

# Annexure

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## Annexure - 1

### Codes of Practice of Indian Road Congress (IRC) in terms of Environment

Sl. No.	IRC Code	Description
1	IRC:34-2011	Recommendations for Road Construction in Areas Affected by Water Logging, Flooding and/or Salts Infestation (First Revision)
2	IRC:56-2011	Recommended Practices for Treatment of Embankment and Roadside Slopes for Erosion Control (First Revision)
3	IRC:90-2010	Guidelines of Selection, Operation and Maintenance of Bituminous Hot Mix Plant (First Revision)
4	IRC:103-1988	Guidelines for Pedestrian Facilities
5	IRC:104-1988	Guidelines for Environmental Impact Assessment of Highway Projects
6	IRC:SP:21-2009	Guidelines on Landscaping and Tree Plantation
7	IRC: SP: 42 - 1994	Guidelines on Road Drainage
8	IRC: SP: 44 - 1996	Highway Safety Code
9	IRC: SP: 48 - 1998	Hill Road Manual
10	IRC: SP: 88 - 2010	Road Safety Audit Manual

### Legal and Institutional Requirements

#### 1. Key Environmental Laws and Regulations of Gol

The Indian constitution makes environmental protection an explicit duty for every citizen by the statement, “It shall be duty of every citizen of India to protect and improve the environment including forests, lakes, rivers, wild life, and to have compassion for living creatures”. In addition, Gol has laid out various policy guidelines, acts and regulations pertaining to sustenance of environment and these have been presented in the following sections.

##### 1.1. Environment (Protection) Act, 1986

The Environmental (Protection) Act, 1986 is the umbrella legislation providing for the protection of environment in the country. This Act provided for the Environment (Protection) Rules, which were formulated in 1986, the Environmental Impact Assessment Notification, 1994 and the Amendments thereto (up to July 2004), and various other notifications.

##### 1.2. EIA Notification, 2006

The EIA notification dated 14<sup>th</sup> September, 2006 imposes certain restrictions and prohibitions on new projects or activities, or on the expansion or modernization of existing projects or activities based on their potential environmental impacts as indicated in the schedule to the notification, being undertaken in any part of India, unless prior environmental clearance has been accorded by the Ministry of Environment, Forests and Climate Change (MoEF&CC) or the State or Union territory Level Environment Impact Assessment Authority (SEIAA).

Item No 7(f) of the EIA notification, 2006 specifies that Expansion of National Highways greater than 100 Km involving additional right of way or land acquisition greater than 40 m on existing alignments and 60 m on re-alignments or bypasses is categorized as “A” project and requires prior environmental clearance from MoEF&CC. Whereas, all new State Highway projects; and expansion of State Highways in hilly terrain (above 1,000 m above mean sea level) and or ecologically sensitive areas falls in Category ‘B’ project and requires prior environmental clearance from SEIAA.

The project road is not attracting the provisions of EIA Notification, 2006 since it is not a National Highway or a new State Highway. Even though this project involves expansion of existing State Highway, it is not falling in hilly terrain above 1000 m above mean sea level or eco sensitive areas. Hence, the project road do not require environmental clearance from SEIAA or MoEF&CC.

##### 1.3. The Water (Prevention & Control of Pollution) Act, 1974

This act provided for the prevention and control of water pollution and the maintaining and restoring of the wholesomeness of water. The Act resulted in the establishment of the Central and State level Pollution Control Boards whose responsibilities include managing water quality and effluent standards, as well as monitoring water quality, prosecuting offenders and issuing licenses for construction and operation of certain facilities.

The Contractor has to obtain consent to establish for construction camps from the Tamil Nadu Pollution Control Board as per the Water (Prevention and Control of Pollution) Act of 1974, since it involves discharge of waste water from construction camps.

#### **1.4. The Air (Prevention & Control of Pollution) Act, 1981**

This act provides for prevention, control and abatement of air pollution. 'Air Pollution' means the presence in the atmosphere of any 'air pollutant' which means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

The SPCB is empowered to implement air quality standards and monitor and prosecute offenders under The Air (Prevention and Control of Pollution) Act, 1981. The Contractor has to obtain consent to establish and consent to operate for construction camps from the Tamil Nadu Pollution Control Board as per the Air (Prevention and Control of Pollution) Act of 1981, since it involves operation of Hot Mix Plants and Diesel Generator Sets.

#### **1.5. Noise Pollution (Regulation and Control) Rules, 2000**

The ambient air quality standards in respect of noise for different areas/zones are specified in the Schedule of these rules. The State Government may categorize the areas into industrial, commercial, residential or silence areas/zones for the purpose of implementation of noise standards for different areas. As per these rules, an area comprising not less than 100 meters around hospitals, educational institutions and courts may be declared as silence area/zone.

The noise levels in any area/zone shall not exceed the ambient air quality standards in respect of noise as specified in the Schedule. The State Pollution Control Board is responsible for the enforcement of noise pollution control measures and the due compliance of the ambient air quality standards in respect of noise. The proposed project in its construction and operation phases may attract the provisions of these rules if the noise level from the construction machinery and the vehicles are above the standards.

#### **1.6. The Ancient Monuments and Archaeological Sites and Remains Act, 1958 and its Amendments**

According to this Act, area within the radii of 100m and from 100m to 300m from the "protected area" are designated as "prohibited area" and "regulated area" respectively. No development activity (including building, mining, excavating, blasting) is permitted in the "protected area" and development activities likely to damage the protected property are not permitted in the "regulated area" without prior permission of the Archaeological Survey of India (ASI) if the site/remains/ monuments are protected by ASI or the State Directorate of Archeology, if these are protected by the State. No Archaeologically protected monuments are present along the project road. Hence, provisions of the said act are not applicable for the project road.

#### **1.7. Fly Ash Notification, 2007**

The notification specifies the responsibility of highway agencies for use of fly ash for road construction, if any thermal power plant is located within 300 Km from it. Since, Mettur Thermal Power Plant is located within 300 Km from the proposed project corridor, provisions of the said notification is applicable for the project.

### **1.8. The Explosives Act (& Rules), 1884 (revised in 1983)**

This Act specifies regulations regarding the use of explosives and precautionary measures while blasting and quarrying. Provisions of these rules are applicable to this project.

### **1.9. Solid Waste Management Rules, 2016**

The Solid Waste Management (SWM) Rules, 2016 establish consistent regulation governing collection, segregation, transportation, and disposal of types of solid wastes throughout India. This rule is applicable for all kind of activities which generates solid waste except industrial waste, hazardous waste, hazardous chemicals, bio medical wastes, e-waste, lead acid batteries and radio-active waste, which are covered under separate rules framed under the Environment (Protection) Act, 1986. The SWM Rules seeks to minimize the burden of on landfills for the disposal of solid waste by adopting appropriate waste segregation and treatment technologies. Provisions of this rule is applicable for the project, as waste generation from labour camp and construction camp during construction phase is anticipated.

### **1.10. Construction and Demolition Waste Management Rules, 2016**

To manage Construction and Demolition waste (C&D waste) in more effective way, the central government has made this rule to improve the collection, segregation, recycling, treatment and disposal of C&D waste in an environmentally sound manner. It emphasis on the roles and accountability of waste generators and various stakeholders, give thrust to segregation, recovery, reuse, recycle at source, address in detail the management of C&D wastes. Since, the project envisages dismantling of existing structures, clearing of site & vegetation, etc., provisions of this rule is applicable for the project.

### **1.11. Hazardous & Other Wastes (Management and Transboundary Movement) Rules, 2016**

The Hazardous Wastes (Management, Handling and Trans boundary movement) Rules, 2008 and its subsequent amendments till 2016, were created to provide 'cradle-to grave' or comprehensive guidance to the generators, transporters and operators of disposal facilities among others, and monitoring norms for State governments. As per the provisions of Rules, every occupier handling, or recycler recycling, hazardous wastes including facility for collection, reception, treatment, transport, storage and disposal of such wastes is required to obtain authorization from concerned State Pollution Control Board (SPCB) / Pollution Control Committee (PCC) in UT for any of the said activities. Provisions of this act is applicable to this sub project, as hazardous waste is likely to generate and disposed during the construction activities.

### **1.12. E-Waste (Management) Rules, 2016**

These rules shall apply to every manufacturer, producer, consumer, bulk consumer, collection centres, dealers, e-retailer, refurbisher, dismantler and recycler involved in manufacture, sale, transfer, purchase, collection, storage and processing of e-waste or electrical and electronic equipment listed in Schedule I of this rule, including their components, consumables, parts and spares which make the product operational.

The project is likely to generate e-waste from the equipment and machineries used in construction activity. Hence the said rule are applicable for the subject project.

Workers engaged in dismantling and handling e-waste are to be issued with proper personal protective equipment (gloves, dust mask etc.) The recoverable items are to be sold only to authorized recyclers.

### **1.13. Plastic Waste Management Rules, 2016**

These rules more effectively give thrust on plastic waste minimization, source segregation, recycling, involving waste pickers, recyclers and waste processors in collection of plastic waste fraction either from households or any other source of its generation or intermediate material recovery facility and adopt polluter's pay principle for the sustainability of the waste management system. During construction and operation stages, plastic wastes will be generated in various forms such as plastic wastes in drains, waste generated from construction camp etc., Hence provision of this rules are applicable for the project.

