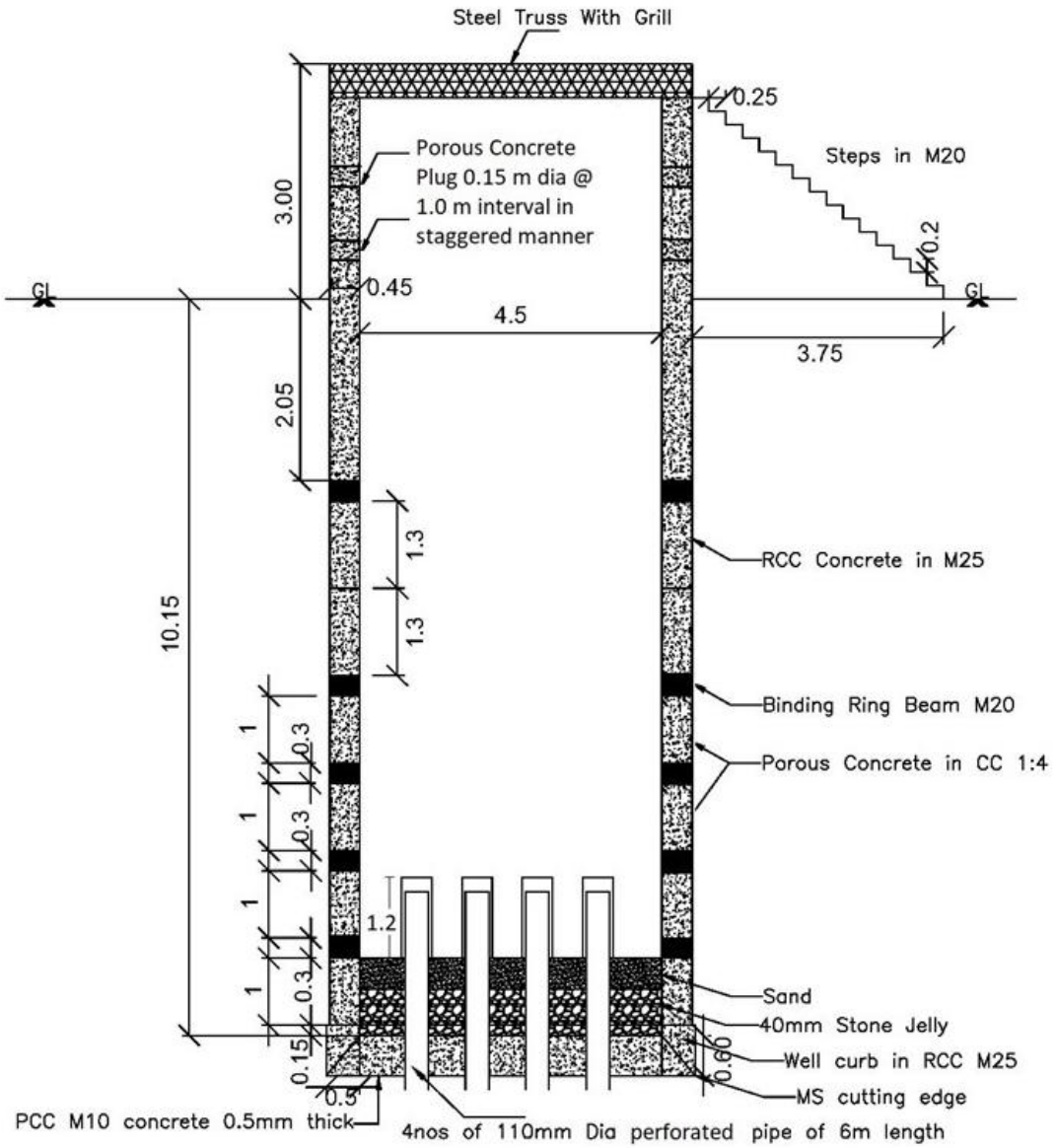


Figure 13: Typical Cross-Section of Artificial Groundwater Recharge Well Structure in Ponds and Lakes

8.1.6.9 Water Requirement for Project

The Contractor will arrange for water required for construction in such a way that the water availability and supply to nearby communities/ settlements remain unaffected. The total requirement of water has been worked out as 240 – 300 cum/day. The Contractor shall source the requirement of water preferentially from surface water bodies, as rivers and tanks in the project areas. The Contractor shall make sure that there are no major threat to other water users is expected due to extraction of water from the surface water bodies. Wastage of water during the construction will be minimized. While working across or close to perennial water bodies, the Contractor will not impede or block any flow of water. If for any bridgework, containment of flow is required, the Contractor will seek approval of the Engineer – in charge (CSC). For the use of groundwater for construction purpose, the contractor shall get permission from the competent agencies (Central/State Ground Water Board/ PWD department).

Construction over and close to any non-perennial streams shall be carried out in the dry season. Construction over irrigation canals will be undertaken with prior permission from PWD irrigation department, GoTN. Care should be taken to minimise any disruption to the flows and to ensure that a high quality of water is maintained. The Contractor may use the natural sources of water subject to the provision that any claim arising out of conflicts with other users of the said natural sources will be his responsibility.

8.1.6.10 Water Quality

All kind of wastes arising from the project areas will be disposed off, as per TNPCB norms, so as not to block the flow of water in the channels. The wastes will be collected, stored and transported to the approved disposal sites. To avoid contamination of the various surface water bodies and drainage channels in the vicinity of the construction site, construction work close to the rivers/ streams or other water bodies will be avoided, especially during monsoon period. It will be ensured that any liquid construction waste discharged into the existing waterways is treated to the required standard. Construction of temporary or permanent devices to prevent water pollution due to increased siltation and turbidity shall be ensured. It will be ensured that no sanitary wastes from the labour camps are discharged into the nearby watercourses. Adequate sanitary measures in labour camps are essential in this regard. Various measures that have been proposed for the protection of water quality along the Phase-1 Corridors have been detailed in the following sections.

a) **Silt Fencing**: Silt fencing will be provided to prevent sediments from the construction site entering into the nearby watercourses. The silt fencing consists of geotextile (MIRAFI 140N or equal) with extremely small openings supported by a wire-mesh mounted on a panel made up of angle frame (Refer **Figure 14**). Modules of 625 mm each are designed to allow ease of handling and construction. It is expected that a single person will be able to drive the angles 300 mm into the ground by pressing from the top. The frame will be installed around stockpiles close to water bodies. The wire-mesh will provide structural stability and the 25x25x3 mm angle section will act as posts for the silt fencing. About 25 Number of silt fencing would be required in the project to protect the water bodies

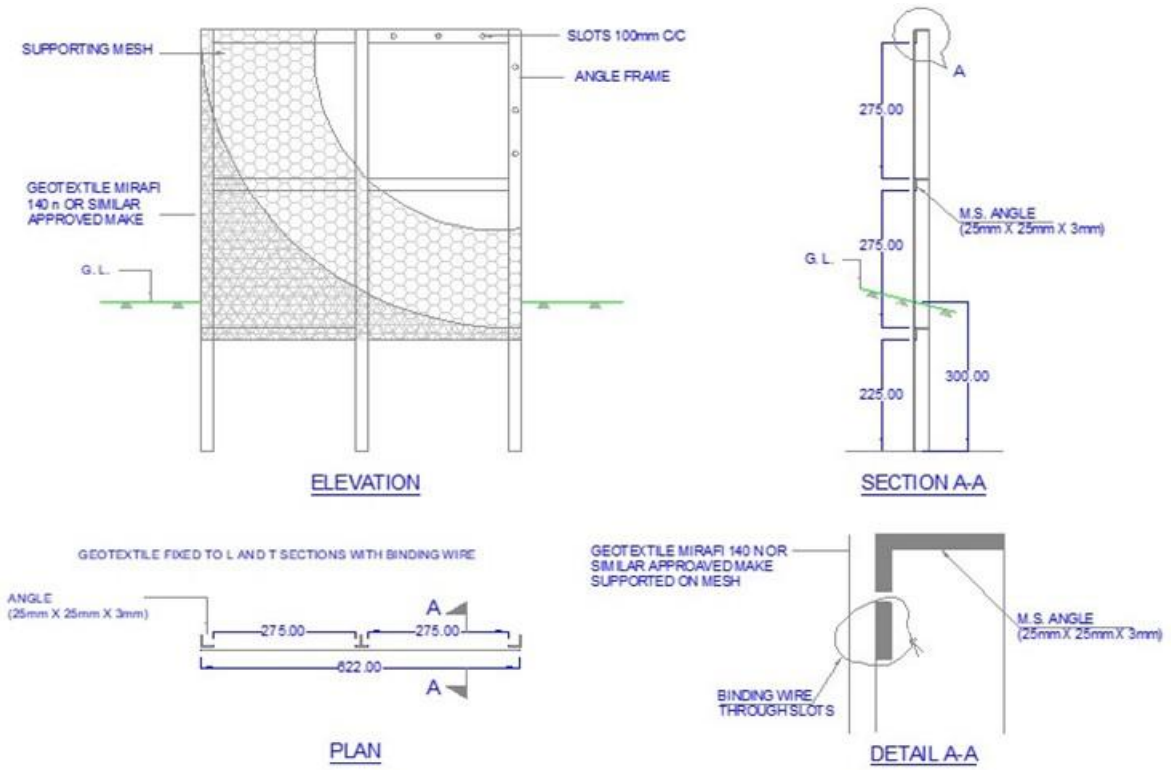


Figure 14: Concept Plan of Silt Fencing

b) **Oil Interceptor**: Oil and Grease from road run-off is another major concern. During construction, discharge of Oil and Grease is most likely from vehicle parking areas of the Contractors' camps. The source is well defined and restricted. The technique for the separation of oil and water is gravity separation. Enough detention time is provided to allow oil to float on to the surface. The construction vehicle parking area, vehicle repair area and the workshops will be provided with oil interceptor. Slope of the prepared and paved site (1:40) ensures that all the wastewater flows into the interceptor before discharge. Periodic cleaning (once in a week) will be done from the outside by skimming off film of oil over the surface (**Figure 15**) which provides the details of the arrangement for the oil interceptor for the removal of oil and grease from 'point' sources. The location of all fuel storage and vehicle cleaning area will be at least 500 m from the nearest drain/ water body. In addition, the maintenance and repairs of vehicles will be carried out in a manner such that contamination of water bodies and drainage channels can be avoided. The slopes of embankments leading to water bodies will be modified and rechannelised to prevent entry of contaminants into the water body.

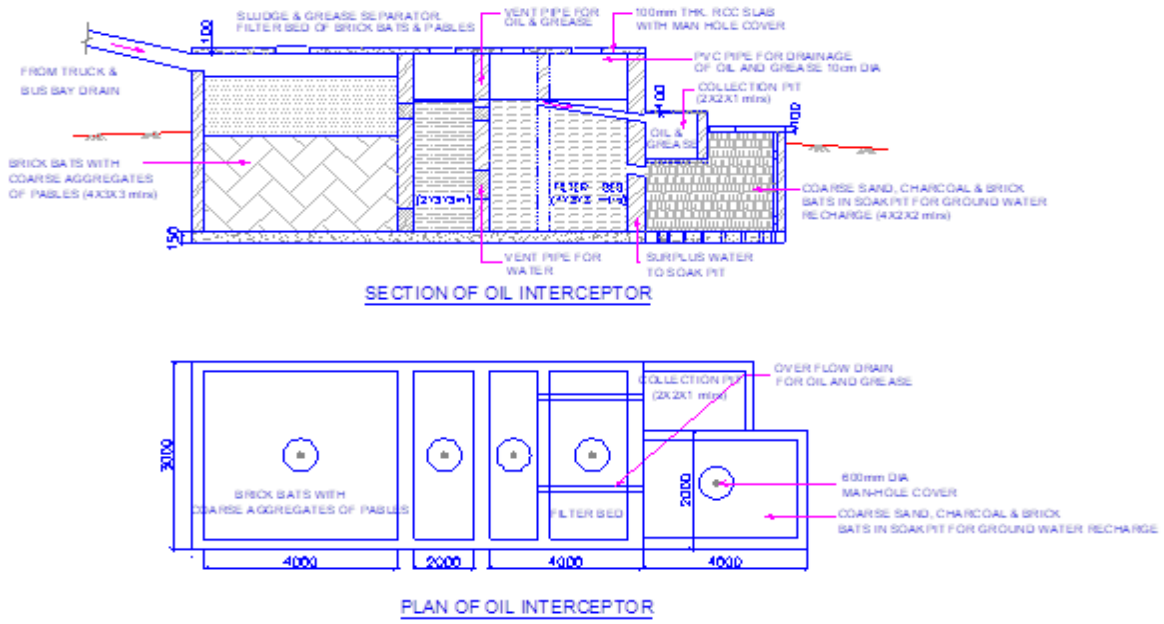


Figure 15: Conceptual Plan of Oil Interceptor

8.1.7 Solid Waste Management

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. The following table depicts the estimated debris likely to be generated for the phase-1 corridors. It shall be recycled to the extent possible (refer section 7.4).

Sl.no	Item	Unit	Quantity		
			SH 222	SH 30	SH 15
1	Bituminous Material	Cum	16101	14622	16233
2	Pavement Crust	Cum	63572	56784	19114
3	Stone Masonry	Cum	641	Nil	1370
4	RCC	Cum	292	34657	3833
5	Hume Pipes	m	189	Nil	130

Source: DPR 2020

The municipal solid waste generated from the construction camp and labour camp is estimated to be 100kg per day/ per corridor. For each anticipated waste category, the potential environmental impacts are highlighted and appropriate mitigation measures/disposal options recommended below.

- Avoiding and/or minimising waste generation where practical by improvements or changes in the project design or site procedures;
- Reusing/recycling/recovering materials where possible and thereby negating / minimising disposal requirements (e.g. by waste segregation according to type, separation of recyclable materials such as metal, reuse of wood from site hoarding/concrete formwork, utilisation of excavated material for filling or landscaping)
- Ensuring that all treatment and disposal options comply with best practice and all relevant guidelines and legislation.

The following specific measures should therefore be adopted during the detailed design and construction stages of the project to minimise waste generation:

Detailed Design

- Minimising excavation requirements as far as possible.
- Balancing cut and fill requirements.
- Evaluating the potential for maximising the re-use of excavated materials for example, within landscape mounds.
- Considering treatments for unsuitable excavated materials e.g. upgrading of subsoils to top soils by mixing with compost.
- Providing an area within the construction site to allow for sorting and segregation of materials.

Construction

- Segregating waste materials according to type in order to facilitate re-use and recycling.
- Separation of inert construction and demolition materials for either re-use on-site or use as public fill.
- During demolition works, segregating materials at source as far as practical.
- Co-ordinate material deliveries to site in order to minimise storage time on site and the likelihood of causing damage.
- Consider on site mulching of vegetation to reduce bulk and review opportunities for possible use within landscaping areas.
- Training site staff in waste minimisation practices.

In accordance with good practice, accurate site records should be maintained throughout the construction works detailing the quantities of materials; a) generated on site; b) reused on site; and c) disposed off site, together with disposal routes/locations.

8.1.7.1 Wastes Generated from Site Clearance and Excavated Materials

All materials should be re-used or transported off site as soon as possible to minimise the potential of adverse environmental impacts. It is recognised that some stockpiling of materials will be required in some instances although these should be segregated in terms of material type as far as practical to facilitate material re-use (i.e. top soil for landscaping, suitable fill for engineering works).

All excavated material should be handled in a manner that minimises the release of fugitive dust (especially during hot and dry weather) and where possible the movement of material should be kept to a minimum. Within the stockpile area, the following measures should be in place to control potential impacts.

- Covering material during heavy rainfall;
- Using dust suppression techniques (such as dampening with fine water spray and covering with tarpaulin);
- Controlling the excessive use of water during spraying to prevent the generation of runoff contaminated with elevated levels of suspended solids;
- Segregation of the surface water system for the stockpile area and the fitting of silt traps where appropriate;
- Locating stockpiles to minimise potential visual impacts;
- Minimising land intake of stockpile areas as far as possible;

- Provide fencing within designated areas to separate sensitive habitats and prevent stockpiling in unsuitable locations; and designate appropriate haulage roads.

A reduction in the total volume of excavated materials requiring offsite disposal will be achieved as far as possible by optimising the re-use of suitable material on-site. Both excavated material which cannot be re-used on site and inert construction and demolition materials will require disposal at low lying areas. The low lying areas shall be identified in consultation with the local communities/ village panchayat.

8.1.7.2 Inert Construction and Demolition Material

Inert construction and demolition materials such as wood and metal should be separated out from other materials for recycling. All recyclable material should be clearly segregated and stored in appropriate skips/containers or stockpiled. Segregation of material will aid in the potential for re-use of material and in final disposal, if necessary. Material recycling or re-use reduces both the need for new construction materials and subsequent collection, transportation and disposal costs. Only when materials cannot be reused should they be disposed off to the filling areas.

8.1.7.3 Chemical Wastes

Chemical waste, as defined in the Hazardous Wastes (Management and Handling) Rules, 1989, as amended in January 6, 2000 and May 21, 2003, will require disposal by appropriate and approved means. Potential hazards associated with the inappropriate handling of these materials include:

- Effects on human health (i.e. dermal and toxic effects with respect to site workers);
- Phytotoxic effects to vegetation;
- Contamination of the soil, groundwater's 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.

Chemical wastes should be stored in a locked, fully bunded area which is impermeable to both water and the waste being stored. The waste storage area should also be covered to prevent rainfall from accumulating within the bunded areas. The bunded area must have a volume of either 110% of the largest container or 20% by volume of the chemical waste stored in that area. Appropriate spill absorption material should be stored near the storage area in order to clean up any minor spill events. The risks associated with chemical waste storage and handling can be further minimised by:

- Designation of an appropriate, well ventilated storage area;
- Minimisation of waste production and recycling/reprocessing for certain waste liquids where appropriate (e.g. oils, solvents);
- Careful handling of waste fuel and oil residues;
- Use of appropriate and labelled (Hindi and English) storage containers;
- Storage of wastes remote from sensitive receivers (e.g. drains, residential properties and water bodies); and
- Education of workers on the concepts of site cleanliness and appropriate waste management procedures.

8.1.7.4 Municipal Waste

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;
- Vermin and pests in the waste storage area if it is not well maintained and cleaned regularly; and
- Adverse visual impacts.