### **1.14. Batteries (Management and Handling) Rules, 2001**

These rules shall apply to every manufacturer, importer, re-conditioner, assembler, dealer, recycler, auctioneer, consumer and bulk consumer involved in manufacture, processing, sale, purchase and use of batteries or components thereof. Establishing construction camp may attract these kind of activities and applicable for the subject project.

### **1.15. Policies of Ministry of Environment, Forests and Climate Change, Government of India**

#### **1.15.1. National Environmental Policy, 2006**

This policy intends to mainstream environmental concerns in all developmental activities. The policy stresses on conservation of critical environmental resources, intra-generational and inter-generational equity, efficiency in environmental resource use and adoption of a precautionary approach.

#### **1.15.2. Ground Water Recharge**

Groundwater recharging structures should be constructed along the road for ground water recharge. MoEF&CC insists this while issuing environmental clearance for road projects.

## **2. Environmental Requirements of the State**

### **2.1. Tamil Nadu Forest Act 1882 and Tamil Nadu Timber Transit Rules**

No person shall move timber notified as Schedule Timber under the Tamil Nadu Forest Act, 1882 into or from or within the State by land, water or air unless such timber is accompanied by a permit issued by the Tamil Nadu Forest Department. Black wood, Red Sanders, Rosewood, Sandalwood and Teakwood are trees notified as Schedule Timber under Tamil Nadu Forest Act, 1882. Since the project envisages cutting of non-schedule trees for widening of existing at-grade road, requires permit from respective District Collectors and forest department for cutting of trees and their transportation.

### **2.2. Tamil Nadu Highways Bill, 2000**

The Tamil Nadu Highways Bill, 2000 was introduced on 13.11.2000. Objective of the bill is stated as: "To provide for the declaration of certain highways to the 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 charge and for matters connected therewith or incidental thereto." It

provides for a legal status to the assets and premises of the highways along with functions and powers with the highways authorities to protect and maintain them. It specifically empowers highways authority towards restriction of Ribbon development, acquisition of property, prevention and removal of encroachments, restriction of heavy traffic and also the road safety. Penalties can be levied under the provisions of the bill for causing damage to highways properties and unauthorized occupation of the highway land.

### **2.3. Tamil Nadu Groundwater (Development and Management) Act, 2003**

The Tamil Nadu legislature passed the Ground Water (Development and Management) Act and the Act came into force after receiving the assent of the President in March 2003. The Act is applicable to the whole State of Tamil Nadu except the Chennai Metropolitan Area which is governed by a separate Act.

“An Act to protect groundwater resources to provide safeguards against hazards of it’s over exploitation and to ensure its planned development and proper management in the State of Tamil Nadu and for matters connected therewith or incidental thereto”.

The act empowers the government through the Tamil Nadu Groundwater Authority to develop, control, regulate and administer the groundwater in the state by ensuring its optimal and efficient utilization. The act also provides for conjunctive use of surface and groundwater. The act also provides for registration of new users of wells and also prohibition of sinking wells in notified areas without permit. It empowers the authority penalize the activities not in accordance with the act regarded as offences.

### **2.4. Tamil Nadu Aquaculture (Regulation) Act, 1995**

The act is meant for regulation of coastal aquaculture in Tamil Nadu. It is administered through the Directorate of Fisheries at state level and District committee at the district level. The act provides for issue of licenses for setting up of any new aquaculture farm or expansion of the same. Aquaculture farms setup before the existence of the act is also to be registered with the District Committee setup for the purpose. The act prohibits setting up of aquaculture farms in areas (termed as prohibited area) as:

“Wetlands including biodiversity rich areas mangrove swamps, migratory bird routes, breeding grounds, sanctuaries, national parks, biosphere reserves designated as protected areas or areas committed to community conservation or prediction forestry, place of heritage or place of worship, grey or dark areas in the map prepared by the Public Work Department (Groundwater).”

Certain minimum distances as 300m for villages with population less than 500, 500m for villages with population more than 500 and 2 km from any place of heritage. A buffer zone of 50 to 100m is to be maintained between aquaculture zone and non-aquaculture zone in case of sea-based aquafarms and 25 to 50m, in case of estuarine based farms. No aquaculture farm is envisaged to extract ground water for culture purpose. The act empowers Directorate of Fisheries to penalize the offenders of provisions of the act by cancellation of licenses and/or levying of fines.

### **2.5. Tamil Nadu State Environment Policy (Draft), 2012**

The State environment policy will strive to look at the regulatory framework, its adequacy, awareness levels among the stakeholders, recent judicial pronouncements and participation of technical institutions/industries in furthering the cause of environment. The Thrust Areas: Key Issues and Major Interventions are as follows:

- Air Quality: local pollution hot spots and status of current actions
- Water Quality: domestic and industrial pollution flow into water bodies and status of various interventions.
- Pollution abatement in rivers, lakes and water bodies.
- Waste Management: Municipal Solid Waste and status of adherence to MSW 2000 rules; bio-medical waste; plastic waste; hazardous waste; electronic waste,
- Coastal Zone Management: Impact on coastal regulation zone of various economic activities; progress on integrated coastal zone management.

## **2.6. Tamil Nadu State Water Policy, 1994**

Tamil Nadu adopted a State Water Policy in 1994 along the lines of the National Water Policy of 1987. Subsequently, the National Water Policy was revised in 2002. Some of the major aspects of the policy are the following:

- Importance of water resources in the development of the State
- Need for basin wide planning for equitable water use
- Priorities for water use in the State
- Management and development of ground water resources
- Watershed management in rainfed areas
- Increase in demand for non-agricultural uses
- Management of water quality and environmental aspects.
- Need for a hydrological database for planning and management
- Stakeholder participation in management e.g water user associations
- Need for proper pricing of water in different sector

The apex institution in the State at the policy level is the Water Resources Control and Review Council chaired by the Chief Minister. The primary agency charged with implementation of the policy is the Water Resources Organisation. The Institute of Water Studies is the nodal agency responsible for water planning while the Irrigation Management Training Institute imparts training to farmers and officials. Domestic water supply (urban and rural) schemes are executed by the Tamil Nadu Water Supply and Drainage Board (TWAD) for the entire State except Chennai Metropolitan Area where Metro Water is the implementing agency. TWAD executes capital projects which are handed over to the concerned local bodies for operation and maintenance. Industrial water pollution is regulated by the Tamil Nadu Pollution Control Board. Management of water quality and environmental aspects of rivers and water bodies is being monitored and coordinated by the Department of Environment.



North Chennai Thermal Power Station Information on Fly Ash

<p>தமிழ்நாடு மின்சாரக் கட்டுத்துறை தமிழ்நாடு மின்சாரக் கட்டுத்துறை - II</p> <p><b>24 DEC 2019</b></p> <p>171, தென் கிழக்கு குடியேற்றம், கிழக்கு சாலை, சென்னை-600 028.</p>	<p><b>TANGEDCO</b> <b>ENNORE THERMAL POWER STATION</b></p>	<table border="1"> <tr> <td>தி.இ.</td> <td></td> </tr> <tr> <td>த.பொ</td> <td>BM</td> </tr> <tr> <td>க.கா.பொ</td> <td></td> </tr> </table>	தி.இ.		த.பொ	BM	க.கா.பொ	
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<p>From</p> <p>Er.N.Sadayappavallal, B.E., Chief Engineer, Ennore Thermal Power Station, Ennore, Chennai- 600 057.</p>	<p>To</p> <p>The Project Director Tamilnadu Road Sector Project-II 171, South Kesavaperumal puram Off Greenways Road R.A. Puram, Chennai-28</p>	<table border="1"> <tr> <td>கோ.பொ</td> <td></td> </tr> <tr> <td>து.தி.இ.</td> <td></td> </tr> </table>	கோ.பொ		து.தி.இ.			
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<p><b>Lr.No.CE/ETPS/SE/E/EE/EM/AEE/M/F. Fly Ash/D/90/2019 dt.21.12.2019.</b></p>								

Sir,

Sub: Tamilnadu Road Sector Project-II –Road improvement works under Tamilnadu Road sector Project II (TNRSP II) PPCO6-Use of fly ash in Embankment construction –Availability of fly ash at ETPS- Reg.

Ref : Letter No: 4969/2019/TNRSP-II/AE12 dt 16.12.19

Kindly refer to the above. Your requirement for fly ash for Embankment construction could not be meted out by us, as the generation at ETPS was stopped from 11/2016 onwards.

*aj Feedback*

*AEE authority to commence to BM*

*BM 21/12*  
Chief Engineer/ETPS

## Environmental Monitoring Results

## Ambient Air Quality

## I. Omalur- Meicheri Road

S.No.	Parameters	Units	Pachanampatti Village	Mecheri village	Sadhapadi Village	Test Method	NAAQ Standards : 2009	
1	Sulphur Dioxide	µg/m <sup>3</sup>	12.86	14.56	15.38	CPCB guide lines Volume 1:2012	80 (24 hours)	50 (Annual)
2	Nitrogen Dioxide	µg/m <sup>3</sup>	22.76	24.28	25.5	IS: 5182 (P-6):2006	80 (24 hours)	40 (Annual)
3	Particulate Matter Size Less than 10 µm	µg/m <sup>3</sup>	57.39	53.65	49.16	IS: 5182 (P-23):2006	100 (24 hours)	60 (Annual)
4	Particulate Matter Size Less than 2.5 µm	µg/m <sup>3</sup>	27.48	25.1	22.7	HECS/AIR/SOP/003 : 2017	60 (24 hours)	40 (Annual)
5	Carbon Monoxide	mg/m <sup>3</sup>	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	IS : 5182 (P-10) 1999	4 (1 hours)	2 (8 hours)
6	Lead	µg/m <sup>3</sup>	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	IS: 5182 (P-22): 2004	1 (24 hours)	0.5 (Annual)
7	Ozone	µg/m <sup>3</sup>	13.61	11.67	11.49	HECS/AIR/AMBIENT/SOP/007 :2013	180 (1 hours)	100 (8 hours)
8	Ammonia	µg/m <sup>3</sup>	8.74	7.5	7.38	HECS/AIR/AMBIENT/SOP/006 :2013	400 (24 hours)	100 (Annual)
9	Benzene	µg/m <sup>3</sup>	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	IS: 5182 (P-11):2006	5 (Annual)	5 (Annual)
10	Benzo(a)pyrene	ng/m <sup>3</sup>	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	IS: 5182 (P-12): 2004	1 (Annual)	1 (Annual)
11	Arsenic	ng/m <sup>3</sup>	BLQ(LOQ 2)	BLQ(LOQ 2)	BLQ(LOQ 2)	HECS/AIR/AMBIENT/SOP/009 :2013	6 (Annual)	6 (Annual)
12	Nickel	ng/m <sup>3</sup>	BLQ(LOQ 10)	BLQ(LOQ 10)	BLQ(LOQ 10)	HECS/AIR/AMBIENT/SOP/009 :2013	20 (Annual)	20 (Annual)

## II. Attur - Malliakarai Road

S.No.	Parameters	Units	Eachampatti Village	Attur- Top of SKN Lodge	Test Method	NAAQ Standards : 2009	
1	Sulphur Dioxide	µg/m <sup>3</sup>	13.45	12.41	CPCB guide lines Volume 1:2012	80 (24 hours)	50 (Annual)
2	Nitrogen Dioxide	µg/m <sup>3</sup>	24.1	22.39	IS: 5182 (P-6):2006	80 (24 hours)	40 (Annual)
3	Particulate Matter Size Less than 10 µm	µg/m <sup>3</sup>	57.62	54.1	IS: 5182 (P-23):2006	100 (24 hours)	60 (Annual)
4	Particulate Matter Size Less than 2.5 µm	µg/m <sup>3</sup>	28.11	25.76	HECS/AIR/SOP/003 : 2017	60 (24 hours)	40 (Annual)
5	Carbon Monoxide	mg/m <sup>3</sup>	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	IS : 5182 (P-10) 1999	4 (1 hours)	2 (8 hours)
6	Lead	µg/m <sup>3</sup>	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	IS: 5182 (P-22): 2004	1 (24 hours)	0.5 (Annual)
7	Ozone	µg/m <sup>3</sup>	11.25	11.4	HECS/AIR/AMBIENT/SOP/007 :2013	180 (1 hours)	100 (8 hours)
8	Ammonia	µg/m <sup>3</sup>	7.63	7.11	HECS/AIR/AMBIENT/SOP/006 :2013	400 (24 hours)	100 (Annual)
9	Benzene	µg/m <sup>3</sup>	BLQ(LOQ 1)	BLQ(LOQ 1)	IS: 5182 (P-11):2006	5 (Annual)	5 (Annual)
10	Benzo(a)pyrene	ng/m <sup>3</sup>	BLQ(LOQ 1)	BLQ(LOQ 1)	IS: 5182 (P-12): 2004	1 (Annual)	1 (Annual)
11	Arsenic	ng/m <sup>3</sup>	BLQ(LOQ 2)	BLQ(LOQ 2)	HECS/AIR/AMBIENT/SOP/009 :2013	6 (Annual)	6 (Annual)
12	Nickel	ng/m <sup>3</sup>	BLQ(LOQ 10)	BLQ(LOQ 10)	HECS/AIR/AMBIENT/SOP/009 :2013	20 (Annual)	20 (Annual)

### III. Chithode - Erode Road

S.No.	Parameters	Units	Chithode Village	Erode-Commercial Area	Test Method	NAAQ Standards : 2009	
1	Sulphur Dioxide	µg/m <sup>3</sup>	10.45	10.74	CPCB guide lines Volume 1:2012	80 (24 hours)	50 (Annual)
2	Nitrogen Dioxide	µg/m <sup>3</sup>	18.47	20.35	IS: 5182 (P-6):2006	80 (24 hours)	40 (Annual)
3	Particulate Matter Size Less than 10 µm	µg/m <sup>3</sup>	46.82	47.58	IS: 5182 (P-23):2006	100 (24 hours)	60 (Annual)
4	Particulate Matter Size Less than 2.5 µm	µg/m <sup>3</sup>	17.63	19.63	HECS/AIR/SOP/003 : 2017	60 (24 hours)	40 (Annual)
5	Carbon Monoxide	mg/m <sup>3</sup>	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	IS : 5182 (P-10) 1999	4 (1 hours)	2 (8 hours)
6	Lead	µg/m <sup>3</sup>	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	IS: 5182 (P-22): 2004	1 (24 hours)	0.5 (Annual)
7	Ozone	µg/m <sup>3</sup>	10.35	12.19	HECS/AIR/AMBIENT/SOP/007 :2013	180 (1 hours)	100 (8 hours)
8	Ammonia	µg/m <sup>3</sup>	6.47	7.42	HECS/AIR/AMBIENT/SOP/006 :2013	400 (24 hours)	100 (Annual)
9	Benzene	µg/m <sup>3</sup>	BLQ(LOQ 1)	BLQ(LOQ 1)	IS: 5182 (P-11):2006	5 (Annual)	5 (Annual)
10	Benzo(a)pyrene	ng/m <sup>3</sup>	BLQ(LOQ 1)	BLQ(LOQ 1)	IS: 5182 (P-12): 2004	1 (Annual)	1 (Annual)
11	Arsenic	ng/m <sup>3</sup>	BLQ(LOQ 2)	BLQ(LOQ 2)	HECS/AIR/AMBIENT/SOP/009 :2013	6 (Annual)	6 (Annual)
12	Nickel	ng/m <sup>3</sup>	BLQ(LOQ 10)	BLQ(LOQ 10)	HECS/AIR/AMBIENT/SOP/009 :2013	20 (Annual)	20 (Annual)

Note:- BLQ - Below the Limit of Quantification, LOQ- Limit of Quantification, µg/m<sup>3</sup>- Micrograms per cubic meter, mg/m<sup>3</sup>- Milligrams per cubic meter, ng/m<sup>3</sup>- Nanograms per cubic meter.

Remarks: The Tested Parameters as above are within the Limits of NAAQ Standards 2009

## Surface Water Quality

### I. Omalur- Meicheri Road

S.No.	Parameters	Units	Kamaneri Village	Melaguvandanur village	Test Method	Limits as per IS 2296:1982
1	pH (at 25 °C)	-	7.63	8.42	IS 3025 (Part - 11):1983	6.5 - 8.5
2	Electrical conductivity	µS/cm	397	904	IS 3025 (Part - 14):1983	-
3	Colour	Hazen Unit	BLQ(LOQ:1.0)	BLQ(LOQ:1.0)	IS 3025(Part - 4):1983	300
4	Turbidity	NTU	35	2	IS 3025(Part - 10):1984	-
5	Calcium Hardness as CaCO3 #	mg/l	65	90	IS 3025 (Part - 21):1983	-
6	Magnesium Hardness as CaCO3 #	mg/l	70	120	IS 3025 (Part - 21):1983	-
7	Total Hardness as CaCO3	mg/l	135	210	IS 3025 (Part - 21):1983	-
8	Calcium as Ca	mg/l	26.05	36.07	IS 3025 (Part - 40):1991	75
9	Total Alkalinity as CaCO3	mg/l	145	200	IS 3025 (Part - 23):1986	-
10	Chloride as Cl	mg/l	31.84	112.68	4500 Cl --- B APHA 23rd Edn: 2017	600
11	Total Dissolved Solids	mg/l	215	457	IS 3025(Part -16):1984	1500
12	Sulphate as SO4	mg/l	20.17	71.29	IS 3025(Part - 24):1986	200
13	Fluoride	mg/l	0.21	0.32	IS 3025 (Part - 60):2008	1.5
14	Nitrate as NO3	mg/l	6.8	2.4	APHA 23rd Edition (4500 NO3B)	-
15	Iron as Fe	mg/l	1.04	0.15	IS 3025 (Part - 53):2003	50
16	Boron as B #	mg/l	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	IS:3025 (Part - 57):2003	-
17	Zinc as Zn	mg/l	BLQ(LOQ:1.0)	BLQ(LOQ:0.1)	US EPA Method 200.8	15
18	Chromium as Cr	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	IS 3025 (Part - 52):2003	0.05
19	Copper as Cu	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	US EPA Method 200.8	1.5
20	Cadmium as Cd	mg/l	BLQ(LOQ:0.001)	BLQ(LOQ:0.001)	US EPA Method 200.8	0.01
21	Lead as Pb	mg/l	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	US EPA Method 200.8	0.1