A temporary refuse collection facility should be set-up by the contractor and wastes should be stored in appropriate containers prior to collection and disposal. A private waste collection firm may be commissioned by the site contractor to remove the waste regularly (daily basis), to the satisfaction of the Engineer-in charge (CSC)

8.1.8 Biological Environment

8.1.8.1 Forest Area

As discussed in the Section 4.2, Malliyakarai to Attur Road (SH – 30) starts near a Reserved Forest (RF) it is also called as Sri Sanaasivarathan Samy Hills. The hill has been accessed by the devotees to reach the temple located on top of the hill lock. The field studies carried out in the reserved forest (Malliyakarai area) wildlife such as Black Naped Hare, Three striped palm squirrel, Rat Snake, White Headed Babblers, etc., and hence, implementation of the construction activities do not have any direct impact on the RF. Other than this, there are no forest areas located in the Phase- 1 Corridors.

8.1.8.2 Wild life

As discussed in the section 4.2, the project districts are under the major influence of Eastern Ghats, however, the Phase-1 Corridors are located little far from the influence zone. Hence, the land use pattern is dominated by the agriculture and at some isolated locations, the following wild animals are recorded in the area of influence. Jackal - *Canis aureus,* Jungle cat - *Felis chaus,* squirrels - *Funambulus pennant,* Hare - *Lepus nigricollis nigricollis,* Common mongoose - *Harpestes edwardsi,* Common rat snake - *Ptyas mucosus and* Green whip snake - *Ahaetulla nasutus* are the common seen/ available in the project areas some bird species such as pied wagtails, White headed babblers, common drongos, ect. Most of the listed animals are night dwellers, hence construction activities in day time doesn't have any impact on wildlife.

8.1.8.3 Tree Cutting

Avenue trees falling within the PROW shall be removed for the proposed improvements. As per the detailed assessment the total number of trees that are getting affected is depicted in the following table.

Table 51: Impact on Avenue Trees

Phase - 1 Corridors	Government trees	Private Trees	Trees saved
Omalur to Mecheri Road (SH 222)	1340	249	154
Malliyakarai to Attur Road (SH 30)	484	54	258
Chithode to Erode Road (SH 15)	723	39	43
Total	**2547**	**342**	**455**

Source: DPR, 2020

By adopting CoI, It is estimated around 2,889 trees, out of which 20% are fruit bearing will be affected due to the project and nearly 455 trees has been saved (**refer Annexure 5**). As per the road inventory survey, Tamarind trees (*Tamarindus indica*), Coconut trees (*Cocos nucifera*), Arasa Maram (*F. Religiosa*), Veppa Maram (*Azadirachta indica*) are observed to be the dominating species across phase-1 corridors.

Sl.no	Phase - 1 Corridor	Tree Grith Size	
		Total Number of Trees to be Transplanted (GBH<30 cm)	Total Number of Trees to be Cut (GBH>30 cm)
1	Omalur to Mecheri Road	0	1589
2	Malliyakarai to Authur Road	22	526
3	Chithode to Erode Road	0	762

8.1.8.4 Removal of Vegetation

Existing road side vegetation and agriculture area in the PROW and the realignment sections are likely to be impacted due to the widening proposal. The portion falling within the PROW will be fully utilised for widening purpose, which leads to a permanent impact on vegetation. However, the suggested landscaping will mitigate the loss of vegetation.

MITIGATION MEASURES

8.1.8.5 Forest area

Though a RF is located in the start point of the Malliyakarai to Attur Road (SH 30), it does not have any influence on the project corridor and it is very much utilized by the local people. Other than the RF, the phase-1corridors do not have any protected or environmental sensitive areas which has been confirmed from the reconnaissance survey and secondary informationcollected from Forest Department and Survey of India

8.1.8.6 Wild Life

As per records, there is no wildlife recorded in the Phase-1 Corridors, however, as discussed in the section 8.1.8.2, there are nocturnal animals which may reside in the agriculture and other wild vegetation areas. Being nocturnal animals, the construction activities do not possess threat to the local faunal populace. There are no endangered species reported in the site and hence, no impacts are anticipated and mitigation measures are not required.

8.1.8.7 Trees and Vegetation

Though no endangered flora is present within the Phase-1 Corridors, trees within the proposed Right of Way (PROW) needs to be cleared of vegetation for construction of the roads. As per assessment and inventory approximately 2,889 trees, out of which 20% are fruit bearing will be affected due to the project. The mitigation and enhancement measures taken along the phase-1 corridors includes,

- Compensatory tree plantation at the ratio of 1:10
- Transplantation of small trees (<30 cm girth size)
- Plantation at Government institutional premises

Avenue plantation shall be carried out as per IRC SP 21 – 2009 “Guidelines on Landscaping and Tree Plantation”. Such plantations will be initiated once the construction is complete. The objective behind such plantation is to cover / re-vegetate the areas within the PRoW that are presently barren. To maintain the present character of strip plantation, similar indigenous trees should be planted. The possibilities for tree transplantation (Small trees

(<30 cm)) shall be explored wherever possible to minimize the impacts of loss of trees. List of indigenous tree species recommended in "Annex E (clause 11.11.1)" in IRC SP 21 - 2009 for plantation of Tamil Nadu State is presented as **Table 52**.

Table 52: List of Indigenous Trees Species Suggested for Avenue Plantation

Sl No.	Botanical Name	Common Name
1	*Albizzia procera*	Safed Siris
2	*Albizzia amara*	Cylone Siris
3	*Amhertia nobilis*	Tree of Heaven / Pride of Burma
4	*Bischofia javanica*	Paniala / Pankain
5	*Colvelia recemosa*	Kilbili
6	*Dalbergia latifolia*	Black shisham / Rosewood
7	*Delonix regia*	Gulmohar
8	*Mengifera indica*	Desi mango
9	*Michelia champaka*	Swarnachampa
10	*Peltophorum pherugenium*	Fellow Gulmohar
11	*Polyalthia longifolia*	Ashok
12	*Arecaceae*	Palm trees
13	*Saraca asoca*	Sita Ashok
14	*Santalum album*	White sandal
15	*Tamrindus Indica*	Imli

As per the Madras High Court order, 10 trees are to be planted for each tree to be cut. All plantation work shall take place at the onset of monsoon season. The plant should be provided with adequate protection from animals and proper monitoring should be carried out to ensure their growth and survival rate. Costing has been done as per forest schedule of rate, including the plantation and maintenance cost for 5 years.

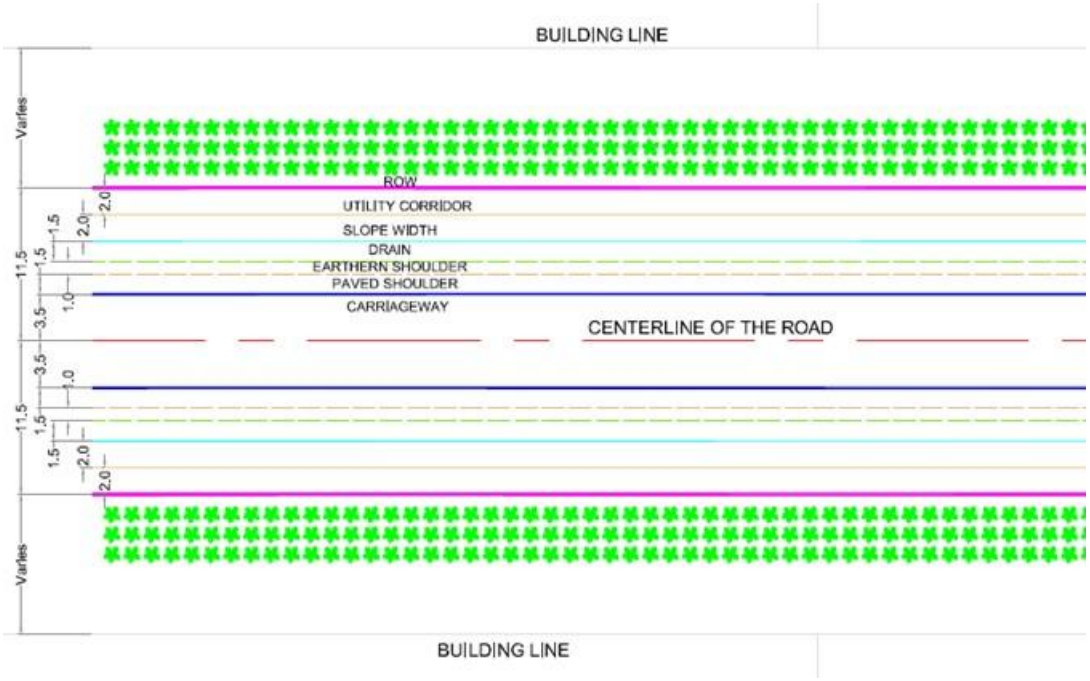


Figure 16:Conceptual Plan for Avenue Plantation (2 lane Road)

Compensatory Plantation measures. As per the proposed designs the land area available between the EROW and PROW has been estimated and accordingly the compensatory plantation has been proposed. The information about the area availability location wise is given in the **Annexure 8**. The summary is given in the following table.

Sl.no	Name of the Corridor	Area of land available (sq.m)
1.	Omalur – Mecheri Road	2,345.00
2.	Malliyakarai – Attur Road	46,696.49
3.	Chithode – Erode Road	43,100.15
Total		92,141.64

Source: DPR 2020

Compensatory plantation at the ratio of 1:10 estimated for Omalur – Mecheri Road is 15,890 trees, for Malliyakarai – Attur Road is 538 trees and for Chithode – Erode Road is 7,620.The following table illustrates the area available for plantation

Sl.no	Name of the Corridor	Compensatory Plantation	Land available (sq.m)	Total number of trees can be planted	Trees Deficit/ Excess
1.	Omalur – Mecheri Road	15,890	2,345.00	586	-15,304
2.	Malliyakarai – Attur Road	5,380	46,696.49	11,674	+6295
3.	Chithode – Erode Road	7,620	43,100.15	10,775	+3155
	Total	**28,890**	**92,141.64**	**23,035**	**-5,854**

Based on the above calculation, the short fall of trees is estimated to be 5,854. For which TNRSP shall have a MoU with the Forest Department for plantation. Suitable compensation cost for the trees shall be deposited with the forest department or TNRSP shall assign the Engineer –in charge (CSC) along with the concern PIU to get consent for plantation of trees in the government offices, Schools and Hospitals. Either way the compensatory plantation shall be achieved, for which budgetary provision has been worked out and included in the EMP budget.

Plantation at Enhancement Sites

Plantation are proposed at government offices, schools, hospitals, and cultural properties exist along the phase-1 corridors. Tree such as *Polyalthia longifolia* (Mast tree) is proposed for planting sensitive receptor's premises, so that impact of noise pollution due to traffic can be reduced. Landscape design has been worked out to enhance the aesthetic beauty of selected cultural property premises.

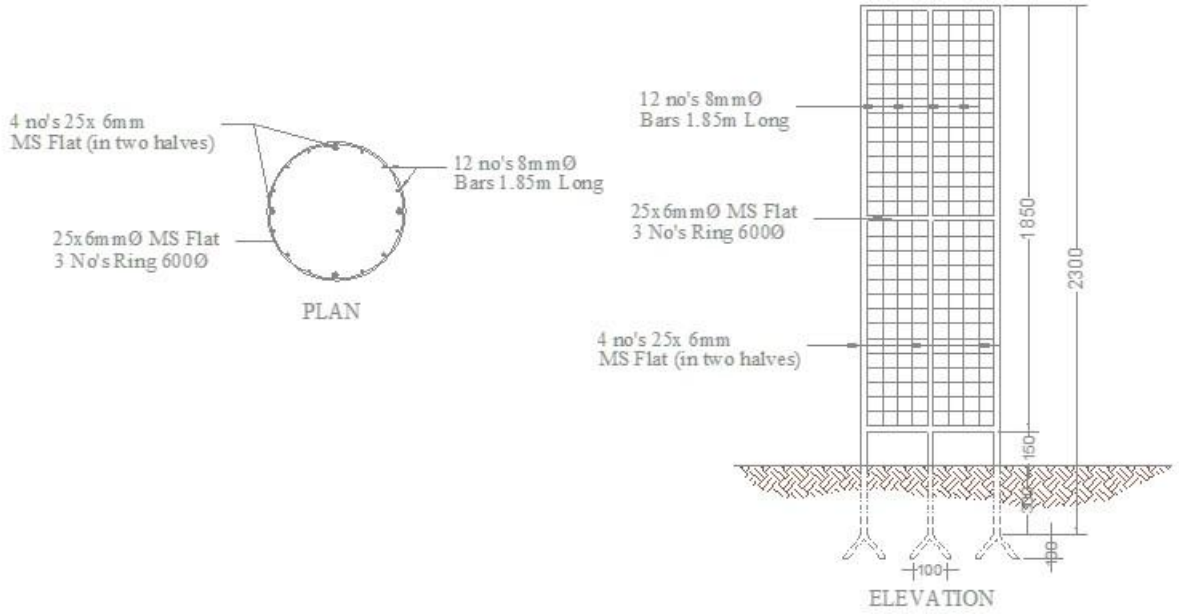


Figure 17: Conceptual Plan for Tree Guard

8.2 Social Impact Assessment

The objective of Social Impact Assessment (SIA) is to enumerate affected land and structures, affected families and persons, to identify social impacts and to prepare Resettlement Action Plan (RAP)[10] for the identified impacts. In order to capture data for the present exercise, both primary as well as secondary sources were systematically tapped. As a part of SIA, census socio-economic survey has been conducted for the Phase-1 Corridors to list out the favorable and adverse impacts of the project.

As per the assessment, it is estimated to acquire 13.06Ha of land (11.83 Ha of private land and alienation of 1.23 Ha of government land). The land acquisition shall have an impact on 859 land owners including land cum structures (346 landowners) and land only (513 landowners). As per records, the impacted land comes under non-agriculture (dry land) category. The approach for the land acquisition and compensation is detailed in the Chapter 2 of Resettlement Action Plan (RAP).

The widening proposal also has direct impact on 378 private structures, 19 Common Property Resources (CPR's). Detailed information pertaining to (i) Project Affected Families, (ii) Tenure wise Use of Structure, (iii) Type of Structure wise Impact, (iv) Type of CPR Impacted are given in the RAP (Refer Chapter 3 - Baseline Socio-Economic Characteristics of Affected Population).

8.2.1 Other Social Impacts

8.2.1.1 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.

8.2.1.2 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

8.2.1.3 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.

[10] The Resettlement Action Plan describes: (i) the project components that cause involuntary resettlement impact; (ii) the policy principles of TNRSP -II in identifying and mitigating involuntary resettlement impacts; (iii) the magnitude of impact and the mitigation measures proposed in accordance with the approved Resettlement Policy Frameworks (RPF) (iv) the institutional and implementation arrangements to mitigate adverse impacts and to provide prompt and effective compensation at replacement cost; and (v) measures for consultation and disclosure.

8.2.1.4 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. These have been further discussed in the RAP (refer Chapter 3). Utility relocation plan showing utilities along the road to be shifted due to improvement are submitted as Volume-XIV of FDPR, summary of utility to be relocated in each road is shown below

Sl no	Type of Utility	Omalur to Mecheri	Malliyakarai to Attur	Chithode to Erode
1	Electric pole	207	166	336
2	Transformers	8	13	11
3	Telephone	-	-	19
4	Borewell	3	21	-
5	Water Tank/Over Head Tank	4	-	-
6	HT Line Crossing	5	1	3
7	Pylon	0	-	-
8	OFC Stones	38	80	33
9	Lamp Poles	-	-	7
10	Well	2	3	1
11	Hand Pump	7	2	-

Source: DPR 2020

8.2.1.5 Public Health and Safety

Impacts on Public health and safety may arise during the phases of pre-construction, construction and operation phases. 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.

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, where they are 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.
- In sanitary 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 dependents 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.

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.

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. In rural areas it was seen that cattle also cross the highways near the settlement.

MITIGATION MEASURES

8.2.1.6 Fear of Uncertainties Regarding Future

The proposed project is only of widening and strengthening of the existing State Highways, and within the confines of the existing PRoW, the fear of uncertainties is most likely limited to the people squatting and encroaching in the PRoW. 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 PRoW. 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 (refer Chapter 5).

The second stage of public participation was in the form of village meetings and focus group discussion with women. The third stage of participation session will start before pre-construction. The PIU will verify and consult the individual PAPs with the help of an NGO for distribution of ID card. At this stage, the PAP's will be explained about their entitlement and RAP.

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/ settlements at any point of time.

8.2.1.7 Inducement of Land Prices

As the project becomes familiar to the public, the land prices along the corridor will increase to some extent. For realignment and geometric improvement of highway, extra additional land may be required; TNRSP is bound to pay all compensations and additional assistances as per the RFCTLARR Act 2013.

8.2.1.8 Inducement of Squatter Influx

Once the project becomes familiar, 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 PAP's recorded during socio-economic baseline survey are eligible for compensation after verification by PIU.

8.2.1.9 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 etc. will be constructed or replaced at appropriate place with the consent of community prior to dismantling the existing one.

8.2.1.10 Public Health and Safety

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 that might result to the owners and other tenants. The advance notice as per RAP will be given to the owners of the affected properties (refer Chapter 2 in RAP). An advance notice will be served at least one month 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 off to avoid the health problems in the safeties. Earth material, if required will be dumped in borrow areas as approved by the Engineer-in charge (CSC). Borrow areas will be filled to avoid health hazards from stagnant water collecting in these areas. The Contractors will make all arrangements for dismantling and cleaning up of debris. Implementation will be as per the approval and direction of the engineer.

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

- Comply with IFC EHS Guidelines on Occupational Health and Safety
- All contractors will be encouraged to recruit the local people as labourer's 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 charge (CSC)
- Construction workers shall be instructed how to protect natural resources, fauna and flora
- In the labour camps (Refer **Annexure 10**), all temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing.

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 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– in charge (CSC) 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.

Accidents and Safety

- To avoid the accidents during construction phase, Contractors shall take all necessary measures to ensure traffic safety. The Contractors will provide, erect and maintain barricades, including signs marking flags lights and flagmen as required by the Engineer- in charge (CSC).
- 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 tanks.