22	Arsenic as As	mg/l	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	US EPA Method 200.8	0.2
23	Sodium as Na	mg/l	15	54	IS3025 (Part - 45):1993	-
24	Potassium as K	mg/l	1	4	IS3025 (Part - 45):1993	-
25	Phosphate as PO4 #	mg/l	0.19	0.08	IS 3025 (Part 31):1988	-
26	Total suspended solid	mg/l	78	5	IS 3025 (Part - 17):1984	-
27	BOD,3 days 27°C as O2 #	mg/l	8	4	IS 3025 (Part - 44):1993	3
28	Chemical oxygen demand as O2 #	mg/l	56	32	IS 3025 (Part - 58):2006	-
29	Oil and Grease	mg/l	BLQ(LOQ:4.0)	BLQ(LOQ:4.0)	IS 3025 (Part - 39):1991	0.1
30	Temperature #	°C	29.1	29.1	IS 3025 (Part - 9):1984	-
31	Dissolved oxygen	mg/l	5.9	6.1	IS 3025 (Part - 38):1989	4
32	Salinity #	ppt	0.06	0.2	2520 A APHA 22nd Edn. 2012	-
33	Total Nitrogen as N #	mg/l	6.9	2.5	IS 3025(Part- 34):1988	-
34	Total Coliform	MPN/100ml	<2	<2	IS 1622	-
35	Faecal coliform	MPN/100ml	<2	<2	IS 1622	-

## II. Attur - Malliakarai Road

S.No.	Parameters	Units	Chitraru river	Test Method	Limits as per IS 2296:1982
1	pH (at 25 °C)	-	No sample	IS 3025 (Part - 11):1983	6.5 - 8.5
2	Electrical conductivity	µS/cm		IS 3025 (Part - 14):1983	-
3	Colour	Hazen Unit		IS 3025(Part - 4):1983	300
4	Turbidity	NTU		IS 3025(Part - 10):1984	-
5	Calcium Hardness as CaCO <sub>3</sub> #	mg/l		IS 3025 (Part - 21):1983	-
6	Magnesium Hardness as CaCO <sub>3</sub> #	mg/l		IS 3025 (Part - 21):1983	-
7	Total Hardness as CaCO <sub>3</sub>	mg/l		IS 3025 (Part - 21):1983	-
8	Calcium as Ca	mg/l		IS 3025 (Part - 40):1991	75
9	Total Alkalinity as CaCO <sub>3</sub>	mg/l		IS 3025 (Part - 23):1986	-
10	Chloride as Cl	mg/l		4500 Cl --- B APHA 23rd Edn: 2017	600
11	Total Dissolved Solids	mg/l		IS 3025(Part -16):1984	1500
12	Sulphate as SO <sub>4</sub>	mg/l		IS 3025(Part - 24):1986	200
13	Fluoride	mg/l		IS 3025 (Part - 60):2008	1.5
14	Nitrate as NO <sub>3</sub>	mg/l		APHA 23rd Edition (4500 NO <sub>3</sub> B)	-
15	Iron as Fe	mg/l		IS 3025 (Part - 53):2003	50
16	Boron as B #	mg/l		IS:3025 (Part - 57):2003	-
17	Zinc as Zn	mg/l		US EPA Method 200.8	15
18	Chromium as Cr	mg/l		IS 3025 (Part - 52):2003	0.05
19	Copper as Cu	mg/l		US EPA Method 200.8	1.5
20	Cadmium as Cd	mg/l		US EPA Method 200.8	0.01
21	Lead as Pb	mg/l		US EPA Method 200.8	0.1

22	Arsenic as As	mg/l		US EPA Method 200.8	0.2
23	Sodium as Na	mg/l		IS3025 (Part - 45):1993	-
24	Potassium as K	mg/l		IS3025 (Part - 45):1993	-
25	Phosphate as PO4 #	mg/l		IS 3025 (Part 31):1988	-
26	Total suspended solid	mg/l		IS 3025 (Part - 17):1984	-
27	BOD,3 days 27° C as O2 #	mg/l		IS 3025 (Part - 44):1993	3
28	Chemical oxygen demand as O2 #	mg/l		IS 3025 (Part - 58):2006	-
29	Oil and Grease	mg/l		IS 3025 (Part - 39):1991	0.1
30	Temperature #	°C		IS 3025 (Part - 9):1984	-
31	Dissolved oxygen	mg/l		IS 3025 (Part - 38):1989	4
32	Salinity #	ppt		2520 A APHA 22nd Edn. 2012	-
33	Total Nitrogen as N #	mg/l		IS 3025(Part- 34):1988	-
34	Total Coliform	MPN/100ml		IS 1622	-
35	Faecal coliform	MPN/100ml		IS 1622	-



### III. Chithode - Erode Road

S.No.	Parameters	Units	Annai sathya Nagar	Test Method	Limits as per IS 2296:1982
1	pH (at 25 °C)	-	8.28	IS 3025 (Part - 11):1983	6.5 - 8.5
2	Electrical conductivity	µS/cm	941	IS 3025 (Part - 14):1983	-
3	Colour	Hazen Unit	BLQ(LOQ 1.0)	IS 3025(Part - 4):1983	300
4	Turbidity	NTU	1	IS 3025(Part - 10):1984	-
5	Calcium Hardness as CaCO <sub>3</sub> #	mg/l	140	IS 3025 (Part - 21):1983	-
6	Magnesium Hardness as CaCO <sub>3</sub> #	mg/l	180	IS 3025 (Part - 21):1983	-
7	Total Hardness as CaCO <sub>3</sub>	mg/l	320	IS 3025 (Part - 21):1983	-
8	Calcium as Ca	mg/l	56.11	IS 3025 (Part - 40):1991	75
9	Total Alkalinity as CaCO <sub>3</sub>	mg/l	290	IS 3025 (Part - 23):1986	-
10	Chloride as Cl	mg/l	93.08	4500 Cl --- B APHA 23rd Edn: 2017	600
11	Total Dissolved Solids	mg/l	507	IS 3025(Part -16):1984	1500
12	Sulphate as SO <sub>4</sub>	mg/l	74.04	IS 3025(Part - 24):1986	200
13	Fluoride	mg/l	0.31	IS 3025 (Part - 60):2008	1.5
14	Nitrate as NO <sub>3</sub>	mg/l	2.4	APHA 23rd Edition (4500 NO <sub>3</sub> B)	-
15	Iron as Fe	mg/l	0.04	IS 3025 (Part - 53):2003	50
16	Boron as B #	mg/l	BLQ(LOQ 0.1)	IS:3025 (Part - 57):2003	-
17	Zinc as Zn	mg/l	BLQ(LOQ 0.1)	US EPA Method 200.8	15
18	Chromium as Cr	mg/l	BLQ(LOQ 0.01)	IS 3025 (Part - 52):2003	0.05
19	Copper as Cu	mg/l	BLQ(LOQ 0.01)	US EPA Method 200.8	1.5
20	Cadmium as Cd	mg/l	BLQ(LOQ 0.001)	US EPA Method 200.8	0.01
21	Lead as Pb	mg/l	BLQ(LOQ 0.05)	US EPA Method 200.8	0.1

22	Arsenic as As	mg/l	BLQ(LOQ 0.05)	US EPA Method 200.8	0.2
23	Sodium as Na	mg/l	44	IS3025 (Part - 45):1993	-
24	Potassium as K	mg/l	3	IS3025 (Part - 45):1993	-
25	Phosphate as PO4 #	mg/l	0.42	IS 3025 (Part 31):1988	-
26	Total suspended solid	mg/l	3	IS 3025 (Part - 17):1984	-
27	BOD,3 days 27°C as O2 #	mg/l	9	IS 3025 (Part - 44):1993	3
28	Chemical oxygen demand as O2 #	mg/l	64	IS 3025 (Part - 58):2006	-
29	Oil and Grease	mg/l	BLQ(LOQ 4.0)	IS 3025 (Part - 39):1991	0.1
30	Temperature #	°C	29.2	IS 3025 (Part - 9):1984	-
31	Dissolved oxygen	mg/l	5.9	IS 3025 (Part - 38):1989	4
32	Salinity #	ppt	0.17	2520 A APHA 22nd Edn. 2012	-
33	Total Nitrogen as N #	mg/l	2.6	IS 3025(Part- 34):1988	-
34	Total Coliform	MPN/100ml	<2	IS 1622	-
35	Faecal coliform	MPN/100ml	<2	IS 1622	-

Note:-BDL - Below Detection Limit, D.L- Detection Limit, NTU-Nephelometric Turbidity Unit, mg/l - Milligrams per liter  
CFU- Colony Forming Unit, MPN- Most Probable Number, EU- Endotoxin Unit

## Ground Water Quality

### I. Omalur- Meicheri Road

S.No.	Parameters	Units	Pachanampatti Village	Anjavathu-Mile	Senkattur Pirivu Village	Test Method	Acceptable Limits	Permissible Limits
1	pH (at 25 °C)	-	8.49	8.44	7.14	IS 3025 (Part - 11):1983	6.5 - 8.5	6.5 - 8.5
2	Colour	Hazen Unit	BLQ(LOQ:1.0)	BLQ(LOQ:1.0)	BLQ(LOQ:1.0)	IS 3025(Part - 4):1983	5	15
3	Turbidity	NTU	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	IS 3025(Part - 10):1984	1	5
4	Odour	-	Agreeable	Agreeable	Agreeable	IS 3025 (Part - 5):1983	Agreeable	Agreeable
5	Taste	-	Agreeable	Agreeable	Agreeable	IS 3025 (Part - 8):1984	Agreeable	Agreeable
6	Total Hardness as CaCO <sub>3</sub>	mg/l	330	530	680	IS 3025 (Part - 21):1983	200	600
7	Calcium as Ca	mg/l	64.12	92.18	128.25	IS 3025 (Part - 40):1991	75	200
8	Total Alkalinity as CaCO <sub>3</sub>	mg/l	370	490	690	IS 3025 (Part - 23):1986	200	600
9	Chloride as Cl	mg/l	318.44	171.47	186.16	4500 Cl --- B APHA 23rd Edn: 2017	250	1000
10	Residual free Chlorine	mg/l	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	IS 3025 (Part - 26):1986	0.2	1
11	Magnesium as Mg	mg/l	41.31	72.9	87.48	IS 3025 (Part - 46) 1994	30	100
12	Total Dissolved Solids	mg/l	1184	958	1168	IS 3025(Part -16):1984	500	2000
13	Sulphate as SO <sub>4</sub>	mg/l	341.39	178.58	197.15	IS 3025(Part - 24):1986	200	400
14	Fluoride	mg/l	0.49	0.41	0.39	IS 3025 (Part - 60):2008	1.0	1.5
15	Nitrate as NO <sub>3</sub>	mg/l	6.4	35.8	37.4	APHA 23rd Edition (4500 NO <sub>3</sub> B)	45	45
16	Iron as Fe	mg/l	BLQ(LOQ:0.02)	0.04	0.06	IS 3025 (Part - 53):2003	0.3	0.3
17	Aluminium as Al	mg/l	BLQ(LOQ:0.03)	BLQ(LOQ:0.03)	BLQ(LOQ:0.03)	IS 3025 (Part - 55):2003	0.03	0.2
18	Boron as B #	mg/l	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	IS:3025 (Part - 57):2003	0.5	1
19	Phenolic compounds as C <sub>6</sub> H <sub>5</sub> OH	mg/l	BLQ(LOQ:0.001)	BLQ(LOQ:0.001)	BLQ(LOQ:0.01)	APHA 23rd edition (Method 5530C):	0.001	0.002
20	Anionic Detergents as MBAS	mg/l	BLQ(LOQ:0.05)	BLQ(LOQ:0.05)	BLQ(LOQ:0.05)	Annex K of IS 13428-2005	0.2	1

21	Zinc as Zn	mg/l	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	US EPA Method 200.8	5	15
22	Chromium as Cr	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	IS 3025 (Part - 52):2003		
23	Copper as Cu	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	US EPA Method 200.8	0.05	1.5
24	Manganese as Mn	mg/l	BLQ(LOQ:0.05)	BLQ(LOQ:0.05)	BLQ(LOQ:0.05)	IS 3025:(Part - 59):2006	0.1	0.3
25	Cadmium as Cd	mg/l	BLQ(LOQ:0.001)	BLQ(LOQ:0.001)	BLQ(LOQ:0.001)	US EPA Method 200.8	0.003	No Relaxation
26	Lead as Pb	mg/l	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	US EPA Method 200.8	0.01	No Relaxation
27	Selenium as Se	mg/l	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	US EPA Method 200.8	0.01	No Relaxation
28	Arsenic as As	mg/l	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	US EPA Method 200.8	0.01	0.05
29	Mercury as Hg	mg/l	BLQ(LOQ:0.0005)	BLQ(LOQ:0.0005)	BLQ(LOQ:0.0005)	US EPA Method 200.8	0.001	No Relaxation
30	Mineral Oil	mg/l	BLQ(LOQ:0.5)	BLQ(LOQ:0.5)	BLQ(LOQ:0.5)	IS 3025 (Part39):1991:RA 2003	0.5	No Relaxation
31	Sulphide as S <sup>2-</sup>	mg/l	BLQ(LOQ:0.04)	BLQ(LOQ:0.04)	BLQ(LOQ:0.04)	IS3025 (Part - 29):1986	0.05	No Relaxation
32	Pesticides	-				-	-	-
	Alpha HCH	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	0.01	No Relaxation
	Beta HCH	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	0.04	No Relaxation
	Gama HCH ( Lindane )	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	2	No Relaxation
	Delta HCH	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	0.04	No Relaxation
	O,P-DDT	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	1	No Relaxation
	P,P-DDT	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	1	No Relaxation
	Chlorpyrifos	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	30	No Relaxation
	Aldrin	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	0.03	No Relaxation

	Methyl Parathion	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/074	0.03	No Relaxation
	Malathion	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/074	190	No Relaxation
33	Nickel	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	US EPA Method 200.8	0.02	No Relaxation
34	Chloroform	mg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/076	0.2	No Relaxation
35	Cyanide	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	IS 3025 (Part-27):1986	0.05	No Relaxation
36	Polyneuclear Aromatic Hydrocarbons	mg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/W&WW/SOP/064	0.0001	No Relaxation
37	Total Aromatic Hydrocarbons	mg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/W&WW/SOP/064	-	-
38	Chlorophyll A	mg/l	1.55	1.79	1.85		-	-
39	Total Coliform Bacteria	MPN/100ml	<2	900	<2	IS 1622	-	-
40	Escherichia coli	MPN/100ml	<2	<2	<2	IS 1622	Shall not be detectable in any 100 ml sample	-

## II. Attur - Malliakarai Road

S.No.	Parameters	Units	Eachampatti village	Attur - SKN Lodge	Test Method	IS:10500-2012	
						Acceptable Limits	Permissible Limits
1	pH (at 25 °C)	-	7.65	8.27	IS 3025 (Part - 11):1983	6.5 - 8.5	No relaxation
2	Colour	Hazen Unit	BLQ(LOQ:1.0)	BLQ(LOQ:1.0)	IS 3025(Part - 4):1983	5	15
3	Turbidity	NTU	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	IS 3025(Part - 10):1984	1	5
4	Odour	-	Agreeable	Agreeable	IS 3025 (Part - 5):1983	Agreeable	Agreeable
5	Taste	-	Agreeable	Agreeable	IS 3025 (Part - 8):1984	Agreeable	Agreeable
6	Total Hardness as CaCO3	mg/l	950	116	IS 3025 (Part - 21):1983	200	600
7	Calcium as Ca	mg/l	204.4	24.04	IS 3025 (Part - 40):1991	75	200
8	Total Alkalinity as CaCO3	mg/l	380	112	IS 3025 (Part - 23):1986	200	600
9	Chloride as Cl	mg/l	436.02	29.39	4500 Cl --- B APHA 23rd Edn: 2017	250	1000
10	Residual free Chlorine	mg/l	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	IS 3025 (Part - 26):1986	0.2	1
11	Magnesium as Mg	mg/l	106.92	13.6	IS 3025 (Part - 46) 1994	30	100
12	Total Dissolved Solids	mg/l	1450	172	IS 3025(Part -16):1984	500	2000
13	Sulphate as SO4	mg/l	198.18	11.04	IS 3025(Part - 24):1986	200	400
14	Fluoride	mg/l	0.45	0.2	IS 3025 (Part - 60):2008	1.0	1.5
15	Nitrate as NO3	mg/l	39.2	2.4	APHA 23rd Edition (4500 NO3B)	45	No Relaxation
16	Iron as Fe	mg/l	0.05	BLQ(LOQ:0.02)	IS 3025 (Part - 53):2003	0.3	No Relaxation
17	Aluminium as Al	mg/l	BLQ(LOQ:0.03)	BLQ(LOQ:0.03)	IS 3025 (Part - 55):2003	0.03	0.2
18	Boron as B #	mg/l	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	IS:3025 (Part - 57):2003	0.5	1
19	Phenolic compounds as C6H5OH	mg/l	BLQ(LOQ:0.001)	BLQ(LOQ:0.001)	APHA 23rd edition (Method 5530C):	0.001	0.002