8.2.1.11 Disturbance to the Road Side services

Along the highways, near settlements, small shops serve the local people as well as highway users. Some of these shops are within the PRoW. To avoid any impact on livelihood of people dependent on roadside business, the cleaning of such informal establishment will be carried out phase-wise. Loss of livelihood of the displaced shop owners will be compensated as per assistance mentioned in the Entitlement Matrix (Refer RPF).

8.2.1.12 Avoidance of Disruption and Safety Risks during the Construction Stage

I. Loss of Access

At all times, the Contractors 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.

II. 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 – in charge (CSC) and the PIU. Special consideration will be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night.

The Contractors 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 Contractors 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 – in charge (CSC) for the information and protection of traffic approaching or passing through the section of the highways under improvement.

8.2.1.13 Safety of the Workers

i. **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 Organisation (ILO) Convention No. 62 as far as applicable to the contract. The contractor will supply all necessary safety appliances such as safety goggles, helmets, masks, etc., to the workmen. 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.
ii. **Risk from electrical equipment**: Adequate precautions will be taken to prevent danger from electrical equipment. No material at any of the sites will be so stacked or placed so 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, be free from patent defect, in good working order and will be regularly inspected and properly maintained as per IS provisions and to the satisfaction of the Engineer – in charge (CSC).
iii. **Risk at hazardous activity**: All workers employed on mixing asphaltic material, cement, 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. Workers engaged in stone breaking activities, 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 – in charge (CSC) 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, emergency and first aid procedures for the product.

iv. **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 is dry rubbed and scraped.
v. **Risk caused by force de majure**: 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 that are likely to be sustained during the course of work.
vi. **Risk from explosives**: Except as may be provided in the contract or ordered or authorized by the Engineer – in charge (CSC), the Contractor will not use explosives. Where the use of explosives is so provided or ordered or authorized, the Contractor will take every possible precaution. He will comply with appropriate laws and regulations relating to the import, 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 who so ever concerned or affected or likely to be concerned or affected by blasting operations.
vii. **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 kilometre or so of their breeding place. Thus borrow pits and any other water bodies created during the construction process should be situated 1 to 2 km 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.
viii. **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 of Tamil Nadu. 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 take injured or ill person(s) to the nearest hospital. At every workplace an ambulance room containing the prescribed equipment and nursing staff will be provided.
ix. **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.
x. 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.

xi. **Sanitation Facilities**: These will be provided within the precincts of every workplace, latrines and urinals in an accessible place, and the accommodation, separately for each of 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 language will be provided. There will be adequate supply of water, close to latrines and urinals. Unless otherwise arranged for by the local sanitary authority, arrangement for disposal of excreta will be made through anaerobic decomposition. Excreta will 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).

8.2.2 Safety measures during Operation Stage

The basic aim for road safety review is to identify areas of major concern, including black spots and accident-prone stretches on project road and to propose measures to be taken for improving the engineering design with respect to road safety aspects. Consultants have carried out a detailed reconnaissance survey along the Phase-1 Corridors and identified areas of major concern, including black spots and accident-prone stretches. The construction and operation phase of the project could also cause hindrance to public, especially to the road users. This is mainly attributed due to the obstruction of the roads and the diversions in the traffic. This is a temporary impact and it is time dependent. But at present the corridors doesn't have adequate safety measures like road markings, direction marking, road studs and zebra crossing.

The Phase-1 Corridors are designed for a travel speed of 40 to 50km/hr in the urban section and 65 to 80km/hr in the rural sections. Apart from the speed restrictions, the road furniture's as suggested as per IRC will be provided. Some of the mitigation measures to avoid accidents are discussed in detail below

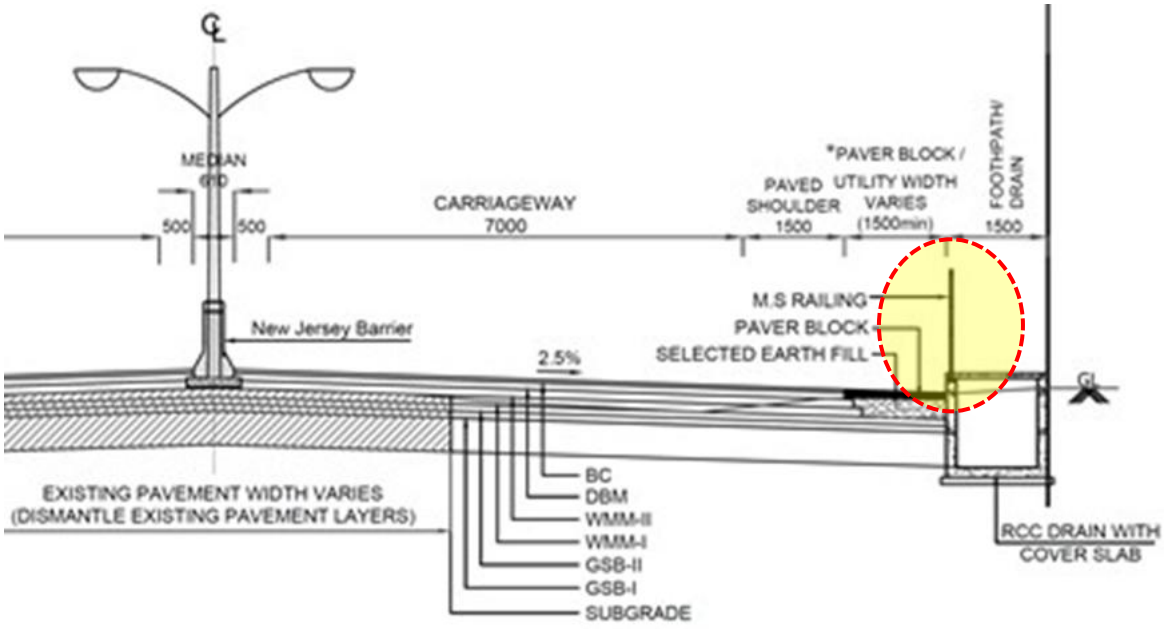
MITIGATION MEASURES

Traffic safety measures are inbuilt into the project design and specifications. These would take care of the safety aspects in the operation stage. Following components are provided with safety aspects in view.

- Foot paths are provided throughout the cross section for urban area
- Specify Speed Limit and De-restriction Signs at the entry and exit to each urban or rural areas, which has street lighting. These signs will be shown on the road plans and will be subject to modification prior to erection.
- Provision for M.S. Railing in the urban areas to avoid accident (refer the following table)

S. No	Design Chaiange		Length, m	Road Safety Measures
	From	To		
Omalur to Mecheri Road				
1.	1/150	2/060	910	Provision for M.S Railing in the urban sections for preventing accidents. Typical cross section for 2 lane (Malliyakarai to Attur road) and 4 lane (Omalur to Mecheri Road and Chithode - Erode road (SH- 15)) is showing the following figure
2.	2/500	2/800	300	
3.	3/300	5/200	1900	
4.	5/980	6/500	520	
5.	6/800	8/000	1200	
6.	8/350	9/100	750	
7.	11/150	11/700	550	
8.	12/020	13/100	1080	
9.	13/450	14/320	870	
Malliyakarai to Attur road				
10.	87/218	88/138	920	
Chithode - Erode road (SH- 15)				
11.	153/600	161/725	**8125**	

Source: DPR, 2020



Railing provision in the Urban areas

- In Chithode to Erode road two pedestrian foot over bridges are proposed at design km 156/900 and km160/020.
- In 4-lane section urban limits in Omalur to Mecheri road and Chithode to Erode road, non-mountable New Jersey crash barriers of height 1.1m with 0.3m height with reflective sheet to prevent glare of opposite side vehicles are proposed.

Traffic Calming Measures. As the existing land use along the existing road is predominantly Ribbon development. The following Provisions have been made in built up locations.

- Thermo Plastic Rumble strips are provided at start and end of built up locations to alert the driver
- Thermo Plastic Rumble strips are provided on either side of Intersections

- Provision of Cautionary/Warning sign boards such as Speed Regulatory sign, Place identification sign etc
- Pedestrian crossings with Rumble strips and Advance warning sign is provided built up locations, School ad Hospital locations.
- Guard rail is provided in built up stretch.
- Pelican Signal is provided at school locations
- LED Blinkers are provided at all School, Hospital and Intersection locations.
- Road studs have been proposed in all marking along the road for built up stretch
- Object/hazard markers are proposed at all Median openings and Cross drainage structures.

8.2.2.1 Road Marking

The specification and standards for road markings are as per IRC: 35 1997. Lane markings are provided both with Thermoplastic paint mixed with retro-reflective beads throughout and with Raised Pavement Markers (Cat's eye) on curves. The lane marking are provided at 3.5 m lane width and edges of paved shoulders are proposed. The cat's eyes at curves are provided at 9 m intervals placed at the center of the line marking spacing for improve visibility and drivability during night drive. Edge markings are provided at the carriageway edges. The markings are continuous strip of painting with breaks at the junctions. Other markings, viz, island marking, warning lines, chevron markings and directional arrows, etc. are provided at suitable locations.

8.2.2.2 Traffic Signs

Various traffic signs, viz, regulatory, cautionary and information signs are provided in the project road at curves, intersections, median openings and at all necessary places. The specifications and standards for traffic signs are as per IRC: 67-2012.

Typical Signs	List of Signs
Mandatory / Regulatory Signs	Stop Sign
	No parking Signs at locations of 2.5m paved shoulder
Cautionary / Warning Signs	Curve Sign
	Object Marker
	Side Road
	Chevron Signs for curves
	Red reflectors
	Keep left
	Cat's eyes
Information Sign	Advanced Direction Sign
	Route Marker Sign
	Place Identification Sign
	Overhead Cantilever Sign Boards
	Cluster of Reflectors
	Overhead Gantry Sign Boards
	Bus Stop

8.2.2.3 Pedestrian Hand Rails

Pedestrian hand rails are proposed at following locations;

- At all major junctions

- Schools and hospitals
- Bus bay locations

8.2.2.4 Project Facilities

Adequate provisions of wayside amenities are provided on the project road to improve the safety for the convenience of road users and aesthetics of the surrounding environment.

Litter Bins: Litter bins are provided at all bus bays and passenger shelter locations for temporarily storing the refuse and waste. Also, two bins each are provided at all major junctions.

8.2.3 Labour Influx Management

According to preliminary estimates, approximately 200-250 workers would be required for each of the project corridors, of which 30%-50% may be brought in from other states including West Bengal, Bihar and North-eastern states of India. Migrant labour may be semi-skilled or may be brought in where the requirement of labour is large. Preference would be given to offering these jobs to PAPs and other local people. The bid documents specify that the contractor shall give preference to local villagers for unskilled labour requirement. However skilled labour would also be required for technical support and construction. The skilled workers could be primarily migrant labours from places outside the state of Tamil Nadu. Labor influx for construction works can lead to a variety of adverse social and environmental risks and impacts.

i. Social Risks and Impacts

- **Risk of social conflict**: Conflicts may arise between the local community and the migrant labours, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in the local community may be exacerbated. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other.
- **Increased risk of illicit behaviour and crime**: The influx of migrant labours into communities may increase the rate of crimes and/or a perception of insecurity by the local community. Such illicit behaviour or crimes can include theft, physical assaults, substance abuse, prostitution and human trafficking. Local law enforcement may not be sufficiently equipped to deal with the temporary increase in local population.
- **Influx of additional population ("followers")**: Especially in projects with longer timeframe, people can migrate to the project area in addition to the labor force, thereby exacerbating the problems of labor influx. These can be people who expect to get a job with the project, family members of workers, as well as traders, suppliers and other service providers, particularly in areas where the local capacity to provide goods and services is limited.
- **Impacts on community dynamics**: Depending on the number of migrant labours and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Pre-existing social conflict may intensify as a result of such changes.
- **Increased burden on and competition for public service provision**: The presence of migrant labours (including their families) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education and social services. This is particularly the case when the

influx of migrant labours is not accommodated by additional or separate supply systems.

- **Increased risk of communicable diseases and burden on local health services**: The influx of migrant labours may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), or the incoming migrant labours may be exposed to diseases to which they have low resistance. This can result in an additional burden on local health resources. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the project's medical facility and instead go anonymously to local medical providers, thereby placing further stress on local resources. Local health and rescue facilities may also be overwhelmed and/or ill-equipped to address the industrial accidents that can occur in a large construction site.
- **Child labor and school dropout:** Increased opportunities for the host community to sell goods and services to the incoming migrant labours can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.
- **Local inflation of prices**: A significant increase in demand for goods and services due to labor influx may lead to local price hikes and/or crowding out of community consumers.
- **Increased pressure on accommodations and rents**: Depending on project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of local residents.
- **Increase in traffic and related accidents**: Delivery of supplies for migrant labours and the transportation of migrant labours can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure.

ii. Environmental Risks and Impacts

- **Inadequate waste disposal and illegal waste disposal sites**: Large populations of migrant labours generate increased amounts of waste, for which no sufficient local waste management capacities may exist, which would likely lead to improper disposal practices.
- **Wastewater discharges**: Project-related activities, along with workers' camps, and a lack of appropriate wastewater discharges may pollute nearby water resources. Major health risks can occur if latrine pits spill over into local streams that are used for drinking water by the host community. However, in Phase-1 corridors all the identified surface water sources are observed to be seasonal and hence the anticipated impact will be marginal, even though appropriate mitigation measure as suggested in the ESMP have to be adopted.
- **Increased demand on freshwater resources**: The provision of clean drinking water and water for hygiene purposes can result in increased pressure on freshwater resources in the project or camp site area.
- **Camp related land use, access roads, noise and lights**: In ecologically sensitive areas, workers' camps can have impacts on the local wildlife. This may include disturbance of species, as well as illegal hunting. In the same context, new access routes for workers' camps may have impacts on natural habitats. Though, none of the Phase-1 corridors traverse ecological sensitive areas, precautionary measure have to be taken to reduce impact on the available wild species (as discussed in the section 4.2 Biological Environment).

- **Increased deforestation, ecosystem degradation, and species loss**: These can result from forest or land conversion for worker housing/ labour shed and migrant labours' agricultural subsistence activities
- **Increased use of / demand for natural resources**: This can include logging for construction, fuel wood collection, use of water resources, farming and grazing, hunting and fishing, potential introduction of invasive or non-native species, and land degradation

MANAGEMENT MEASURES

Sl.no	Labour Influx Risks and Impacts	Management Measures
Social Risks and Impacts		
1.	Risk of social conflict	• Provision of information regarding Worker Code of Conduct in local language(s); • Provision of cultural sensitization training for migrant labours regarding engagement with local community.
2.	Increased risk of illicit behaviour and crime (including prostitution, theft and substance abuse)	• Paying adequate salaries for migrant labours to reduce incentive for theft; • Paying salaries into workers' bank accounts rather than in cash; • Sourcing of local workforce; • Creation of supervised leisure areas in workers' camp; • Cooperation with local law enforcement; • Introduction of sanctions (e.g., dismissal) for workers involved in criminal activities; • Provision of substance abuse prevention and management programs
3.	Adverse impacts on community dynamics	• Provision of services in the workers' camp to reduce the need for workers to use local community facilities; • Provision of entertainment and events for migrant labours within camp to reduce incentives for mixing with local community
4.	Influx of Additional Population ("Followers")	• Contractor to hire workers through recruitment offices and avoid hiring "at the gate" to discourage spontaneous influx of job seekers.
5.	Increased burden on public service Provision	• Workers' camp to include wastewater disposal and septic systems; • Identification of authorized water supply source and prohibition of use from other community sources; • Separate service providers for community and workers' camp/construction site; • Worker Code of Conduct on water and electricity consumption.
6.	Increased risk ofcommunicable diseases (including STDs and HIV/AIDS)	• Vaccinating migrant labours against common and locally prevalent diseases; • Contracting of an HIV service provider to be available on-site;

Sl.no	Labour Influx Risks and Impacts	Management Measures
Social Risks and Impacts		
		• Implementation of HIV/AIDS education program; • Information campaign on STDs among the migrant labours and local community; • Education about the transmission of diseases; • Provision of condoms
7.	Child labor and school drop out	• Ensuring that children and minors are not employed directly or indirectly on the project.
8.	Local inflation of prices and crowding out of local consumers	• Appropriate mix of locally and non-locally procured goods to allow local project benefits while reducing risk of crowding out of and price hikes for local consumers
9.	Increased pressure on accommodation and rents	• When accommodation supply is limited establishment of workers' camp facilities with sufficient capacity for workers including sub-contractors and associated support staff
10.	Increased traffic and rise in accidents	• Preparation and implementation of a traffic management plan to be approved by Engineer – in charge; • Building additional/separate roads to project and workers' camp sites; • Organization of commute from camp to project to reduce traffic; • Road safety training and defensive driving training for staff; • Sanctions for reckless driving
Environmental Risks and Impacts		
11.	Inadequate waste disposal and creation of illegal waste disposal sites	• Reduction of waste generation; • Sound practices for waste disposal
12.	Wastewater Discharges	• Ensuring workers' camp and associated facilities are connected to septic tank or other wastewater systems which are appropriate and of sufficient capacity for the number of workers and local conditions.
13.	Increased demand on freshwater resources	• Water conservation and recycling of water; • Consideration of use of rainwater where feasible; • Avoiding contamination of fresh water sources
14.	Camp related land use, access roads, noise and lights	• Placement of workers' camp away from environmentally sensitive areas to avoid impacts on the local wildlife; • Routing of new access routes for workers' camp to avoid/minimize environmentally sensitive areas.
15.	Increased deforestation, ecosystem degradation, and species loss	• Only wood from commercial sources to be used on the project;

Sl.no	Labour Influx Risks and Impacts	Management Measures
Social Risks and Impacts		
		• Use of wood for fuel prohibited; • Reduction in energy demand, reduced noise and light generation, reduced and safe use of dangerous chemical substances.
16.	Increased use/demand on natural resources	• Minimized land use change and use of other natural resources; • Avoidance of deforestation around camp area; • Prompt and effective response to environmental and social issues raised by supervision engineer.

8.2.4 Gender Based Violence

8.2.4.1 GBV issues due to the Influx of Migrant labours

Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and act outside their normal sphere of social control. This can lead to inappropriate and criminal behaviour, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the local community. A large influx of male labour may also lead to an increase in exploitative sexual relationships and human trafficking whereby women and girls are forced into sex work. The mitigation measures are as follows

- Mandatory and regular training for workers on required lawful conduct in host community and legal consequences for failure to comply with laws;
- Commitment / policy to cooperate with law enforcement agencies investigating perpetrators of gender-based violence;
- Creation of partnership with local NGO to report workers' misconduct and complaints/reports on gender-based violence or harassment through the GRM;
- Provision of opportunities for workers to regularly return to their families;
- Provision of opportunities for workers to take advantage of entertainment opportunities away from rural host communities.

8.2.4.2 Consultations with Women

a) Omalur to Mecheri Road (SH 222)

Two FGD's were conducted at Omalur to Mecheri Road (SH 222), about 41 women participated in the meeting. The women were more concerned about the safety and in the FGD they demanded for gender specific facilities.

8.2.5 Consultation with School Girls (South Indian Matriculation School,P. Kalipatti)

FGD with adolescent girls and higher secondary school female teachers was done at South Indian Matriculation School, P. Kalipatti, Omalur Taluk, Salem District, Tamil Nadu 636455 on 14th February 2020. Eight teachers and 23 students participated in the meeting. The project road (Omalur – Mecheri Road) details has been shared with the group along with the goal of the Gender Based Violence (GBV), risk assessment and development of

mitigation plan, which aims to make the road transport sector gender and socially inclusive.

This discussion was conducted to understand the issues faced by adolescent girls and female commuters while using public transport and how public transport can become more risk-free mode of transport to women and children. The gender development expert of the consultant encouraged the participants to share their views on the existing and probable risks, such as safety threat and mental agony by the male co-commuters.

To bring the session to an interactive mode, Gender development expert, put forward various questions to the participants for discussion. The questions include,

- Is the neighborhood well lit?
- Are there adequate streetlights?
- Are there any isolated bus waiting shelters in your area known for eve-teasing/harassment?
- Are there enough hygiene toilets available in major bus stations?
- Are there facilities for drinking water in public places?
- Are you aware about the GBV prevention laws?
- Are you aware about where to report when harassed?
- Do you feel that, the general population should be sensitised on the GBV prevention laws?
- What are the situations that pulls you back from travelling alone?
- Do you prefer a companion while traveling? If yes, why?

Outcome/Comments – South Indian Matric Higher Secondary School

- There are no proper streetlights, they recommend for reliable streetlight.
- Antisocial men use the space under Omalur flyover, for consuming alcohol and they even eve tease ladies and school going girl students
- There is no safety for girls in isolated bus waiting areas
- Bus shelters are unhygienic and not maintained properly. The bus shelters are used by antisocial men for consuming alcohol etc. during night and holidays, it is kept unhygienic. Concrete benches provided are not clean.
- At least, in main bus shelters CCTV camera may be placed
- Ladies mostly use two wheelers, over speed and overtaking in wrong side by buses, heavy vehicles etc. creates difficulty and fear to drive. They prefer separate lane for two wheelers.
- In school area there are no sign board, zebra crossing and speed breakers.
- There is no hygiene toilet or drinking water facility in public places
- During peak hours, more number of local transport facility is needed.
- Private buses don’t stop in school areas during school timings, to avoid students with free passes entering the bus.
- Displaying helpline numbers, bus time schedule in bus shelters and public places should be made compulsory.
- Since there is a railway crossing in the proposed road, train crossing time should be displayed
- In Omalur, town shopkeepers have encroached the foot path, so it is difficult to walk in that area, especially for females.
- Since there is lot of beverage shops in the main roads, crimes and accidents are happening frequently.

- Police patrolling may be done during night to control antisocial activities at bus shelters.
- In Kamineri village there is no bus bay or bus shelter. Bus drivers doesn't stop in a permanent place. It is very difficult for female passengers.

Discussion with Adolescent girls and female teachers

8.2.5.1 Consultation with PAF's (KSV Mahal, Kamineri)

FGD with female members of the project affected family was conducted in the side-line of the public consultation conducted at KSV Mahal, Kamineri, Omalur Taluk, Salem District, Tamil Nadu 636455 on 15thFebruary 2020. Nine female members participated in the discussion. The project road (Omalur – Mecheri road) details has been shared with the group along with the goal of the Gender Based Violence (GBV) risk assessment and development of mitigation plan, which aims to make the road transport sector gender and socially inclusive.

This discussion was conducted to understand the issues faced by adolescent girls and female commuters while using public transport and how public transport can become more risk-free mode of transport to women and children. The Gender development expert encouraged the participants to share their views on the existing and probable risks, such as safety threat and mental agony by the male co-commuters.

To bring the session to an interactive mode, Gender development expert, put forward various questions to the participants for discussion. The questions include,

- Is the neighborhood well lit?
- Are there adequate streetlights?
- Are there any isolated bus waiting shelters in your area known for eve-teasing/harassment?
- Are there enough hygiene toilets available in major bus stations?
- Are there facilities for drinking water in public places?
- Are you aware about the GBV prevention laws?
- Are you aware about where to report harassment?
- Do you feel that, the general population should be sensitised on the GBV prevention laws?
- What are the situations that pulls you back from travelling alone?

Outcome: Comments – Female PAPs, KSV Mahal

- No proper streetlights are available in the interior roads

- No rest room or drinking water facility in public places
- During night, alcoholics make noises, knock the doors of their house in Kamineri, Cantharamalkadai hamlet etc.Since there is a beverage outlet nearby and ladies are scared to go outside after 7 Pm
- Police patrolling may be done during night.
- In Murudan colony, there are no toilet facility in any of their houses, ladies and girls are compelled to go outside, which is a risk.
- The water supply in Canthramalkadai hamlet is received only once in 2 weeks, they use to borrow water from other area. They have applied for digging borewell permission in panchayath but it is getting delayed.
- Mrs. Chellamma (name changed), disclosed that her husband and two sons are addicted to alcohol and doesn't take care of family. She must go for daily labour work to meet the family needs. This is the situation in many of the houses nearby.
- Out of 9 participants, 8 of them are members of Self-Help Groups. They rarely interfere in social issues.
- None of them are aware about Gender Act and common laws available for their protection.

Discussion with Women Group

The outcome of the consultation has been discussed with the Design / Engineering Team to include the suggested measures in the project. The consultation for the remaining two roads (Maliyakari to Attur (SH 30) and Erode to Chithode (SH 15) will be conducted in the month of March/ April 2020 and accordingly the safeguard documents including the Gender Action Plan shall be prepared/ updated.

8.2.5.2 GBV issues in the Phase- 1 Corridors

The consultations had with the women group in the Phase-1 corridors, highlights the following key issues

- Antisocial men use the space under flyover, for consuming alcohol and they even eve tease ladies and school going girl students
- There is no safety for girls in isolated bus waiting areas
- There are no proper streetlights, they recommend for reliable streetlight.
- Bus shelters are unhygienic and not maintained properly. The bus shelters are used by antisocial men for consuming alcohol etc. during night and holidays, it is kept unhygienic.
- In school area, there are no sign board, zebra crossing and speed breakers.

- There is no hygiene toilet or drinking water facility in public places
- Since there is lot of beverage shops in the main roads, crimes and accidents are happening frequently.

The noted observations are shared with the design team and appropriate mitigation measures has been included in the Project Design to mitigate the GBV issues, which includes (i) Provision of Solar powered Street lights which will function even there is power failure in the project area, (ii) Adequate sign boards as per the IRC requirement is provided, (iii) Zebra Crossing along with adequate signals are proposed at Schools and Hospitals for pedestrian safety, (iv) Bus shelters are provided with lighting arrangements and separate Toilet facility is provided at bus shelters with bus bays, (v) helpline numbers, bus time schedule will be provided in Bus shelter location, (vi) The existing GRM shall accept the grievances related on the GVB and appropriate actions shall be taken.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

9.1 EMP Table

The Environmental and Social Management Plan (ESMP) is prepared based on the assessment of Environmental and Social Impacts (refer to Chapter 7) concerning Location impacts, Design impacts, Construction related impacts, and Operational and maintenance related impacts. The ESMP is prepared to cover all the project related activities that are to be implemented during the project pre-construction, construction, and post-construction stages.

9.2 Summary of Site and Activity Specific Plan as per ESMP

Table 53: Site and Activity Specific Plans/Programs as per ESMP

To be Prepared During	Specific Plan/Program	Purpose	Responsible for Preparation	Responsible for Implementation
Detailed Design Phase	Environmental monitoring program as per Detailed design	Indicate sampling locations, methodology, and parameters	Supervision Consultant	Contractor
Detailed Design Phase	Erosion control Plan/ measures	Mitigate impacts due to erosion	Supervision Consultant	Contractor
Detailed Design Phase	List and maps showing utilities to be shifted	Utilities shifting	Supervision Consultant during the preliminary stage, Contractor as per detailed design	Contractor
Detailed Design Phase	Contingency plan	Mitigate impacts due to interruption of services during utilities shifting	Supervision Consultant	Contractor
Detailed Design Phase	Chance find protocol	Address archaeological or historical finds	Supervision Consultant	Contractor
Detailed Design Phase	List of pre-approved sites	Location/s for work camps, areas for the stockpile, storage, and disposal	Supervision Consultant	Contractor
Detailed Design Phase	Waste management plan (measures)	Mitigate impacts due to waste generation	Supervision Consultant	Contractor
Detailed Design Phase	H&S plan	Occupational health and safety	Supervision Consultant	Contractor
Detailed Design Phase	Spill prevention and containment plan	Mitigate impacts of accidental spills of oil, lubricants, fuels, concrete, and other hazardous materials	Supervision Consultant	Contractor
Post Construction Phase	Restoration of the construction campsite/ area	Restoring the area to the usable condition	Contractor under the guidance of Supervision Consultant	Contractor