20	Anionic Detergents as MBAS	mg/l	BLQ(LOQ:0.05)	BLQ(LOQ:0.05)	Annex K of IS 13428-2005	0.2	1
21	Zinc as Zn	mg/l	BLQ(LOQ:0.1)	BLQ(LOQ:0.1)	US EPA Method 200.8	5	15
22	Chromium as Cr	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	IS 3025 (Part - 52):2003		
23	Copper as Cu	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	US EPA Method 200.8	0.05	1.5
24	Manganese as Mn	mg/l	BLQ(LOQ:0.05)	BLQ(LOQ:0.05)	IS 3025:(Part - 59):2006	0.1	0.3
25	Cadmium as Cd	mg/l	BLQ(LOQ:0.001)	BLQ(LOQ:0.001)	US EPA Method 200.8	0.003	No Relaxation
26	Lead as Pb	mg/l	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	US EPA Method 200.8	0.01	No Relaxation
27	Selenium as Se	mg/l	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	US EPA Method 200.8	0.01	No Relaxation
28	Arsenic as As	mg/l	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	US EPA Method 200.8	0.01	0.05
29	Mercury as Hg	mg/l	BLQ(LOQ:0.0005)	BLQ(LOQ:0.0005)	US EPA Method 200.8	0.001	No Relaxation
30	Mineral Oil	mg/l	BLQ(LOQ:0.5)	BLQ(LOQ:0.5)	IS 3025 (Part39):1991:RA 2003	0.5	No Relaxation
31	Sulphide as S <sup>2-</sup>	mg/l	BLQ(LOQ:0.04)	BLQ(LOQ:0.04)	IS3025 (Part - 29):1986	0.05	No Relaxation
32	Pesticides	-			-	-	-
	Alpha HCH	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	0.01	No Relaxation
	Beta HCH	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	0.04	No Relaxation
	Gama HCH ( Lindane )	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	2	No Relaxation
	Delta HCH	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	0.04	No Relaxation
	O,P-DDT	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	1	No Relaxation
	P,P-DDT	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	1	No Relaxation
	Chlorpyrifos	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	30	No Relaxation

	Aldrin	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/072	0.03	No Relaxation
	Methyl Parathion	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/074	0.03	No Relaxation
	Malathion	µg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/074	190	No Relaxation
33	Nickel	mg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.01)	US EPA Method 200.8	0.02	No Relaxation
34	Chloroform	mg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/INS/SOP/076	0.2	No Relaxation
35	Cyanide	mg/l	BLQ(LOQ:0.01)	BLQ(LOQ:0.01)	IS 3025 (Part-27):1986	0.05	No Relaxation
36	Polyneuclear Aromatic Hydrocarbons	mg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/W&WW/SOP/064	0.0001	No Relaxation
37	Total Aromatic Hydrocarbons	mg/l	BLQ(LOQ:0.00001)	BLQ(LOQ:0.00001)	HECS/W&WW/SOP/064	-	-
38	Chlorophyll A	mg/l	1.89	1.91		-	-
39	Total Coliform Bacteria	MPN/100ml	500	300	IS 1622	-	-
40	Escherichia coli	MPN/100ml	<2	<2	IS 1622	Shall not be detectable in any 100 ml sample	-



### III. Chithode - Erode Road

S.No.	Parameters	Units	Erode Railway Station	Chithode	Test Method	IS:10500-2012	
						Acceptable Limits	Permissible Limits
1	pH (at 25 °C)	-	8.21	8.32	IS 3025 (Part - 11):1983	6.5 - 8.5	No relaxation
2	Colour	Hazen Unit	BLQ(LOQ 1.0)	BLQ(LOQ 1.0)	IS 3025(Part - 4):1983	5	15
3	Turbidity	NTU	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	IS 3025(Part - 10):1984	1	5
4	Odour	-	Agreeable	Agreeable	IS 3025 (Part - 5):1983	Agreeable	Agreeable
5	Taste	-	Agreeable	Agreeable	IS 3025 (Part - 8):1984	Agreeable	Agreeable
6	Total Hardness as CaCO <sub>3</sub>	mg/l	240	150	IS 3025 (Part - 21):1983	200	600
7	Calcium as Ca	mg/l	60.12	36.07	IS 3025 (Part - 40):1991	75	200
8	Total Alkalinity as CaCO <sub>3</sub>	mg/l	280	145	IS 3025 (Part - 23):1986	200	600
9	Chloride as Cl	mg/l	107.78	19.59	4500 Cl --- B APHA 23rd Edn: 2017	250	1000
10	Residual free Chlorine	mg/l	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	IS 3025 (Part - 26):1986	0.2	1
11	Magnesium as Mg	mg/l	21.87	14.58	IS 3025 (Part - 46) 1994	30	100
12	Total Dissolved Solids	mg/l	537	198	IS 3025(Part -16):1984	500	2000
13	Sulphate as SO <sub>4</sub>	mg/l	75.84	15.63	IS 3025(Part - 24):1986	200	400
14	Fluoride	mg/l	0.38	0.21	IS 3025 (Part - 60):2008	1.0	1.5
15	Nitrate as NO <sub>3</sub>	mg/l	10.08	1.6	APHA 23rd Edition (4500 NO <sub>3</sub> B)	45	No Relaxation
16	Iron as Fe	mg/l	0.03	BLQ(LOQ 0.02)	IS 3025 (Part - 53):2003	0.3	No Relaxation
17	Aluminium as Al	mg/l	BLQ(LOQ 0.03)	BLQ(LOQ 0.03)	IS 3025 (Part - 55):2003	0.03	0.2
18	Boron as B #	mg/l	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	IS:3025 (Part - 57):2003	0.5	1
19	Phenolic compounds as C <sub>6</sub> H <sub>5</sub> OH	mg/l	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	APHA 23rd edition (Method 5530C):	0.001	0.002

20	Anionic Detergents as MBAS	mg/l	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	Annex K of IS 13428-2005	0.2	1
21	Zinc as Zn	mg/l	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	US EPA Method 200.8	5	15
22	Chromium as Cr	mg/l	BLQ(LOQ 0.01)	BLQ(LOQ 0.1)	IS 3025 (Part - 52):2003		
23	Copper as Cu	mg/l	BLQ(LOQ 0.01)	BLQ(LOQ 0.1)	US EPA Method 200.8	0.05	1.5
24	Manganese as Mn	mg/l	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	IS 3025:(Part - 59):2006	0.1	0.3
25	Cadmium as Cd	mg/l	BLQ(LOQ 0.001)	BLQ(LOQ 0.01)	US EPA Method 200.8	0.003	No Relaxation
26	Lead as Pb	mg/l	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	US EPA Method 200.8	0.01	No Relaxation
27	Selenium as Se	mg/l	BLQ(LOQ 0.005)	BLQ(LOQ 0.05)	US EPA Method 200.8	0.01	No Relaxation
28	Arsenic as As	mg/l	BLQ(LOQ 0.005)	BLQ(LOQ 0.05)	US EPA Method 200.8	0.01	0.05
29	Mercury as Hg	mg/l	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	US EPA Method 200.8	0.001	No Relaxation
30	Mineral Oil	mg/l	BLQ(LOQ 0.5)	BLQ(LOQ 0.5)	IS 3025 (Part39):1991:RA 2003	0.5	No Relaxation
31	Sulphide as S <sup>2-</sup>	mg/l	BLQ(LOQ 0.04)	BLQ(LOQ 0.04)	IS3025 (Part - 29):1986	0.05	No Relaxation
32	Pesticides	-	-	-	-	-	-
	Alpha HCH	µg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.00001)	HECS/INS/SOP/072	0.01	No Relaxation
	Beta HCH	µg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.00001)	HECS/INS/SOP/072	0.04	No Relaxation
	Gama HCH ( Lindane )	µg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.00001)	HECS/INS/SOP/072	2	No Relaxation
	Delta HCH	µg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.00001)	HECS/INS/SOP/072	0.04	No Relaxation
	O,P-DDT	µg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.00001)	HECS/INS/SOP/072	1	No Relaxation
	P,P-DDT	µg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.00001)	HECS/INS/SOP/072	1	No Relaxation
	Chlorpyrifos	µg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.00001)	HECS/INS/SOP/072	30	No Relaxation

	Aldrin	µg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.00001)	HECS/INS/SOP/072	0.03	No Relaxation
	Methyl Parathion	µg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.00001)	HECS/INS/SOP/074	0.03	No Relaxation
	Malathion	µg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.00001)	HECS/INS/SOP/074	190	No Relaxation
33	Nickel	mg/l	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	US EPA Method 200.8	0.02	No Relaxation
34	Chloroform	mg/l	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	HECS/INS/SOP/076	0.2	No Relaxation
35	Cyanide	mg/l	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	IS 3025 (Part-27):1986	0.05	No Relaxation
36	Polyneuclear Aromatic Hydrocarbons	mg/l	BLQ(LOQ 0.00001)	BLQ(LOQ 0.0001)	HECS/W&WW/SOP/064	0.0001	No Relaxation
37	Total Aromatic Hydrocarbons	mg/l	BLQ(LOQ 0.0001)	BLQ(LOQ 0.0001)	HECS/W&WW/SOP/064	-	-
38	Chlorophyll A	mg/l	1.92	1.89	-	-	-
39	Total Coliform Bacteria	MPN/100ml	<2	<2	IS 1622	-	-
40	Escherichia coli	MPN/100ml	<2	<2	IS 1622	Shall not be detectable in any 100 ml sample	-