Table 54: Environmental and Social Management Plan

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
PRE-CONSTRUCTION STAGE				
Pre-construction activities by PIU				
Land Acquisition	The land will be acquired following the provisions of Tamil Nadu Highway Act, 2001 and the compensation will be determined following India's new Land Acquisition and Rehabilitation and Resettlement Act, (RFCTLARR Act, 2013). The Resettlement Policy Framework (RPF) and the ESS5 (Land Acquisition, Restrictions on Land Use and Involuntary Resettlement) shall be referred.	Corridor of Impact.	SDU (TNRSP), Revenue Dept., and NGOs,	PIU (TNRSP)
Tree Cutting	• As far as possible maximum efforts shall be made to minimize the number of trees proposed to be felled by adopting suitable on the spot adjustment of engineering designs. • Trees shall be removed from the Corridor of Impact (CoI) and construction sites before the commencement of construction. Prior Permission shall be obtained from the Revenue Divisional officer concerned for the felling of trees. • The trees cut shall be disposed of through auction (inclusive of tree stumps). This disposal shall be done immediately to ensure that the traffic movement is not disrupted. Progress of tree cutting shall be reported to the PIU. • The provision as indicated in the ESS 5 (Land Acquisition, Restrictions on Land Use and Involuntary Resettlement) and Resettlement Policy Framework (RPF) shall be adopted	Corridor of Impact.	Environment Cell (PIU, TNRSP), Revenue Department and Forest Department. Tree Felling Contractor	PIU (TNRSP)
Utility Relocation and Common Property Resources (CPR's)	• All community utilities and common property resources such as stand posts bore wells, wells, water supply lines, toilets, sewage lines, drainage systems, optical fiber cables, electric power supply lines, transformers, irrigation pump houses, telephone and television cables shall be relocated and restored before the commencement of the road improvement activity. • While relocating these utilities and facilities, all concerned agencies including PIU shall take necessary precautions and shall provide barricades/delineation of such sites to prevent accidents including accidental fall into boreholes, pits, drains both during demolition and construction/ relocation of such facilities. Standard safety practices shall	Corridor of Impact.	PIU (TNRSP), Concerned Agencies/ Departments , Contractor	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	be adopted for all such works. • Early completion of works for schools, colleges and health centers including shifting of gates and construction of boundary walls shall be planned during holidays so that the risk of accidents and disturbance to the day-to-day activity of such institutions are minimized. • Proper placement (as per codes) of passenger shelters/bus stops shall be ensured to prevent distress to the commuters and passengers. • Access to the Common Property Resources (CPR's) shall be maintained • Relocation sites for all CPRs shall be selected in consultation with concerned communities, local administrative authorities/departments.			
Relocation of Cultural and Religious Properties	• All cultural properties within the CoI, whose structure is getting affected fully, shall be relocated at suitable locations, as desired by the community; and for partially impacted structures enhancement measures shall be applied at the same sites before construction begins, depending on the availability of space, the requirement of the communities and fund availability. • No cultural properties or religious structures shall be removed or relocated without the knowledge and written consent of the concerned parties or communities and local administration as the case may be. Sites for the relocation of these religious structures shall be identified following the choice of the community. • As far as possible, the architectural elements of the structure should be conserved/reflected/translated into the design of new structures following the wishes of the community • Proper drainage and garbage disposal at such sites shall be ensured to prevent unhygienic conditions, blocking of drains, etc. at/near relocated structures. Garbage collection bins, soak pits or other appropriate measures shall be provided apart from the simple enhancement of such sites. • The budget provision for the reconstruction / compensation of the 19 CPR's is included in the RAP	Corridor of Impact.	SDU (TNRSP), NGOs, Contractor, Concerned Community	PIU (TNRSP)
Orientation of Implementing Agencies and Communities	• The PIU shall organize orientation sessions during all stages of the project. This shall include on-site training (general as well as specific to the context of this subproject) as well. These sessions shall involve the		PIU (TNRSP), Site Engineer/ Supervision	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	concerned division-level staff of the TNRSP involved in the project, Staff of the Site Engineer/ Supervision Consultant and the Contractor. • Briefing sessions shall be held for sub-project community representatives before and during implementation.		Consultant	
Pre-construction activities by the Contractor/Engineer of Supervision Consultant				
Joint Field Verification	• The Engineer - Incharge of Supervision Consultant and the Contractor shall carry out joint field verification to ascertain the necessity of saving trees, environmental and community resources wherever such representations or suggestions in writing have been received and forwarded by the project authority or by the site engineer following the local situations (in consultation with the local authority/ interest of community representation). • The complaints/suggestions together with the observations and expert opinion of the joint verification team containing the need for additional protection measures or changes in design/scale/nature of protection measures including the efficacy of enhancement measures suggested in the ESMP shall be summarized in a written document containing all the details with date, time, place, and signature of the individuals involved and this shall be sent to PIU/TNRSP for approval. • The PIU shall maintain proper documentation and justifications/reasons in all such cases where deviation from the original ESMP is proposed.	Project Corridor	Contractor and Environmental Officer of CSC	PIU (TNRSP)
Assessment of Impacts due to Changes/ Revisions in the Project Work	The Engineer - In charge of Supervision Consultant shall assess the anticipated impacts and revise/modify the ESMP in consultation with the PIU/TNRSP in accordance with the recommendations made by the field survey party in the event of changes /revisions /unanticipated impacts (including addition or deletion) in the project's scope of work	Project Corridor	Contractor and Environmental Officer of CSC	PIU (TNRSP)
Procurement of Machinery				
Crushers, Hot-mix Plants & Batching Plants	• Crushers, hot mix plants, and batching plants shall comply with the requirements and specifications of the relevant current emission control legislation and contract specifications. • The guidelines with respect to establishing hot mix plant, batching plant issued by the TNPC Board from time to time shall be followed. • Crushers, hot-mix and batching plants shall be located at least 1000m	Project Corridor	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	(1km) away from residential/ settlements, forests, wildlife movement areas, and commercial establishments, preferably in the downwind direction. • The Contractor shall submit a detailed layout plan for all such sites and seek prior approval of Engineer - Incharge of Supervision Consultant before entering into a formal agreement with a landowner for setting-up such sites. Actions by Supervision Consultant and PIU/TNRSP against any non-compliance shall be borne by the Contractor at his own cost. • Arrangements to minimize dust pollution through the provision of windscreens, mist spray units, and dust encapsulation shall have to be provided at all such sites. Specifications of crushers, hot mix plants, and batching plants shall comply with the requirements of the relevant current emission control legislation and Consent / NOC for all such plants shall be submitted to the CSC and PIU/TNRSP. • No such installation by the Contractor shall be allowed till all the required legal clearances are obtained from the competent authority and the same is submitted to the PIU/TNRSP and the Supervision Consultant. • Environmental Monitoring (dust and emission) have to be conducted to demonstrate compliance.			
Other Construction Vehicles, Equipment and Machinery	• The discharge standards promulgated under the Environment Protection Act, 1986 shall be strictly adhered to. All vehicles, equipment, and machinery to be procured for construction shall conform to the relevant Bureau of Indian Standard (BIS) norms. • Noise limits for construction plant and equipment that are to be procured such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A), when measured at one-meter distance from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. • Efficient and environmentally-friendly equipment confirming to the latest noise and effluent emission control measures available in the market shall be used in the project. • The Contractor shall maintain a record of Pollution under Control (PUC) certificate for all vehicles and machinery used during the contract period, which shall be produced to the PIU/TNRSP and the Supervision Consultant for verification whenever required.	Project Corridor	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
Identification & Selection of Material Sources				
Borrow Areas	• Arrangement for locating the source of supply of material for embankment and subgrade as well as compliance with environmental requirements, as applicable, shall be the sole responsibility of the Contractor. The Environmental and Safety Engineer from the Contractor shall be required to inspect every borrow area location before approval. • Format for reporting shall be as per the Reporting Format enclosed in the ESMP for Borrow Area. The Engineer - Incharge of the Supervision Consultant shall be required to inspect every borrow area location and evaluate such proposals following environmental requirements before issuing approval for use of such sites. • No borrow areas shall be opened within 500m of wildlife movement zones and forest areas. The borrow areas shall be at least 300m from schools and village access roads. • Borrow area should be located at a minimum distance of 300m from the residential/ settlement area. Proper fencing should be provided and access to the borrow areas should be restricted for the locals • The Contractor shall not borrow the earth from the selected borrow area until a formal agreement is signed between landowner and Contractor and a copy of the agreement is to be submitted to the Engineer – In-charge of the Supervision Consultant. The Supervision Consultant shall report these facts to the PIU/TNRSP along with the remarks in the prescribed format with documentary proofs. • Planning of haul roads for accessing borrows materials shall be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas. In case agricultural land is disturbed, the Contractor shall rehabilitate it as per Borrow Area guideline given in the Environmental and Social Management Framework (ESMF) or as approved by the Engineer – In-charge of Supervision Consultant. • Haul roads shall be maintained throughout the operation period of the borrow areas by undertaking the required maintenance and repair works, which may include strengthening, pothole repairing, and diversions. Improvements shall be done to reduce inconvenience to users of these roads, residents living along the haul roads and minimize air and water pollution.	Ecologically sensitive area	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• Such measures shall include, but not limited to, frequent sprinkling of water, repairing of the road, road safety provisions (controlling speed and driving standards, warning and informatory signage, flagmen, etc.), and ensuring covering of loaded vehicles by waterproof tarpaulin; consultation with public and special precautions are required when measures are implemented near schools, health centers, and settlement areas. • All borrow areas whether in private, community or govt. the land shall be restored either to the original condition or as per the approved rehabilitation plan immediately upon completion of the use of such a source.			
Quarries	• The Contractor shall identify materials from existing licensed quarries with suitable materials for construction. Apart from approval of the quality of the quarry materials, the Engineer's representative shall verify the legal status (including environmental clearance, NoC from competent authorities (TNPCB, Dept. of mines) etc.,) of the quarry operation, as to whether approval from the Department of Geology and Mining, GoTN is obtained. • No quarry and/or crusher units shall be selected or used, which is within 1000m from the forest boundary, wildlife movement path, breeding and nesting habitats, and national parks/sanctuaries. No quarry or associated plants can be set-up within 1000m from the residential/ settlement locations • Contractor shall also work out haul road network used for quarry transport and report to Engineer - Incharge of Supervision Consultant who shall inspect and in turn report to PIU/TNRSP on the suitability of such haul roads from the safety of residents, biodiversity and other environment points of views.	Quarry area should be located 1000m from the settlement locations	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Arrangement for Construction Water	• The Contractor shall source the requirement of water preferentially from surface water bodies, as rivers and tanks in the project area. The Contractor shall be allowed to pump only from the surface water bodies. Boring of any tube wells shall be prohibited. To avoid disruption/disturbance to other water users, the Contractor shall extract water from fixed locations. The Contractor shall consult the local people before finalizing the locations. • Only at locations where surface water sources are not available, the	All rivers/ surface water bodies that can be used in the project	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	Contractor can contemplate the extraction of groundwater. Consent from the Engineer that "no surface water resource is available in the immediate area for the project" is a pre-requisite before extraction of groundwater. The Contractor shall need to comply with the requirements of the PWD – Water Resources Department. GoTN and seek their approval for doing so.			
Sand (all river and stream beds used directly or indirectly for the project)	• To the extent possible the Contractor shall explore the possibilities of utilising the Fly ash for the construction purposes as specified in the Notification on use of fly ash (subsequent amendments). • The Contractor shall procure sand through online system as instructed by the Government of Tamil Nadu. No new sand quarries will be allowed.	All riverbeds recommended for sand extraction for the project	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Labour Requirements	• The Contractor shall use unskilled labor drawn from local communities to avoid any additional stress on the existing facilities (medical services, power, water supply, etc.) • The recruitment of women and members of vulnerable groups shall be prioritized. • The Contractor shall provide training to build the skills of locally-recruited labour. • All staff, skilled and unskilled labour employed on a site shall be required to sign Codes of Conduct that shall ensure compliance with the Environmental, Social, Health and Safety provisions of civil works and consultancy contracts.	Along the project corridor at construction sites	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Labour Influx				
Risk of social conflict	• Provision of information regarding Worker Code of Conduct in local language(s); • Provision of cultural sensitization training for migrant labours regarding engagement with local community.	Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Increased risk of illicit behaviour and crime (including prostitution, theft and	• Paying adequate salaries for migrant labours to reduce incentive for theft; • Paying salaries into workers' bank accounts rather than in cash; • Sourcing of local workforce; • Creation of supervised leisure areas in workers' camp; • Cooperation with local law enforcement;	Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
substance abuse)	• Introduction of sanctions (e.g., dismissal) for workers involved in criminal activities; • Provision of substance abuse prevention and management programs			
Adverse impacts on community dynamics	• Provision of services in the workers' camp to reduce the need for workers to use local community facilities; • Provision of entertainment and events for migrant labours within camp to reduce incentives for mixing with local community	Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Influx of Additional Population ("Followers")	• Contractor to hire workers through recruitment offices and avoid hiring "at the gate" to discourage spontaneous influx of job seekers.	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Increased burden on public service Provision	• Workers' camp to include wastewater disposal and septic systems; • Identification of authorized water supply source and prohibition of use from other community sources; • Separate service providers for community and workers' camp/construction site; • Worker Code of Conduct on water and electricity consumption.	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Increased risk of communicable diseases (including STDs and HIV/AIDS)	• Vaccinating migrant labours against common and locally prevalent diseases; • Contracting of an HIV service provider to be available on-site; • Implementation of HIV/AIDS education program; • Information campaign on STDs among the migrant labours and local community; • Education about the transmission of diseases; • Provision of condoms	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Child labor and school drop out	• Ensuring that children and minors are not employed directly or indirectly on the project.	Construction site	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Increased pressure on accommodation and rents	• When accommodation supply is limited establishment of workers' camp facilities with sufficient capacity for workers including sub-contractors and associated support staff	Areas in the immediate vicinity of the construction camp	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
Inadequate waste disposal and creation of illegal waste disposal sites	• Reduction of waste generation; • Sound practices for waste disposal	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Wastewater Discharges	• Ensuring workers' camp and associated facilities are connected to septic tank or other wastewater systems which are appropriate and of sufficient capacity for the number of workers and local conditions.	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Increased demand on freshwater resources	• Water conservation and recycling of water; • Consideration of use of rainwater where feasible; • Avoiding contamination of fresh water sources	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Camp related land use, access roads, noise and lights	• Placement of workers' camp away from environmentally sensitive areas to avoid impacts on the local wildlife; • Routing of new access routes for workers' camp to avoid/minimize environmentally sensitive areas.	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Increased deforestation, ecosystem degradation, and species loss	• Only wood from commercial sources to be used on the project; • Use of wood for fuel prohibited; • Reduction in energy demand, reduced noise and light generation, reduced and safe use of dangerous chemical substances.	Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Increased use/demand on natural resources	• Minimized land use change and use of other natural resources; • Avoidance of deforestation around camp area; • Prompt and effective response to environmental and social issues raised by Engineer – incharge (CSC).	Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Setting up construction sites				
Construction Camp Locations – Selection, Design & Layout	• Construction camps shall not be proposed: o Within 1000m of Ecologically sensitive areas/ zones o Within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. The layout of construction camps has to be prepared and approved by the Engineer – Incharge of the Supervision Consultant.	All Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• The location for stockyard for construction materials shall be identified at least 1000 m from watercourses. The waste disposal and sewage system for the camp shall be designed, built and operated such that there will be no contamination to the soil, groundwater and also ensure that there is no odor generation. • Unless otherwise arranged by the ULB's, arrangements for disposal of excreta suitably approved by the local medical health or municipal authorities or as directed by Engineer shall be provided by the Contractor.			
Arrangements for Temporary Land Requirement	• The Contractor as per prevalent rules shall 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 Engineer shall ensure that the site is cleared before handing over to the owner (after construction or completion of the activity) and it is included in the contract.	Areas temporarily acquired for construction sites / hot mix plants / borrow areas / diversions / detours	Contractor	Environmental Officer of CSC and PIU (TNRSP)
CONSTRUCTION STAGE				
Construction Stage Activities by Contractor				
Site Clearance				
Clearing and Grubbing	• Site clearance including clearance of marked trees for felling and removal has to be carried out much before the actual road construction takes place. • Structures and utilities (cabins, commercial properties, hoardings, overhead power transmission lines, cable connections, telephone lines, bore wells, stand posts, wells, statues, temples, etc.) shall be compensated/relocated as per RAP and ESMP provisions before tree felling; clearing or grubbing activities are to be undertaken as these activities may damage structures (private and govt.) and essential facilities/utilities of public use. • All works shall be carried out in a manner such that the damage or disruption to flora is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works shall be removed with prior approval from Engineer - Incharge of Supervision	Corridor of Impact	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	Consultant. • The Contractor, under any circumstances, shall not cut or damage trees. Vegetation above 30 cm girth shall be considered as trees and shall be compensated.			
Dismantling of Bridgework / Culverts	All necessary measures shall be taken especially while working close to cross drainage channels to prevent earthwork, stonework, materials, and appendage as well as the method of operation from impeding cross-drainage at rivers, streams, water canals, and existing irrigation and drainage systems, or causing flooding.	At locations were bridge works and culverts are proposed.	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Generation & disposal of Debris	Debris generated due to the dismantling of the existing road shall be suitably reused in the proposed construction as follows: • Eighty percent (80%) of the sub-grade excavated from the existing road surface, excluding the scarified layer of bitumen, shall be reused in the civil works after improving the soil below the subgrade through the addition of sand and suitable cementing material for qualitative up-gradation. • The dismantled scraps of bitumen shall be utilized for the paving of crossroads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes, parking areas along the corridor or in any other manner approved by the Engineer - Incharge of Supervision Consultant. • At locations identified for disposal of residual bituminous wastes, the disposal shall be carried out over a 60 mm thick layer of rammed clay to eliminate the possibility of leaching of wastes into the groundwater. • The Contractor shall suitably dispose of unutilized non-toxic debris either through filling up of borrows areas located in the wasteland or at pre-designated disposal sites, subject to the approval of the Engineer - Incharge of Supervision Consultant. • Debris generated from pile driving or other construction activities along the rivers and streams drainage channels shall be carefully disposed of in such a manner that it does not flow into the surface water bodies or form puddles in the area. • The pre-designated disposal locations shall be part of the Comprehensive Solid Waste Management Plan to be prepared by the Contractor in	Throughout Project Corridor	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	consultation and with approval of Engineer - Incharge of Supervision Consultant and approval local competent authority.			
Non-bituminous construction wastes disposal	The location of disposal sites shall be finalized before completion of the earthworks on any particular section of the road. The Engineer shall approve these disposal sites conforming to the following o These are not located within the designated forest area o The dumping does not impact natural drainage courses o No endangered/rare flora is impacted by such dumping. o Settlements are located at least 1000 m away from the site.	Disposal site locations	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Bituminous wastes disposal	The disposal of stratified bituminous wastes shall be done by the contractor for reuse in the road formation especially village roads after getting approval from Village Panchayat Presidents and in consultation with Environmental Specialist (PIU)	Throughout Project Corridor	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Stripping, stacking and preservation of topsoil	• The topsoil from all sites including roadside widening and working area, cutting areas, quarry sites, borrows areas, construction camps, haul roads in agricultural fields (if any) and areas to be permanently covered shall be stripped to a specified depth of 150mm and stored in stockpiles for reuse. • A portion of the temporarily acquired area and/or RoW edges shall be earmarked for storing topsoil. The locations for stacking shall be pre-identified in consultation and with approval of Engineer - Incharge of Supervision Consultant. The following precautionary measures shall be taken by the Contractor to preserve the stockpiles until they are re-used: • Stockpile shall be arranged such that the slope does not exceed 1:2 (vertical to horizontal), and height is restricted to 2 m. • To retain soil and to allow percolation of water, the edges of the pile shall be protected by silt fencing. • Multiple handling is to be kept to a minimum to ensure that no compaction occurs. • Such stockpiles shall be covered with empty gunny bags or shall be planted with grasses to prevent loss during rains. • Such stockpiled topsoil shall be utilized for o Covering reclamation sites or other disturbed areas including borrow	Throughout Project Corridor	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	areas (not those in barren areas) o Topdressing of road embankment and fill slopes o Filling up of tree pits and in the agricultural fields of farmers, acquired temporarily that need to be restored. • Residual topsoil, if there is any, shall be utilized for the plantation works along the road corridor. • The utilization as far as possible shall be in the same area/close to the same area from where the topsoil was removed. • The stripping, preservation, and reuse shall be carefully inspected, closely supervised and properly recorded by the Supervision Consultant.			
Accessibility	• The Contractor shall provide safe and convenient passage for vehicles, pedestrians, and livestock to and from roadsides and property access connecting the project road by providing temporary connecting road and foot path, as necessary. • The Contractor shall take measures necessary to prevent access to the works, borrow pits and quarry sites by members of the public and animals. • Construction activities that shall affect the use of side roads and existing accesses to individual properties, whether public or private, shall not be undertaken without providing adequate provision approved by the Supervision Consultant. • The Contractor shall ensure that the public and animals are prevented from entering the construction works. • The Contractor shall take care that the crossroads are constructed in such a sequence that construction work over the adjacent crossroads are taken up in a manner that traffic movement in any given area does not get affected.	All along the project corridor, all access roads.	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Planning for Traffic Diversions and Detours	• Detailed traffic control plans shall be prepared by the Contractor and the same shall be submitted to the Engineer - Incharge of Supervision Consultant for approval. The traffic control plans shall contain details of temporary diversions, traffic safety arrangements including layouts for signs and barriers, night time safety measures, details of traffic arrangement after cessation of work each day, safety measures are undertaken for the transport of hazardous materials and arrangement of flagmen, etc. to regulate traffic congestion.	All along the project corridor, all access roads	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• The Contractor shall provide specific measures for the safety of pedestrians and workers as a part of traffic control plans. • The Contractor shall ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. • Appropriate and safe speed limits through working areas and along detours shall be established and enforced. • The Contractor shall also inform the local community of changes in traffic routes and pedestrian access arrangements with assistance from the Supervision Consultant and TNRSP.			
Construction Materials				
Earth from Borrow Areas for Construction	• No borrow area shall be opened without permission of the Engineer –Incharge of Supervision Consultant. • Borrow pits shall not be dug continuously in a stretch. The location, shape, and size of the designated borrow areas shall be as approved by the Engineer and following the IRC recommended the practice for borrow pits for road embankments (IRC 10: 1961). • The borrowing operations shall 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 shall be maintained dust-free by the Contractor. Since dust rising is the most significant impact along the hauled roads, a sprinkling of water shall be carried out twice a day along such roads during their period of use.	All along the project corridor, all access roads sites temporarily acquired & all borrow areas	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Quarries	• The Contractor shall obtain materials for quarries only after the approval of the Department of Geology and Mining, GoTN. A copy of this consent must be submitted to TNRSP/PIU through Engineer –Incharge of Supervision Consultant. • The Contractor shall develop a Comprehensive Quarry Redevelopment Plan, as per the Mining Rules of the State and submit a copy to TNRSP and Supervision Consultant before the opening of the quarry site. • The quarry operations shall be undertaken within the rules and regulations in vogue.	All along the project corridor and all haul roads	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Blasting	• Except as may be provided in the contract or ordered or authorized by	All blasting and	Contractor	Environmental

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	the Engineer, the Contractor will not use explosives. Where the use of explosives is so provided or ordered or authorized, the Contractor shall comply with the requirements of the following Sub-Clauses of MoRTH 302 besides the law of the land, as applicable. • The Contractor shall at all times take every possible precaution and shall comply with appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives. The Contractor shall at all times when engaged in blasting operations, post sufficient warning flagmen, to the satisfaction of the Engineer. • The Contractor shall 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 whomsoever concerned or affected or likely to be concerned or affected by blasting operations. • Blasting shall be carried out only with the permission of the Engineer. All the statutory laws, regulations, rules, etc., about the acquisition, transport, storage, handling and use of explosives shall be strictly followed. • Blasting shall be carried out during fixed hours (preferably during mid-day) or as permitted by the Engineer. The timing shall be made known to all the people within 1000m (200m for pre-splitting) from the blasting site in all directions. • A Blast Management Plan that sets out procedures and measures needed for the safe implementation of blasting activities at each blasting site shall be prepared by the Contractor and approved by the Engineer – incharge of Supervision Consultant	Pre-splitting Sites.		Officer of CSC and PIU (TNRSP)
Water Extraction	Procurement of water is to be carried out as per "Arrangement for Construction Water". The Contractor shall minimize the wastage of water during construction.	All water bodies recommended being used in the project	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Transporting Construction Materials	• All vehicles delivering materials to the site shall 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 shall be kept clean and clear of all dust/mud or other extraneous materials dropped by such vehicles	All along the Project corridor and all haul roads	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• The unloading of materials at construction sites close to settlements shall be restricted to daytime only. • Transportation vehicles shall be cleaned before leaving the site			
Construction work				
Disruption to other users of Water	• While working across or close to any perennial water bodies, the Contractor shall not obstruct/ prevent the flow of water. • Construction over and close to the non-perennial streams shall be undertaken in the dry season and if such activity is likely to disrupt, constrain or impact the community use of the water body, adequate prior information (at least two weeks in advance) shall be provided to such community. Such water bodies may be limited to ponds, water harvesting structures (WHS), feeder channels to the pond, irrigation sources, etc. • If the supply of water or access to a source is being completely cut off, then the Contractor shall make necessary arrangements to provide water in the interim period. A water quality test shall be done before providing/supplying water. • Wherever excavation results in diversion of water flow shall be required as per the engineering designs, the Contractor shall ensure that such diversion channels have no stepper slopes than 1:2 (V to H). Proper slope protection measures have to be taken as approved by the Engineer - Incharge of Supervision Consultant and TNRSP/PIU. • The Contractor shall take prior approval from PWD –Water Resource Department, GoTN and Supervision Consultant for any such activity. The PIU/TNRSP shall ensure that Contractor has served the notice to the downstream users of water well in advance where such diversion of the flow is likely to affect the downstream population subject to the condition that under no circumstances the downstream flow shall be stopped putting the wildlife, the aquatic fauna, and the shoreline settlement under distress.	Water withdrawal locations	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Drainage and Flood Control	• The Contractor shall ensure that any construction materials like earth, stone, ash or appendage is disposed of such that it does not block the flow of water of any watercourse and cross drainage channels. • Where necessary adequate mechanical devices to bailout accumulated water from construction sites, campsites, storage yard, excavation areas	Surface water sources/ drains/ Nalahs/ Ponds etc	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	are to be pre-settled and arranged well in advance of the rainy season besides providing temporary cross drainage systems. Areas with accumulated water shall be securely fenced and guarded. • The Contractor shall take all adequate precautions to ensure that construction materials and excavated materials are enclosed in such a manner that erosion or run-off of sediments is controlled. Silt fencing shall be installed before the onset of the monsoon at all the required locations, as directed by Engineer - Incharge of Supervision Consultant and PIU/TNRSP. • The Contractor shall also ensure that no material blocks the natural flow of water in any watercourse or cross drainage channel. Before monsoon, the Contractor shall provide either permanent or temporary drains to prevent water accumulation or flooding in surrounding residential, commercial and agricultural areas.			
Siltation of Water Bodies and Degradation of Water Quality	• The contractor shall construct silt fencing at the base of the embankment construction near all water bodies (including wells) and around the stockpiles at the construction sites. • Silt fencing shall be provided before the commencement of earthwork and shall continue till the stabilization of the embankment slopes is complete on the particular sub-section of the road. • The Contractor shall 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.	Surface water sources/ drains/ Nalahs/ Ponds etc.	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Slope Protection and Control of Soil Erosion	• The Contractor shall construct slope protection works as per design, or as directed by the Engineer - Incharge of Supervision Consultant to control soil erosion and sedimentation through use of dykes, sedimentation chambers, basins, fiber mats, mulches, grasses, slope drains and other devices as required under specific local conditions. • Contractor shall ensure the following: o After construction of road embankments and cuttings, the side slopes of all cut and fill areas shall be graded and covered with stone pitching, grass and shrub as per design specifications. o Turfing works shall be taken up as soon as possible provided the season is favourable for the establishment of grass sods.	High raise embankment and surface water bodies locations	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	○ Catchment drains shall be installed at the top of cut and fill slopes ○ Other measures of slope stabilization shall include mulching netting and seeding of batters and drain immediately on completion of earthworks with the sowing of seeds of grass, shrub and bushes 30cm interval from line to line across the slope and sprinkling of water on such slopes after completion of the earthwork. ○ In borrow pits, the depth shall be regulated so that the sides of the excavation shall not be steeper than 1 vertical to 2 horizontal, from the edge of the bank. ○ Stabilization of embankments and cuttings with appropriate technique/s shall commence soon after the embankment formation, to be in place in advance of the rainy season.			
Pollution Control				
Water Pollution				
Water Pollution from Fuel, Lubricants, Bituminous Products and Chemicals	• The Contractor shall take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system. The contractor shall avoid construction works close to the streams or water bodies during monsoon. • All waste arising from the project is to be disposed of in the manner that is acceptable to the Tamil Nadu State Pollution Control Board (TNPCB) or as directed by Engineer – Incharge of Supervision Consultant. The Engineer – Incharge shall certify that all liquid wastes disposed of from the sites meet the discharge standards.	Surface water sources/ drains/ Nalahs/ Ponds etc.	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Water Pollution from Fuel, Lubricants, and Chemicals	• The contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refuelling shall be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors shall be provided for vehicle parking, wash down and refuelling areas as per the design provided. • In all, fuel storage and refueling areas are located on agricultural land or areas supporting vegetation, the topsoil shall be stripped, stockpiled and returned after cessation of such storage. • The contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites approved by the Engineer – Incharge. All spills and collected petroleum products shall be disposed of following MoEF&CC and TNPCB guidelines.	Surface water sources/ drains/ Nalahs/ Ponds etc.	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• Engineer – Incharge shall certify that all arrangements comply with the guidelines of TNPCB/ MoEF&CC.			
Air Pollution				
Dust Pollution	• The Contractor shall take every precaution to reduce the level of dust (PM_{10} and $PM_{2.5}$) from crushers, material storage yards, haul roads and construction sites (including earthwork, dismantling, scarification and material mixing sites) by sprinkling of water, mist spray, encapsulation of dust source and erection of screen /barriers. • Hot mix plant and batch mix plant shall be fitted with dust extraction units and mist spray to keep down the dust emission levels. The PM_{10} value at a distance of 40m from a unit located in such a cluster should be less than 500 $\mu g/m^3$. • The Contractor shall provide necessary certificates to confirm that all crushers used in the project conform to relevant dust emission control legislation. Air pollution monitoring shall be conducted as per the Environmental Monitoring Plan (EMoP) and results shall be used to strengthen/rectify problematic areas. If other existing crushers are used, such units need to have a valid license from the TNPCB.	Construction area/ site, Construction camps, Materials Loading/ unloading facilities	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Emission from Construction Vehicles, Equipment and Machineries	• The contractor shall ensure that all vehicles, equipment, and machinery used for construction are regularly maintained and conform to the emission standards specified by the TNPCB. Certification issued for such contrivances obtained from designated/approved authority shall be submitted along with the specified reporting format. • The contractor shall maintain a separate file and submit Pollution under Control (PUC) certificates for all vehicles/equipment/machinery used for the project. Monitoring results shall also be submitted to Supervision Consultant and PIU/TNRSP as per the Environmental Monitoring Plan in the specified format.	Construction camps, Materials Loading/ unloading facilities	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Noise Pollution				
Noise Pollution: Noise from Vehicles, Plants and Equipment's	The Contractor shall confirm the following: • All plants and equipment used in construction shall strictly conform to the MoEF&CC/ TNPCB noise standards. • All vehicles and equipment used in construction shall be fitted with exhaust silencers.	Sensitive locations including Schools, Hospitals, and Temples	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• Servicing of all construction vehicles and machinery shall be done regularly and during routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found defective shall `be replaced. • Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one-meter distance 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 and up to the satisfaction of the Engineer to keep noise levels at the minimum. • Idling of temporary trucks or other equipment shall not be permitted during periods of unloading or when they are not in active use. (MoRTH - Section: 201.2) • At the construction sites within 150m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching shall `be stopped during the night time between 9.00 pm to 6.00 am. • No noisy construction activities shall be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors. • The contractor shall provide noise barriers to the suggested locations of select schools/ Temples/health centers. • Monitoring shall be carried out at the construction sites as per the monitoring schedule and results shall be submitted to Engineer-Incharge of Supervision Consultant. The engineer shall be required to inspect regularly to ensure the compliance of ESMP. (Refer MoRTH - Section 111.3)			
Safety				
Personal Safety Measures for Labour, Material handling, Painting, etc.	• The contractor shall continually monitor that the implementation of health and safety complies with measures set out in the contract. Risk assessments for ongoing and new activities shall be carried out at regular intervals. • All personnel working on the site shall receive induction training in health and safety, and regular safety training related to their tasks.	Construction sites	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• The contractor shall provide all necessary safety appliances such as safety goggles high visibility vests, helmets, gloves, safety belts, earplugs, masks, boots, etc. to workers and staff. • Protective footwear, gloves and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete, etc. • Welder's protective eye-shields and gloves to workers engaged in welding works • Protective goggles and clothing to workers engaged in stone breaking activities and workers shall be seated at sufficiently safe intervals • Earplugs to workers exposed to loud noise (above 75dB (A)), and workers working in crushing compaction, or concrete mixing operation. • Adequate safety measures for workers during the handling of materials at the site are taken up. • The Contractor shall comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. • The Contractor shall not employ any person below the age of 14 years for any work and no woman shall be employed for the work of painting with products containing lead in any form. • The Contractor shall also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. • The contractor shall provide facemasks to the workers when the paint is applied in the form of a spray or a surface having dry lead paint is rubbed and scrapped. • The Contractor shall mark ‘hard hat’ and ‘no smoking’ and other ‘high risk’ areas and enforce non-compliance of use of PPE with zero tolerance. These shall be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and shall be approved by Engineer.			
Traffic and Safety & Pedestrian Safety	• The Contractor shall take all necessary measures for the safety of traffic during construction and shall provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the Engineer - Incharge for the information and protection of traffic	All along the project corridor and all haul roads	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	approaching or passing through the section of any existing crossroads. • The Contractor shall ensure that all signs, barricades, pavement markings are provided as per the MoRTH specifications. • Pedestrian Safety shall be ensured. Pedestrian circulation shall be demarcated before start & unsafe areas shall be cordoned off			
The risk from Electrical Equipment(s)	The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that - • No material shall be so stacked or placed as to cause danger or inconvenience to any person or the public. • All necessary fencing and lights shall be provided to protect the public in construction zones. • All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, shall be free from patent defect, shall be kept in good working order, shall be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer - Incharge. • Precautionary measures shall be taken when working close to the underground or overhead cables	All construction equipment	Contractor	Environmental Officer of CSC and PIU (TNRSP)
First Aid	The contractor shall 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 an injured or sick person(s) to the nearest hospital • Equipment and trained nursing staff at the construction camp.	All construction equipment	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Cultural Property				
Chance Found Archaeological Property	• All fossils, coins, articles of the value of antiquity, structures, and other remains or things of geological or archaeological interest discovered on the site are the property of the Government and shall be dealt with as per provisions of the relevant legislation. • The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He shall, immediately upon discovery thereof and before removal	Along the project road.	Contractor	Environmental Officer of CSC, , State Archaeological Department and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	acquaint the Engineer-Incharge of such discovery and carry out the Supervision Consultant instructions for dealing with the same, waiting which all work shall be stopped. • The Engineer shall seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.			
Labour Camp Management				
Location of Construction labor camps: Accommodation	• The Contractor shall provide, if required, erect and maintain necessary (temporary) living accommodation and ancillary facilities during the progress of work for labor to standards and scales approved by the Engineer- Incharge. • The contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building & other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction & maintenance of labor camp. • Construction camps shall not be proposed within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. The location, layout and basic facility provision of each labor camp shall be submitted to Engineer before their construction. Lighting shall be provided in the camp area and facilities • The construction shall commence only upon the written approval of the Engineer - Incharge.	Along the project corridor at the location of construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Potable Water	• The Contractor shall construct and maintain all labor accommodation in such a fashion that uncontaminated water is available for drinking, cooking, and washing. 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 shall also guarantee the following: o 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. o If any water storage tank is provided that shall be kept such that the bottom of the tank is at least 1m from the surrounding ground level. o If water is drawn from any existing well, which is within 30mt. the proximity of any toilet, drain or other sources of pollution, the well	Construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	shall be disinfected before water is used for drinking. o All such wells shall be entirely covered and provided with a trap door, which will be dustproof and waterproof. o A reliable pump shall be fitted to each covered well. The trap door shall be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. o Testing of water shall be done every month as per the parameters prescribed in IS 10500:1991. • Compliance with ESMP shall be reported to Engineer - Incharge every week. Engineer - Incharge shall inspect the labor camp periodically, to ensure compliance of the ESMP.			
Sanitation and Sewage System	The Contractor shall ensure that - • The sewage system for the camp are designed, built and operated in such a fashion that no health hazards occur and no pollution to the air, groundwater or adjacent watercourses 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 the dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition • Night soil is to be disposed of by putting a layer of it at the bottom of a permanent tank prepared for the purpose and covered with 15 cm. layer of waste or refuse and then covered with a layer of earth for a fortnight. • Adequate health care is to be provided for the workforce during the entire phase.	Construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Waste Disposal	The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed of hygienically as per the Comprehensive Solid Waste Management Plan approved by the Engineer - Incharge. Unless otherwise arranged by ULB's, the Contractor has to make arrangements for disposal of night soils (human excreta) either by suitably approved by the local medical health or municipal authorities or as directed by Engineer - Incharge as provided by the Contractor.	Construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Stock-yards	• Location for stockyards for construction materials shall be identified at	Construction	Contractor	Environmental

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	least 1000 m from the watercourse and separated and sufficiently away from the labor camps. • Separate enclosures shall be planned for storing construction materials containing fine particles such that sediment-laden water does not drain into nearby storm water drain & underground sewerage pipes.	labor camps		Officer of CSC and PIU (TNRSP)
Fuel storage and refueling areas	• The Contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance, and refueling sites are located at least 500 m from rivers and irrigation canal/ponds • All location and lay-out plans of such sites shall be submitted by the Contractor before their establishment and shall be approved by the Engineer. • In all fuel storage and refueling areas, if located on agriculture land or areas supporting vegetation, the topsoil shall be stripped, stockpiled and returned after completion of such storage and refueling activities. Fuel storage shall be provided with bunds. • The plan for the construction campsite shall also include the process of collection and disposal of spent oil and grease. The collection and disposal methods for the spent oil and grease submitted as part of the construction camp plan should be duly approved by the Engineer - Incharge.	Construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Contractor Demobilization				
Clearing of Construction of Camps & Restoration	• Contractor to prepare site restoration plans for approval by the Engineer. The plan has to be implemented by the contractor before demobilization. • On completion of the works, all temporary structures shall be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer. • Residual topsoil shall be distributed on adjoining/proximate barren/rocky areas as identified by the Engineer in a layer of a thickness of 75mm - 150mm.	All Construction Workers' Camps	Contractor and Environment Officer of CSC	PIU (TNRSP)
Redevelopment of Borrow Areas	Redevelopment of borrow areas shall be taken up following the plans approved by the Engineer.	At all borrow area locations suggested for the project.	Contractor and Environment Officer of	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
			CSC	
Environmental Enhancement and Special Issues				
Enhancement measures	• Enhancement of all incidental spaces shall be planned and carried out before completion of construction, along the project road. Some of the enhancement measures to be considered along the project roads include avenue tree plantation, restoration of water bodies, providing public amenities, planting of shrubs in medians, rainwater harvesting, adequate storm water drainage, Landscaping at junctions to improve aesthetics, etc.	At suitable locations along the project road	Contractor and Environment Officer of CSC	PIU (TNRSP)
Roadside Plantation Strategy, Tree Planting & Protection	• The Contractor/identified agency (were specifically identified) shall do the plantation at the median and/or turfing at embankment slopes as per the tree plantation strategy prepared for the project. The Contractor/ identified agency shall plant Indigenous plant varieties to the extent possible, guidance from the forest department shall be taken for the same. • Minimum 80 percent survival rate of the saplings shall be acceptable otherwise the Contractor shall replace dead plants at his own cost. The Contractor shall maintain the plantation until they handover the project site to TNRSP. • Giving due protection to the trees that fall in the shoulders /corridor of impact/ trees planted outside clear zone shall be the prime focus during Construction/post-construction. • Re-plantation of at least ten times the number of trees (1:10) cut should be carried out along the project road. Since the major portion of the project road may pass through open lands, planting of trees along the entire stretch of the road is recommended as an enhancement measure, which would also serve as a mechanism to delineate ROW and prevent future encroachments/squatters into the right of way, wherever possible. • Growth and survival of trees planted shall be ensured and monitoring is done at least for 3 years. Survival status shall be reported every month to Engineer - Incharge. • The Engineer - Incharge shall identify the area available within the premises of Government buildings and cultural properties along the road and get their consent. The Engineer - Incharge shall take the help of Forest Department to identify additional area for planation.	All tree plantation/ greenery areas of the project	Contractor / Forest Department and Environment Officer of CSC	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• The Engineer - Incharge shall inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.			
Transplantation	All trees up to 30 cm girth at breast height and naturally occurring medicinal shrubs within the RoW shall be uprooted mechanically with ball of earth intact for relocation and transplantation at various pre-identified locations such as degraded sites, embankments of road-side water bodies, temples, near-by market places, religious properties, schools and along road corridors for preventing loss of diverse vegetative cover and for reducing growth period.	Along the project road	Contractor and Environment Officer of CSC	PIU (TNRSP)
Flora and Chance found Fauna	• The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. • If any wild animal is found near the construction site at any point in time, the Contractor shall immediately upon discovery thereof acquaint the Engineer - Incharge and execute the Engineer's instructions for dealing with the same. • The Engineer-Incharge shall report to the nearby forest office (range office or divisional office) and shall take appropriate steps/ measures if required in consultation with the forest officials.	Along the project road	Contractor / Forest Department and Environment Officer of CSC	PIU (TNRSP)
Sensitive Areas	• The sensitive areas like schools, hospitals are provided with permanent noise barriers before the start of work to minimize the dust and noise impacts due to vehicle movement (during / post-construction). Their effectiveness to be checked during the operation phase. • Construction activities shall be confined within the present available RoW, regularly strict monitoring/supervision should be done to minimize/control air-noise pollution and abatement of dust particles at the minimum level possible using well maintain modern machineries. Crushers, Hot-mix Plants and Batching Plants should be placed at least 10km aerial distance away from the sanctuary boundary.	Concerned locations	Contractor / Forest Department and Environment Officer of CSC	PIU (TNRSP)
OPERATION STAGE (Activities to be Carried Out by the Contractor (till the DLP) and then TNRSP /Forest Department, GoTN)				
Monitoring and Evaluation of Environmental	• The PIU/ TNRSP shall monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project.	All along the project corridor	Contractor (DLP) and PIU	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
Mitigation Measures provided in the Project				
Maintenance of Drainage	• PIU/ TNRSP shall ensure that all drains (side drains and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding without damaging the land, properties, spurs and check dams erected to stabilize the course and flow of all such drainage channels. • PIU/ TNRSP shall ensure that all the sediment/oil and grease traps set up at the truck and bus lay bye are cleared once in every three months.	All along the project corridor	Contractor (DLP) and PIU	PIU (TNRSP)
Pollution Monitoring	• The frequency of monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination are to be continued at pre-designated locations as identified in the Environmental Monitoring Plan and if necessary, at additional locations for comparative study of pre and post-operation data to ensure further improvement/modification in similar future works. • PIU/TNRSP shall appoint a specific pollution monitoring agency for this purpose.	All along the project corridor	Contractor (DLP) and PIU	PIU (TNRSP)
Atmospheric Pollution	• Ambient air concentrations of various pollutants shall be monitored as envisaged in the Environmental Monitoring Plan at pre-designated locations to compare the levels with the pre-construction data. • Additional data at other locations may be collected as per any site-specific requirement.	All along the project corridor	Contractor (DLP) and PIU	PIU (TNRSP)
Noise Pollution	• Noise pollution shall be monitored as per the Environmental Monitoring Plan at sensitive locations where pre-construction noise data was collected. The functioning of the noise barriers has to be specifically supervised and monitored for further improvement/replication at other affected points if necessary. • Signage indicating 'no horn zones' near sensitive locations shall be maintained and kept clean. Monitoring the effectiveness of the pollution attenuation barriers shall be taken up thrice in the operation period.	All along the project corridor	Contractor (DLP) and PIU	PIU (TNRSP)
Soil Erosion and Monitoring of Borrow Areas	• Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankments and other places expected to	Borrow areas	Contractor (DLP) and PIU	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	be affected, shall be carried out before monsoon, during monsoon, and after winter rains to record and monitor the effectiveness of such structures after the completion of project, to evaluate the beneficial effects of each type of activity together with the cost involved.			
Avenue Trees	• The PIU/TNRSP with the assistance from Forest Department, GoTN shall do survival monitoring of avenue trees for every quarter.	All along the project corridor	PIU and Forest Department	PIU (TNRSP)
Road Safety and Maintenance of Assets	• Monitor data on any road traffic accidents, and identify and implement any remedial measures that may be necessary. • No advertisement/hoardings shall be allowed within the Right of Way limits of the project road. • Regular maintenance and cleaning of assets such as signboards, bus stops, drains, etc. shall be undertaken.	All along the project corridor	Contractor (DLP) and PIU	PIU (TNRSP)

10 IMPLEMENTATION ARRANGEMENT FOR ESMP

The Project Director (PD), TNRSP will head the overall safeguard implementation. A Project Implementation Unit (PIU) shall have an Environmental cell. The PIU shall be supported/ assisted by a Construction Supervision Consultant (CSC) to ensure good construction practices and the implementation of the safeguard provisions. The roles and responsibilities are as follows

The Environmental Cell comprises of a Superintending Engineer (SE), an Assistant Divisional Engineer (ADE), and Assistant Engineers (for HO and field works). The Additional Divisional Engineer and the Assistant Engineers will have full responsibility for ensuring EMP implementation. One Environment Specialist, deputed from Pollution Control Board has been inducted to provide support to the Environmental Cell. The forest wing comprises one Assistant Conservator of Forest, Rangers, and field staffs. The forest officials will supervise and coordinate compensatory plantation and Forest related issues which has been built into the construction contracts for each corridor under the project. At present one Assistant Conservator of Forests has been posted in the Forest Wing.