Note:-BDL - Below Detection Limit, D.L- Detection Limit, NTU-Nephelometric Turbidity Unit, mg/l - Milligrams per liter  
CFU- Colony Forming Unit, MPN- Most Probable Number, EU- Endotoxin Unit

## Soil Quality

### I. Omalur- Meicheri Road

S.No.	Parameters	Units	Near Pachanampatti	Maamarathur Pirivu	Test Method
1	Soil Texture	-	Sandy Loam	Sandy Loam	ASTM D421/422
2	i)Sand	%	60.28	59.28	ASTM D421/422
3	ii)Silt	%	37.6	38.42	ASTM D421/422
4	iii)Clay	%	2.12	2.3	ASTM D421/422
5	pH (at 25°C) @ 10% Solution	-	9.75	8.64	IS:2720 (Part-26):1987
6	Electrical Conductivity (at 25°C)	µS/cm	55.5	40.2	IS:14767:2000
7	Cation exchange capacity	meq/100g	7.96	8.08	IS 2720 (Part XXIV)Reaff:2010-1976
8	Moisture Content	%	6.9	7.71	IS 2720 part 2 Reaff:2000
9	Water holding capacity	%	31.6	29.6	IS 14765
10	Salinity	PSU	1.06	1.74	In house method
11	Particle Size Distribution	-	Passed through 850 micron	Passed through 850 micron	-
12	Potassium	mg/kg	19.7	32.36	US EPA Method 3050B
13	Phosphate	mg/kg	12.32	62.3	IS 10518-1982 Reaffirmed 2003
14	Sodium	mg/kg	281.53	462.3	EPA 3050 B/EPA 7770
15	Porosity	%	31	29	In house method
16	Sodium Absorption Ratio	meq/kg	2.12	3.67	In house method
17	Nitrate as NO <sub>3</sub>	mg/kg	708.08	1445.67	IS 14684:1999
18	Organic Content	%	0.82	0.78	IS 2720(Part-22) 1972

## II. Attur - Malliakarai Road

S.No.	Parameters	Units	Attur	Malliakarai Village	Thandavarayapuram	Test Method
1	Soil Texture	-	Loamy Sand	Sandy Loam	Loamy Sand	ASTM D421/422
2	Soil Texture i)Sand	%	66.54	56.24	72.4	ASTM D421/422
3	Soil Texture ii)Silt	%	30.93	41	25.4	ASTM D421/422
4	Soil Texture iii)Clay	%	2.53	2.76	2.2	ASTM D421/422
5	pH (at 25° C) @ 10% Solution	-	8.87	9.4	8.95	IS:2720 (Part-26):1987
6	Electrical Conductivity (at 25° C)	µS/cm	52.9	44.5	65.5	IS:14767:2000
7	Cation exchange capacity	meq/100g	11.67	10.78	12.45	IS 2720 (Part XXIV)Reaff:2010-1976
8	Moisture Content	%	14.34	9.32	16.45	IS 2720 part 2 Reaff:2000
9	Water holding capacity	%	12	36	5	IS 14765
10	Salinity	PSU	1.12	1.03	1.18	In house method
11	Particle Size Distribution	-	Passed through 850 micron	Passed through 850 micron	Passed through 850 micron	-
12	Potassium	mg/kg	20.45	19.32	21.97	US EPA Method 3050B
13	Phosphate	mg/kg	174.93	156.04	205.08	IS 10518-1982 Reaffirmed 2003
14	Sodium	mg/kg	294.17	276	313.86	EPA 3050 B/EPA 7770
15	Porosity	%	18	30	5	In house method
16	Sodium Absorption Ratio	meq/kg	1.79	1.74	1.84	In house method
17	Nitrate as NO <sub>3</sub>	mg/kg	1489.6	1934.2	1107.85	IS 14684:1999
18	Organic Content	%	1.05	0.85	1.21	IS 2720(Part-22) 1972

### III. Chithode - Erode Road

S.No.	Parameters	Units	Chithode	Vasantha Nagar	Test Method
1	Soil Texture	-	Loamy sand	Sandy Loam	ASTM D421/422
2	Soil Texture i)Sand	%	80.25	44.62	ASTM D421/422
3	Soil Texture ii)Silt	%	14.72	40.16	ASTM D421/422
4	Soil Texture iii)Clay	%	5.03	15.22	ASTM D421/422
5	pH (at 25° C) @ 10% Solution	-	9.02	8.35	IS:2720 (Part-26):1987
6	Electrical Conductivity (at 25° C)	µS/cm	145.8	92.5	IS:14767:2000
7	Cation exchange capacity	meq/100g	9.3	9.3	IS 2720 (Part XXIV)Reaff:2010-1976
8	Moisture Content	%	10.42	5.02	IS 2720 part 2 Reaff:2000
9	Water holding capacity	%	8.71	30.28	IS 14765
10	Salinity	PSU	3.06	0.52	In house method
11	Particle Size Distribution	-	Passed through 850 micron	Passed through 850 micron	-
12	Potassium	mg/kg	2274.2	1989.4	US EPA Method 3050B
13	Phosphate	mg/kg	4.53	35.98	IS 10518-1982 Reaffirmed 2003
14	Sodium	mg/kg	247.2	149.2	EPA 3050 B/EPA 7770
15	Porosity	%	8.7	30.26	In house method
16	Sodium Absorption Ratio	meq/kg	3.1	1.54	In house method
17	Nitrate as NO3	mg/kg	4.06	6.38	IS 14684:1999
18	Organic Content	%	2.76	1.24	IS 2720(Part-22) 1972

## Noise Quality

### I. Omalur- Meicheri Road

S.No	Location	Day Time	Night Time
		Noise level in dB (A)	Noise level in dB (A)
1	NQ-1 Sri Balamurugan College	61.6	52.8
2	NQ-2 Chinnasathanpadi	62.2	51.5
3	NQ-3 Raja manickam Hospital	59.3	54.7
4	NQ-4 South Indian School	60.8	54.4
5	NQ-5 Paalikadai School	73.6	62.9
6	NQ-6 Nalam Hospital	67.5	55.1
7	NQ-7 Paali kadai Primary Health center	62.9	52.3

### II. Attur - Malliakarai Road

S.No	Location	Day Time	Night Time
		Noise level in dB (A)	Noise level in dB (A)
1	NQ-1 Rasi matric higher secondary school	66.6	58.4
2	NQ-2 Panchayat union public school Echampatti	61.5	52.3
3	NQ-3 Thandavarayapuram village Agricultural office	64.3	58.1
4	NQ-4 Thandavarayapuram first Aid medical center	67.9	60.6
5	NQ-5 Attur police station	72.1	65.7

### III. Chithode - Erode Road

S.No	Location	Day Time	Night Time
		Noise level in dB (A)	Noise level in dB (A)
1	NQ-1 Chithode Govt school	62.8	55.6
2	NQ-2 Tamilnadu ITI	65.5	57.2
3	NQ-3 Erode Hindu kalvi nilayam	60.2	54.9
4	NQ-4 CN College Veerapanchathiram	63.1	56.0
5	NQ-5 Thanthai Periyar Hospital	64.0	56.2

## Chainage-wise Details of Trees proposed to be removed for the Improvement

## I. Omalur to Mecheri Corridor (SH 222)

Summary of Government Trees to be Cut / Transplanted																										
Chainage		Girth Size at Breast Height (GBH)																								
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm			
		LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Total	
0+000	1+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1+000	2+000	0	0	0	5	23	28	4	3	7	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0
2+000	3+000	0	0	0	11	54	65	3	4	7	0	3	3	1	0	1	1	3	4	1	1	2	4	5	9	
3+000	4+000	0	0	0	6	4	10	0	1	1	0	1	1	0	0	0	0	1	1	1	4	5	14	9	23	
4+000	5+000	0	0	0	0	1	1	0	1	1	0	0	0	0	1	1	0	1	1	0	1	1	6	8	14	
5+000	6+000	0	0	0	45	9	54	0	1	1	0	2	2	4	0	4	1	1	2	2	0	2	2	0	2	
6+000	7+000	0	0	0	72	26	98	0	7	7	0	2	2	1	1	2	0	1	1	0	3	3	2	5	7	
7+000	8+000	0	0	0	47	54	101	0	9	9	1	3	4	0	0	0	1	1	2	1	9	10	22	15	37	
8+000	9+000	0	0	0	7	49	56	0	0	0	1	1	2	0	1	1	0	7	7	0	5	5	10	8	18	
9+000	10+000	0	0	0	112	106	218	0	6	6	1	0	1	1	1	2	0	0	0	0	4	4	0	2	2	
10+000	11+000	0	0	0	15	22	37	1	0	1	0	0	0	1	4	5	0	1	1	1	5	6	10	8	18	
11+000	12+000	0	0	0	37	35	72	1	0	1	0	0	0	0	3	3	1	1	2	2	1	3	15	15	30	
12+000	13+000	0	0	0	70	73	143	1	1	2	1	0	1	1	1	2	0	1	1	0	0	0	6	0	6	
13+000	14+000	0	0	0	21	26	47	0	3	3	0	0	0	0	1	1	1	3	4	0	8	8	17	23	40	
14+000	15+000	0	0	0	6	15	21	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	14	6	20	
		0	0		454	498		10	38		4	12		9	13		6	22		9	42		122	104		
Sub Total		0			951			46			16			22			28			51			226			
Total Number of Trees to be Transplanted (GBH<30 cm)												0														
Total Number of Trees to be Cut (GBH>30 cm)												1340														