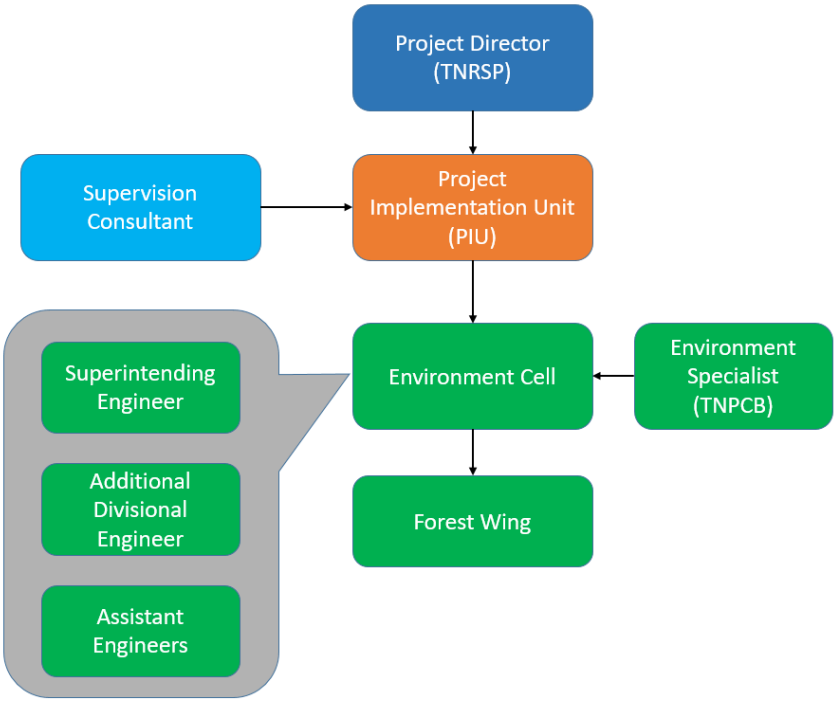


Figure 18: Implementation Arrangement for TNRSP - II

10.1 Implementation of ESMP

The ESMP given in the bid document will be implemented by the Contractor (Environmental and Safety Engineer), he will make sure that all the project related clearance including the NoC/ Permissions from the competent authority is obtained before the start of the construction works. He will be responsible for conducting the environmental monitoring (as per the environmental monitoring plan) and the preparation and submission of the monthly EMP report to the Construction Supervision Consultant (CSC). The CSC (Environmental Officer) will verify the project related clearances (including the NoC/ permissions) and he will review the environmental monitoring outcomes, as well as the monthly EMP reports and guide/ advise the contractor in implementing the EMP. The CSC (Environmental Officer) will submit the revised monthly

EMP report to the PIU. The Environmental cell in the PIU will review the monthly EMP reports and it will be consolidated every quarter and shared with the World Bank for review and disclosure.

11 GRIEVANCE REDRESSAL COMMITTEE (GRC)

A well-functioning GRC system is in place in TNRSP -II, which has been modified over the years of implementation and it is capable to handle the grievances of PAPs effectively. The PAP (Project affected People)/ Displace people, with the assistance from the Implementation Consultants (NGO's) shall submit the grievance to the first level of the GRC headed by the Retired District Revenue Officer (DRO), the submitted grievance shall be scrutinised (based on the facts and figures) and if found inappropriate upon further investigation, the grievance shall be rejected and it will be communicated to the complainant. If the grievance is accepted, it shall be redressed in 3 weeks and a written communication shall be sent to the complainant. A compliance register shall be maintained at divisional level with details of the complaint lodged, date of personal hearing, action taken and date of communication sent to the complainant.

If the complainant is still not satisfied with the outcome from the first level, he/she can approach the Project Director, TNRSP, on acceptance of the grievance it shall be redressed in 3 weeks and a written communication shall be sent to the complainant. If the complainant is still not satisfied with the outcome from the second level, he/she can approach the jurisdictional LARR Authority. The complainant can access the appropriate LARR Authority at any time and not necessarily go through GRC.

As per the experience from the TNRSP-II, the GRC committee has been functioning extremely well and there are no cases that have reached the jurisdictional LARR Authority. However, based on the consultations had with the committee members, the information dissemination on the GRC setup and its roles and responsibilities are not known to many of them in the project area. Hence, it is suggested to increase the role/ activity of the Implementing Consultants (NGO's) to reach the project areas and to explain about the GRC mechanism. It shall be done during the public consultations, organising workshops and by circulating the project information pamphlets/ leaflets.

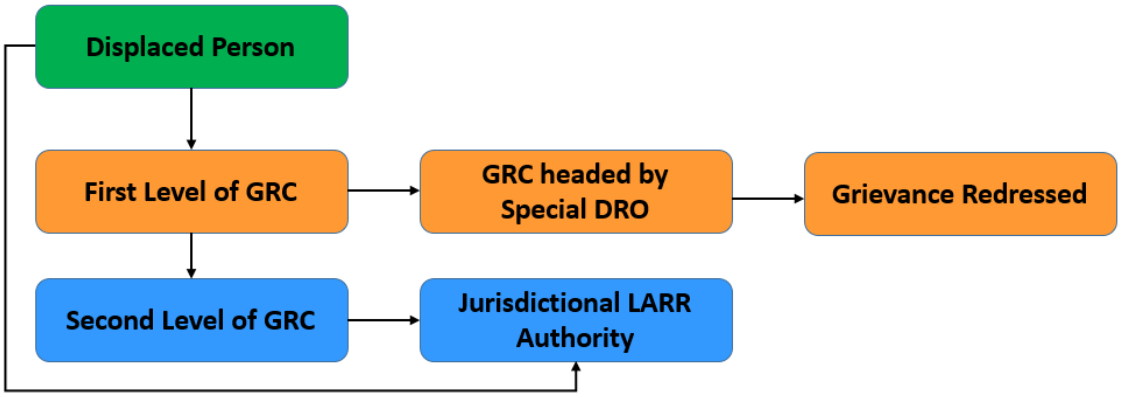


Figure 19: Grievance Redressal Committee for TNRSP - II

12 ENVIRONMENTAL MONITORING PLAN

To ensure the effective implementation of the ESMP, it is essential that an effective monitoring program has to be designed and carried out. For this Phase-1 Corridors, the monitoring plan is based on the following objectives:

- To evaluate the performance of mitigation measures proposed in the ESMP
- To suggest improvements in the management plans, if required
- To satisfy the statutory and community obligations

The monitoring programme contains monitoring plan for all performance indicators and reporting formats, which is presented in the following sections.

12.1 Performance Indicators

The performance indicators are based on the physical, biological and environmental management components identified as of particular significance in affecting the environment at critical locations. The Performance Indicators are evaluated under three heads as:

A. ***Environmental condition*** indicators to determine the efficacy of environmental management measures in control of air, noise, water and soil pollution;
B. ***Environmental management*** indicators to determine compliance with the suggested environmental management measures
C. ***Operational performance*** indicators have also been devised to determine the efficacy and utility of the mitigation/enhancement designs proposed

The performance Indicators and monitoring plans prepared for project Implementation are presented in the following table.

Table 55: Performance Indicators for Project Implementation

Sl. No.	Indicator	Details	Stage	Responsibility
A	**Environmental Condition Indicators and Monitoring Plan**			
1	Air Quality	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared **(Refer Table 59)**	Pre-Construction	Contractor through approved monitoring agency
			Construction	
			Operation	PIU through approved monitoring agency
2	Noise Levels		Pre-Construction	Contractor through approved monitoring agency
			Construction	
			Operation	PIU through approved monitoring agency
3	Water Quality		Pre-Construction	Contractor through approved monitoring agency
			Construction	
			Operation	PIU through approved monitoring agency
4	Soil Quality		Construction	Contractor through approved monitoring agency
			Operation	PIU through approved monitoring agency
B	**Environmental Management Indicators and Monitoring Plan**			
1	Construction	Location of	Pre-	Contractor and CSC

Sl. No.	Indicator	Details	Stage	Responsibility
	Camps	construction camps have to be identified and parameters indicative of environment in the area has to be reported	construction	
2	Borrow Areas	Location of borrow areas have to be identified and parameters indicative of environment in the area has to be reported.	Pre-construction	Contractor and CSC
3	Tree Cutting	Progress of tree removal marked for cutting is to be reported	Pre-construction	Revenue Department and Contractor (under the supervision of CSC)
4	Tree Plantation	Progress of measures suggested as part of the Strategy is to be reported	Construction	Forest Wing (Assisted by supervision of CSC)
C	**Management & Operational Performance Indicators**			
1	Survival Rate of Trees	The number of trees surviving during each visit will be compared with the number of saplings planted	Operation	Contractor (till the DLP) and then PIU will be responsible
2	Status Regarding Rehabilitation of Borrow Areas	The Contractor and PIU will undertake site visits to determine how many borrow areas have been rehabilitated in line with the landowner's request and to their full satisfaction.	Operation	Contractor (till the DLP) and then PIU will be responsible.
3	Soil Erosion	Visual monitoring and operation inspection of embankments will be carried out once in three months.	Operation	Contractor (till the DLP) and then PIU will be responsible

12.2 Monitoring Parameters and Standards

The environmental monitoring of the parameters involved and the threshold limits specified are discussed below:

12.2.1 Ambient Air Quality Monitoring (AAQM)

The air quality parameters namely Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_X), Carbon Monoxide (CO), Hydro-Carbons (HC), Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Ammonia (NH_3), Ozone (O_3), Lead (Pb), Benzo (a) pyrene (BaP), Arsenic (As) and Nickel (Ni) shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in **Table 56**.

Table 56: National Ambient Air Quality Standards

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide (SO_2), µg/m^3	Annual* 24 hours**	50 80	20 80	-Improved West and Gaeke -Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), µg/m^3	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochhieser (Na-Arsenite) -Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM_{10} µg/m^3	Annual* 24 hours**	60 100	60 100	-Gravemetric -TOEM -Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM_{25}µg/m^3	Annual* 24 hours**	40 60	40 60	-Gravemetric -TOEM -Beta attenuation
5	Ozone (o_2) µg/m^3	8 hours* 1 hours**	100 180	100 180	-UV photometric -Chemiluminescence -Chemical Method
6	Lead (Pb) µg/m^3	Annual* 24 hours**	0.50 1.0	0.50 1.0	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper -ED-XRF using Tefloa filter
7	Carbon Monoxide (CO) µg/m^3	8 hours* 1 hours**	02 04	02 04	-Non Dispersive Infra-Red (NDIR)spectroscopy
8	Ammonia (NH_3) µg/m^3	Annual* 24 hours**	100 400	100 400	-Chemiluminescence -Indophenol blue method
9	Benzene (C_6H_6) µg/m^3	Annual*	05	05	-Gas chromatography based continuous analyser -Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) particulate phase only, µg/m^3	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As) µg/m^3	Annual*	06	06	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper
12	Nickel (Ni) µg/m^3	Annual*	20	20	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper

**Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals*
***24 hourly or (8 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.*

12.2.2 Noise Quality Monitoring

The noise levels shall be monitored at identified locations in accordance with the Ambient Noise Quality standards given in **Table 57**.

Table 57: National Ambient Noise Quality Standards

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

** Daytime shall mean from 6.00am to 10.00 pm and Night shall mean from 10.00 pm to 6.00 am*
*** Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicles horns, loud speakers and bursting of cracking are banned in these zones.*

12.2.3 Water Quality Monitoring

Water quality parameters such as pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications, presented in **Table 58**.

Table 58: National Standard of Water

Sl. No	Parameters	IS:2296 (Class C)	Method Adopted
1	pH	6.5-8.5	pH meter
2	BOD (3 days 27ºC)	3.0	DO-Azide modification of Wrinkler's method
3	Temperature (ºC)	NS	Thermometer
4	Dissolved oxygen	4	Azide Modification of Wrinkler's method
5	Color (Hazen)	300	Visual Comparison method
6	Fluorides (F)	1.5	SPANDS method
7	Chlorides (Cl)	600	Argentometric Titration
8	Total Dissolved Solids	1500	Gravimetric Analysis
9	Sulphates (SO_4)	400	Barium Chloride method
10	Iron (Fe)	50	Phenanthrolin method
11	Oil and Grease	0.1	Partition – Gravimetric method
12	Nitrates	50	Chromotropic acid
13	Chromium (Cr^{6+})	0.05	Atomic Absorption Spectrophotometry
14	Cadmium (Cd)	0.01	Atomic Absorption Spectrophotometry
15	Lead (Pb)	0.1	Atomic Absorption Spectrophotometry
16	Copper (Cu)	1.5	Atomic Absorption Spectrophotometry
17	Cyanide (CN)	0.05	Chloramine-T-method
18	Selenium (Se)	0.05	Atomic Absorption Spectrophotometry
19	Arsenic (As)	0.2	Atomic Absorption Spectrophotometry
20	Phenols	0.005	Spectrophotometer
21	Detergents	1.0	Spectrophotometer
22	DDT	Absent	Spectrophotometer
23	Total Coliform (MPN/100 ml)	5000	Multiple Tube Fermentation Technique

NS: Not specified; Brackets ([ ]) indicates extended limits. All the values in mg/l if otherwise mentioned

12.2.4 Monitoring Plans for Environment Condition

For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction and operation stages is presented in **Table 59**. Monitoring plan does not include the requirement of arising out of regulation provision such as obtaining NOC/ consent for plant site operation.

Table 59: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	Construction	SO_2, NO_x, PM_{10}, $PM_{2.5}$, O_3,Pb, CO, NH_3, C_6H_6, BaP, As and Ni	High volume sampler to be located 50m from the plant in the Downwind direction. Use method specified by CPCB for analysis	Air (prevention and Control of Pollution) Rules, CPCB, 2009	Three seasons per year	24 hours Sampling	Along the project road, Hot mix / batching plant & crusher	Contractor under the supervision of CSC
	Operation				Two seasons in a year for three years		Along the project road	Contractor (till the DLP) and PIU
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the CSC and PIU	Grab sample collected from source and Analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982	Four seasons per year	Grab Sampling	Along the road Surface water sources	Contractor under the supervision of CSC
	Operation				Four seasons for three years			Contractor (till the DLP) and PIU
Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF Noise Rules, 2000	Three seasons per year	Leq in dB(A) of day time and night time	Along the project road, Hot mix / batching plant & crusher	Contractor under the supervision of CSC
	Operation				Three seasons per year for three years.		Along the project road	Contractor (till the DLP) and PIU
Soil	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption Spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until	Four seasons per year	Grab Sampling	Along the project road, Hot mix / batching plant	Contractor under the supervision of CSC

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
	Operation			national standards are promulgated	Four seasons for three years		Along the project road	Contractor (till the DLP) and PIU
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a month	-	Borrow area location	Contractor under the supervision of CSC
Tree plantation	Operation stage	As per Design			Quarterly	-	Areas where plantation is being done	Contractor (till the DLP) and then PIU will be responsible

12.3 Reporting System

Reporting system suggested for the Phase-1 Corridors operate at two levels as:

- Reporting for environmental condition indicators and environmental management indicators (except tree cutting indicator)
- Reporting for operational performance indicators at the PIU level

Contractor and Engineer - in charge operate the reporting system for environmental conditions and environmental management indicators (except tree cutting). The Environmental Management Cell of PIU will operate the reporting system for environmental management tree cutting indicators and operational performance indicators. The PIU will set the targets for each activity envisaged in the ESMP beforehand and all reports will be against these targets.

The Contractor will report to the Engineer - in-charge of the progress of the implementation of environmental conditions and management measures as per the ESMP. The Engineer- in-charge will in turn report to the PIU every quarter. Reporting formats have been prepared, which will form the basis of monitoring, by the Engineer- incharge and/or the Environmental Cell as required and presented as **Annexure 11.**

Table 60: Summary details of Reporting

Format No.	Item	Stage	Contractor	Environmental Cell	Supervision Consultant (CSC) / Concessionaire		Project Implementation Unit (PIU)
			Implementation & Reporting to SC	Implementation & Reporting to PIU	Supervision	Reporting to PIU	Oversee / Field Compliance Monitoring
EM1	Identification of Disposal Locations	Pre-Construction	One Time	-	One Time	One Time	One Time
EM2	Setting up of Construction Camp	Pre-Construction	One Time	-	One Time	One Time	One Time
EM3	Borrow Area Identification	Pre-Construction	One Time	-	One Time	One Time	One Time
EM4	Tree Cutting	Pre-Construction	-	Monthly	-	-	Quarterly
EM5	Tree Plantation	Construction	-	Monthly	-	-	Quarterly
EM6	Top Soil Monitoring	Construction	Quarterly		Continuous	Quarterly	Quarterly
EM7	Redevelopment of Borrow Areas	Operation	One Time		One Time	One Time	One Time
EM8	Checklist for Construction Safety	Construction	Quarterly		Continuous	Quarterly	Quarterly
EC1	Pollution Monitoring	Construction	As Per Monitoring Plan	-	Quarterly	Quarterly	Quarterly
EC2	Pollution Monitoring	Operation	-	-	-	-	As Per Monitoring Plan
OP1	Survival Rate of Trees	Operation	-	Quarterly	-	-	Quarterly
OP2	Status Regarding Rehabilitation of Borrow Areas	Operation	-	-	-	-	Half Yearly

12.4 Good Environmental Construction Guidelines

Comprehensive environmental construction guidelines have been prepared to guide the planning and implementing agency in preparing the project specific environmental code of conduct for contractor. The list of good environmental practices is as follows. All guidelines listed are presented as **Annexure 12** for reference and implementation into the Environmental Management Plans for the specific projects.

Table 61: Guideline for Good Environmental Practices

Guidelines	Activities
Guideline-1	Site Preparation
Guideline-2	Construction and Labour Camps
Guideline-3	Borrow Areas
Guideline-4	Topsoil Salvage, Storage and Replacement
Guideline-5	Quarry Management
Guideline-6	Water for Construction
Guideline-7	Slope Stability and Erosion Control
Guideline-8	Waste Management and Debris Disposal
Guideline-9	Water Bodies
Guideline-10	Drainage
Guideline-11	Construction Plants & Equipment Management
Guideline-12	Labour and Worker's Health and Safety
Guideline-13	Cultural Properties
Guideline-14	Tree Cutting and Afforestation
Guideline-15	Forests and Other Natural Habitats
Guideline-16	Air and Noise Pollution
Guideline-17	Environmental Monitoring

13 ESMP BUDGET

The ESMP budget has been estimated under 3 heads as follows.

- Environmental management measures to be abided by the Contractor under the civil cost. The management measures indicated in the civil cost includes rainwater harvesting structures, silt fencing, barricading, oil interceptors, enhancement of community and cultural properties, restoration of surface water bodies, safety measures (including road user safety and construction safety), etc.,
- Monitoring of environmental attributes during project construction activity and operation activity

Table 62: Environmental Management Budget for Omlur to Mecheri Road (SH 222) (Contract BOQ Bill no 6)

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
A. Construction Stage Cost						
6.1	**Mitigation / Enhancement Measures other than Good Engineering Practices**					
6.1.1	Readymade Oil and Grease interceptors at vehicle maintenance and hot mix plant areas in construction camp	Number	25000	2	50,000	
6.1.2	Artificial Groundwater Recharge Structures in roadside drains in rural areas at every 500 m alternatively on both sides	Number	0	13	0	Cost covered under Engineering Cost
6.1.3	Artificial Groundwater Recharge Structures in Ponds and lakes	Number	1760605	1	1760605	CSC shall get consent of the pond owner
6.1.4	Desilting/expansion of Ponds and Lakes	Number	200000	1	200000	CSC shall get consent of the pond owner
6.1.5	**Noise Barriers for Sensitive Noise Receptors**					
6.1.5.1	Government Primary Health Center at Existing km 3+300 LHS	Length	9172	50	458600	No Compound Wall. Noise Barrier proposed.
6.1.5.2	Government School in Panchayath Office Compound at Existing km 3+530 RHS	Length	9172	50	458600	No Compound Wall. Noise Barrier proposed.
6.1.5.3	Library (Govt. Building) at Existing km 3+525 RHS	Length	9172	10	91720	No Compound Wall. Noise Barrier proposed.
6.1.5.4	Govt, Government Veterinary Hospital at Existing km 3+760 RHS	Length	9172	0	0	Small one room building. Noise barrier not required
6.1.5.5	Government Middle School at Existing km 3+800 RHS	Length	9172	0	0	Compound Wall not affected. Plantation is recommended along the Compound Wall
6.1.5.6	Nalam Hospital at Existing km 4+200 RHS	Length	9172	0	0	Small clinic in one room of a building. Noise barrier not required
6.1.5.7	South India Matriculation High Sec. School at Existing km 4+620 LHS	Length	9172	0	0	Compound wall not affected. Noise Barrier not required
6.1.5.8	Sri Balamurugan College (Arts & Science) at Existing km 9+000 RHS	Length	9172	0	0	Compound wall not affected. Noise Barrier not required
	Sub Total				**3,019,525**	
6.2	**Compensatory Plantation (1:10 Ratio)**					

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
6.2.1	**Avenue Plantation**					
6.2.1.1	Plantation, fencing & maintenance of Saplings for 5 years	Number	1517	586	889,341	Trees shall be planted within available Existing RoW at 2 m interval. Remaining trees shall be planted within the premises of Government buildings and cultural properties along the road.
6.2.1.2	Tree Cutting Cost	Covered under Site Clearing cost (Engineering cost)				
6.2.2	**Plantation within the premises of Government buildings and cultural properties as part of Compensatory Plantation**					
6.2.2.1	Trees to be planted within the premises of Government buildings and cultural properties along the road	Number	1517	15,304	23,215,789	CSC shall identify the area available within the premises of Government buildings and cultural properties along the road and get their consent. CSC shall take the help of Forest Department to identify additional area for planation
	Sub Total				**24,105,130**	
6.3	**Transplantation of Small Trees**					
6.3.1	Transplantation of Govt. trees with girth size between 10 cm and 30 cm in Govt. land including transportation of tree and maintenance up to two months	Number	10800	0	0	Govt. trees with girth size between 10 cm and 30 cm only will be transplanted
6.4	**Landscaping**					
6.4.1	At 1 Major Junction	Covered under Engineering Cost				
6.5	**Monitoring of Environmental Attributes during Construction Phase**					
6.5.1	**Air Quality**					
6.5.1.1	Monitoring of Air Quality at Project facilities	Per Sample	2800	24	67200	Four location for three seasons in a year for 2 years
6.5.1.2	Monitoring of Air Quality at Critical Locations	Per Sample	2800	18	50400	Three locations for three seasons in a year for 2 years
6.5.2	**Noise Levels**					
6.5.2.1	Monitoring of Noise Level at Project Facilities	Per Sample	1200	24	28800	Four location for three seasons in a year for 2 years
6.5.2.2	Monitoring of Noise Levels at Critical Locations	Per Sample	1200	24	28800	Four locations for three seasons in a year for 2 years
6.5.3	**Water Quality**					
6.5.3.1	Monitoring of Water Quality at Critical Locations	Per Sample	5500	6	33000	One location for three seasons in a year for 2 years

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
6.5.4	**Soil Quality**					
6.5.4.1	Monitoring of Soil Quality at Critical Locations	Per Sample	4675	12	56100	Two locations for three seasons in a year for 2 years
6.5.4.2	Additional Soil Monitoring during Spills at Project Facilities	Per Sample	4675	12	56100	Two locations for three seasons in a year for 2 years
	Sub Total				**320,400**	
Total Cost During Construction Stage (A)					**27,445,055**	
B. Operation Stage Cost						
6.6	**Monitoring of Environmental Attributes during Operation Phase**					
6.6.1	Monitoring of Air Quality at Critical Locations	Per Sample	2800	12	33600	Two locations for three seasons in a year for 2 years
6.6.2	Monitoring of Noise Levels at Critical Locations	Per Sample	1200	24	28800	Four locations for three seasons in a year for 2 years
6.6.3	Monitoring of Water Quality at Critical Locations	Per Sample	5500	6	33000	One location for three seasons in a year for 2 years
6.6.4	Monitoring of Soil Quality at Critical Locations	Per Sample	4675	12	56100	Two locations for three season in a year for 2 years
Total Cost During Operation Stage (B)					**151,500**	
Grand Total (A+B)					**27,596,555**	

Table 63: Environmental Management Budget for Malliyakarai to Attur Road (SH 30) (Contract BOQ Bill no 6)

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
6.1	**Mitigation / Enhancement Measures other than Good Engineering practices**					
6.1.1	Readymade Oil and Grease interceptors at vehicle maintenance and hot mix plant areas in construction camp	Number	25000	2	50000	
6.1.2	Artificial Groundwater Recharge Structures in roadside drains in rural areas at every 500 m alternatively on both sides	Number	41000	14	0	Cost covered under Engineering Cost
6.1.3	Artificial Groundwater Recharge Structures in Ponds and lakes	Number	1760605	4	7042420	CSC shall get consent of the pond owner
6.1.4	Desilting/expansion of Ponds and Lakes	Number	200000	4	800000	CSC shall get consent of the pond owner
6.1.5	Provision of Toilet blocks at Bus Bays	Number	56423	11	0	Cost covered under Engineering Cost
6.1.6	Provision of Drinking Water Facility at Bus Shelters	Number	60000	18	0	Cost covered under Engineering Cost
6.1.5	**Noise Barriers for Sensitive Noise Receptors**					
6.1.5.1	Government Veterinary Hospital	Length	9172	0	0	Compound Wall not affected
6.1.5.2	Rasi Metric Higher Secondary School	Length	9172	0	0	Compound Wall not affected
6.1.5.3	Government School	Length	9172	0	0	Compound Wall not affected
6.1.5.4	First Aid Medical Center	Length	9172	0	0	Noise Barrier not required
	Sub Total				**78,92,420**	
6.2	**Compensatory Plantation (1:10 Ratio)**					
6.2.1	**Avenue Plantation**					
6.2.1.1	Plantation, fencing & maintenance of Saplings for 5 years	Number	1517	5,260	79,79,420	Trees shall be planted within available Existing RoW at 2 m interval. Remaining trees shall be planted within the premises of Government buildings and cultural properties along the road.
6.2.1.2	Tree Cutting Cost	Covered under Site Clearing cost (Engineering cost)				
6.2.2	**Plantation within the premises of Government buildings and cultural properties as part of Compensatory Plantation**					

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
6.2.2.1	Trees to be planted within the premises of Government buildings and cultural properties along the road	Number	1517	0	0	Avenue plantation is sufficient to meet the requirement of compensatory plantation
	Sub Total				**79,79,420**	
6.3	**Transplantation of Small Trees**					
6.3.1	Transplantation of Govt. trees with girth size beween 10 cm and 30 cm in Govt. land including transportation of tree and maintenance up to two months	Nos.	10800	12	129600	Govt. trees with girth size between 10 cm and 30 cm only will be transplanted
6.4	**Landscaping**					
6.4.1	At 1 Major Junction	Covered under Engineering Cost				
	Sub Total				**0**	
6.5	**Monitoring of Environmental Attributes during Construction Phase**					
6.5.1	**Air Quality**					
6.5.1.1	Monitoring of Air Quality at Project facilities	Per Samples	2800	24	67200	Four location for three season in a year for 2 years
6.5.1.2	Monitoring of Air Quality at Critical Locations	Per Samples	2800	12	33600	Two locations for three season in a year for 2 years
6.5.2	**Noise Levels**					
6.5.2.1	Monitoring of Noise Level at Project Facilities	Per Samples	1200	24	28800	Four location for three season in a year for 2 years
6.5.2.2	Monitoring of Noise Levels at Critical Locations	Per Samples	1200	18	21600	Three locations for three season in a year for 2 years
6.5.3	**Water Quality**					
6.5.3.1	Monitoring of Water Quality at Critical Locations	Per Samples	5500	6	33000	One location for three season in a year for 2 years
6.5.4	**Soil Quality**					
6.5.4.1	Monitoring of Soil Quality at Critical Locations	Per Samples	4675	12	56100	Two locations for three season in a year for 2 years
6.5.4.2	Additional Soil Monitoring during Spills at Project Facilities	Per Samples	4675	12	56100	Two locations for three season in a year for 2 years

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
	Sub Total				**296400**	
Total Cost During Construction Stage (A)					**1,62,97,840**	
6.6	**Monitoring of Environmental Attributes during Operation Phase**					
6.6.1	Monitoring of Air Quality at Critical Locations	Per Sample	2800	12	33600	Two locations for three season in a year for 2 years
6.6.2	Monitoring of Noise Levels at Critical Locations	Per Sample	1200	18	21600	Three locations for three season in a year for 2 years
6.6.3	Monitoring of Water Quality at Critical Locations	Per Sample	5500	6	33000	One location for three season in a year for 2 years
6.6.4	Monitoring of Soil Quality at Critical Locations	Per Sample	4675	12	56100	Two locations for three season in a year for 2 years
Total Cost During Operation Stage (B)					**1,44,300**	
Grand Total (A+B)					**1,64,42,140**	

Table 64: Environmental Management Budget for Chithode to Erode Road (SH 15) (Contract BOQ Bill no 6)

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
6.1	**Mitigation / Enhancement Measures other than Good Engineering practices**					
6.1.1	Readymade Oil and Grease interceptors at vehicle maintenance and hot mix plant areas in construction camp	Number	25000	2	50000	
6.1.2	Artificial Groundwater Recharge Structures in roadside drains in rural areas at every 500 m alternatively on both sides	Number	41000	7	0	Cost covered under Engineering Cost
6.1.3	Artificial Groundwater Recharge Structures in Ponds and lakes	Number	1760605	2	3521210	CSC shall get consent of the pond owner
6.1.4	Desilting/expansion of Ponds and Lakes	Number	200000	2	400000	CSC shall get consent of the pond owner
6.1.5	Provision of Toilet blocks at Bus Bays	Number	56423	8	0	Cost covered under Engineering Cost
6.1.6	Provision of Drinking Water Facility at Bus Shelters	Number	60000	22	0	Cost covered under Engineering Cost
6.1.5	**Noise Barriers for Sensitive Noise Receptors**					
6.1.5.1	Government Veterinary Hospital	Length (m)	9172	0	0	Compound wall not affected. No need to increase the wall height since it is a veterinary hospital. Tree plantation proposed as part of Compensatory Plantation.
6.1.5.2	Government ITI College	Length (m)	9172	40.5	371466	New Compound wall (Noise Barrier) is recommended in place of existing wire fencing. Tree plantation proposed as part of Compensatory Plantation.
6.1.5.3	SVN Matriculation Higher Secondary School	Length (m)	9172	0	0	Compound wall not affected. Distance to class room is 95 m. Hence, no need to increase the height of compound wall. Tree plantation proposed as part of Compensatory Plantation.
6.1.5.4	Erode Hindu Kalvi Nilayam School	Length (m)	9172	90	825480	Out of 130 m, 90 m of the Compound wall is affected. Hence, new compound wall (Noise Barrier) is proposed. Tree plantation proposed as

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
						part of Compensatory Plantation.
6.1.5.5	SR Hospital	Length (m)	9172	0	0	Compound wall not affected. Based on site conditions, increasing the height of existing compound wall is not required.
6.1.5.6	CN College	Length (m)	9172	0	0	Noise barrier is not required in place of existing wire fencing as college buildings are more than 100 m away from the road. Tree plantation proposed as part of Compensatory Plantation.
6.1.5.7	Sree Janani Nursery and Primary School	Length (m)	9172	9	82548	Compound wall is made of iron grill. Hence new compound wall (Noise barrier) is recommended.
6.1.5.8	Government Veterinary Hospital	Length (m)	9172	0	0	Compound wall not affected. No need to increase the wall height since it is a veterinary hospital. Tree plantation proposed as part of Compensatory Plantation.
6.1.5.9	Veerappan Chatram Elementary School and Govt. Girls Higher Secondary School	Length (m)	9172	0	0	Compound Wall is not affected. It has adequate height to mitigate the noise impacts. Hence no additional measures are proposed here.
	Sub Total				**52,50,704**	
6.2	**Compensatory Plantation (1:10 Ratio)**					
6.2.1	**Avenue Plantation**					
6.2.1.1	Plantation, fencing & maintenance of Saplings for 5 years	Number	1517	7,620	1,15,59,540	Trees shall be planted within available Existing RoW at 2 m interval. Remaining trees shall be planted within the premises of Government buildings and cultural properties along the road.
6.2.1.2	Tree Cutting Cost	Covered under Site Clearing cost (Engineering cost)				
6.2.2	**Plantation within the premises of Government buildings and cultural properties as part of Compensatory Plantation**					
6.2.2.1	Trees to be planted within the premises of Government buildings and cultural properties along the road	Number	1517	0	0	Avenue plantation is sufficient to meet the requirement of compensatory plantation
	Sub Total				**1,15,59,540**	
6.3	**Transplantation of Small Trees**					
6.3.1	Transplantation of Govt. trees with girth size beween 10 cm and 30 cm in	Nos.	10800	0	0	Govt. trees with girth size between 10 cm and 30

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
	Govt. land including transportation of tree and maintenance up to two months					cm only will be transplanted
6.4	**Landscaping**					
6.4.1	At 3 Major Junctions	Covered under Engineering Cost				
	Sub Total				**0**	
6.5	**Monitoring of Environmental Attributes during Construction Phase**					
6.5.1	**Air Quality**					
6.5.1.1	Monitoring of Air Quality at Project facilities	Per Samples	2800	24	67200	Four location for three season in a year for 2 years
6.5.1.2	Monitoring of Air Quality at Critical Locations	Per Samples	2800	12	33600	Two locations for three season in a year for 2 years
6.5.2	**Noise Levels**					
6.5.2.1	Monitoring of Noise Level at Project Facilities	Per Samples	1200	24	28800	Four location for three season in a year for 2 years
6.5.2.2	Monitoring of Noise Levels at Critical Locations	Per Samples	1200	24	28800	Four locations for three season in a year for 2 years
6.5.3	**Water Quality**					
6.5.3.1	Monitoring of Water Quality at Critical Locations	Per Samples	5500	12	66000	Two location for three season in a year for 2 years
6.5.4	**Soil Quality**					
6.5.4.1	Monitoring of Soil Quality at Critical Locations	Per Samples	4675	12	56100	Two locations for three season in a year for 2 years
6.5.4.2	Additional Soil Monitoring during Spills at Project Facilities	Per Samples	4675	12	56100	Two locations for three season in a year for 2 years
	Sub Total				**336600**	
Total Cost During Construction Stage (A)					**1,71,46,844**	
6.6	**Monitoring of Environmental Attributes during Operation Phase**					
6.6.1	Monitoring of Air Quality at Critical Locations	Per Sample	2800	12	33600	Two locations for three season in a year for 2 years
6.6.2	Monitoring of Noise Levels at Critical	Per	1200	24	28800	Four locations for three season in a year for 2 years

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
	Locations	Sample				
6.6.3	Monitoring of Water Quality at Critical Locations	Per Sample	5500	12	66000	Two location for three season in a year for 2 years
6.6.4	Monitoring of Soil Quality at Critical Locations	Per Sample	4675	12	56100	Two locations for three season in a year for 2 years
Total Cost During Operation Stage (B)					**1,84,500**	
Grand Total (A+B)					**1,73,31,344**	