**Summary of Private Trees to be Cut / Transplanted**

Chainage		GBH																								
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm			
		LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	
0+000	1+000	0	0	0	0	0	0	0	1	1	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	
1+000	2+000	0	0	0	29	0	29	1	1	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
2+000	3+000	0	0	0	63	0	63	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
3+000	4+000	0	0	0	5	0	5	3	4	7	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
4+000	5+000	0	0	0	2	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5+000	6+000	0	0	0	8	22	30	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	
6+000	7+000	0	0	0	22	0	22	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1
7+000	8+000	0	0	0	5	0	5	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8+000	9+000	0	0	0	3	3	6	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1
9+000	10+000	0	0	0	4	8	12	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
10+000	11+000	0	0	0	0	7	7	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11+000	12+000	0	0	0	1	4	5	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
12+000	13+000	0	0	0	2	21	23	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13+000	14+000	0	0	0	0	10	10	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
14+000	15+000	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
		0	0		145	75		10	8		2	3		1	3		1	1		0	0		4	0		
<b>Sub Total</b>		<b>0</b>			<b>220</b>			<b>18</b>			<b>5</b>			<b>4</b>			<b>2</b>			<b>0</b>			<b>4</b>			
<b>Total Number of Trees to be Transplanted (GBH&lt;30 cm)</b>												<b>0</b>														
<b>Total Number of Trees to be Cut (GBH&gt;30 cm)</b>												<b>249</b>														

**Summary of Government Trees Saved**

Chainage		GBH																							
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm		
		LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot
0+000	1+000	0	0	0	7	11	18	3	7	10	8	1	9	3	5	8	6	0	6	0	0	0	9	4	13
1+000	2+000	0	0	0	5	3	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+000	3+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3+000	4+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4+000	5+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5+000	6+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6+000	7+000	0	1	1	0	3	3	0	2	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
7+000	8+000	0	0	0	19	8	27	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1
8+000	9+000	0	0	0	6	0	6	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9+000	10+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10+000	11+000	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11+000	12+000	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12+000	13+000	0	0	0	0	34	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13+000	14+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14+000	15+000	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Sub Total</b>		<b>1</b>			<b>101</b>			<b>13</b>			<b>10</b>			<b>8</b>			<b>6</b>			<b>1</b>			<b>14</b>		
<b>Total</b>		<b>154</b>																							

## Chainage-wise Details of Trees proposed to be removed for the Improvement

### II. Malliyakarai to Attur Corridor (SH 30)

Summary of Government Trees to be Cut / Transplanted																									
Chainage		Girth Size at Brest Height (GBH)																							
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm		
		LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
81+100	82+000	0	0	0	0	2	2	2	1	3	4	0	4	0	1	1	0	0	0	1	2	3	1	12	13
82+000	83+000	0	0	0	2	0	2	4	3	7	3	0	3	4	1	5	2	2	4	0	3	3	3	13	16
83+000	84+000	0	0	0	6	6	12	7	10	17	1	6	7	1	3	4	0	0	0	1	1	2	9	17	26
84+000	85+000	5	0	5	0	1	1	0	3	3	1	0	1	1	1	2	1	0	1	7	0	7	0	29	29
85+000	86+000	0	7	7	0	3	3	0	0	0	0	1	1	0	1	1	2	7	9	1	7	8	9	32	41
86+000	87+000	0	0	0	2	3	5	0	9	9	1	0	1	2	2	4	0	4	4	2	3	5	0	17	17
87+000	88+000	0	0	0	0	0	0	2	4	6	1	3	4	2	4	6	3	6	9	3	2	5	2	12	14
88+000	89+000	0	0	0	2	0	2	1	4	5	0	0	0	0	1	1	2	2	4	1	4	5	1	19	20
89+000	90+000	0	0	0	1	1	2	5	2	7	3	0	3	4	8	12	3	1	4	0	7	7	11	13	24
90+000	91+000	0	0	0	0	2	2	4	11	15	6	2	8	1	4	5	1	3	4	1	2	3	4	17	21
Sub Total		5	7	12	13	18	31	25	47	72	20	12	32	15	26	41	14	25	39	17	31	48	40	181	221
Total Number of Trees to be Transplanted (GBH<30 cm)																12									
Total Number of Trees to be Cut (GBH>30 cm)																484									

Summary of Private Trees to be Cut / Transplanted																									
Chainage		Girth Size at Brest Height (GBH)																							
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm		
		LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
81+100	82+000	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
82+000	83+000	0	1	1	2	0	2	0	0	0	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0
83+000	84+000	0	0	0	0	0	0	5	0	5	3	0	3	1	0	1	0	0	0	0	0	0	4	0	4
84+000	85+000	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
85+000	86+000	0	7	7	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	6	0	6
86+000	87+000	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
87+000	88+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88+000	89+000	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
89+000	90+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90+000	91+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total		0	12	12	4	1	5	5	6	11	4	0	4	1	1	2	2	0	2	0	1	1	16	1	17
Total Number of Trees to be Transplanted (GBH<30 cm)												12 <sup>1</sup>													
Total Number of Trees to be Cut (GBH>30 cm)												42													

<sup>1</sup>Private trees are not proposed to be transplanted

**Summary of Government Trees Saved**

Chainage		Girth Size at Brest Height (GBH)																							
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm		
		LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
81+100	82+000	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	1	1	1	0	1	23	5	28
82+000	83+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	21
83+000	84+000	0	0	0	2	0	2	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4
84+000	85+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	0	29
85+000	86+000	0	0	0	2	0	2	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	20	1	21
86+000	87+000	0	0	0	0	1	1	0	2	2	0	1	1	0	2	2	0	3	3	0	4	4	22	2	24
87+000	88+000	0	0	0	0	0	0	3	0	3	2	0	2	4	0	4	2	0	2	1	0	1	12	0	12
88+000	89+000	0	0	0	0	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	30	2	32
89+000	90+000	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	0	1	0	0	0	8	0	8
90+000	91+000	0	0	0	0	1	1	1	1	2	0	0	0	0	1	1	0	2	2	2	0	2	16	1	17
<b>Sub Total</b>		0	0	0	4	3	7	5	5	10	2	2	4	7	5	12	3	6	9	4	4	8	185	11	196
<b>Total</b>		<b>246</b>																							

## Chainage-wise Details of Trees proposed to be removed for the Improvement

### III. Erode to Chithode Corridor (SH 15)

Summary of Government Trees to be Cut / Transplanted																									
Chainage		Girth Size at Breast Height (GBH)																							
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm		
		LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot
153+500	154+000	0	0	0	7	1	8	2	1	3	0	0	0	3	7	10	8	4	12	1	4	5	5	4	9
154+000	155+000	0	0	0	16	3	19	2	4	6	1	3	4	6	5	11	0	7	7	1	9	10	26	33	59
155+000	156+000	0	0	0	7	5	12	3	6	9	3	0	3	5	8	13	4	8	12	5	9	14	18	11	29
156+000	157+000	0	0	0	3	8	11	8	4	12	4	8	12	6	16	22	6	10	16	5	3	8	14	23	37
157+000	158+000	0	0	0	2	5	7	3	8	11	4	2	6	6	9	15	5	7	12	4	8	12	15	19	34
158+000	159+000	0	0	0	0	8	8	6	7	13	8	7	15	4	15	19	3	7	10	3	6	9	20	2	22
159+000	160+000	0	0	0	1	0	1	2	3	5	2	0	2	2	3	5	2	8	10	3	1	4	13	1	14
160+000	161+000	0	0	0	2	10	12	6	10	16	10	1	11	13	7	20	5	9	14	10	3	13	20	0	20
161+000	162+620	0	0	0	1	0	1	2	3	5	1	0	1	0	3	3	0	0	0	0	0	0	0	0	0
		0	0	0	39	40	79	34	46	80	33	21	54	45	73	118	33	60	93	32	43	75	131	93	224
<b>Sub Total</b>		<b>0</b>			<b>79</b>			<b>80</b>			<b>54</b>			<b>118</b>			<b>93</b>			<b>75</b>			<b>224</b>		
<b>Total Number of Trees to be Transplanted (GBH&lt;30 cm)</b>												<b>0</b>													
<b>Total Number of Trees to be Cut (GBH&gt;30 cm)</b>												<b>723</b>													

**Summary of Private Trees to be Cut / Transplanted**

Chainage		Girth Size at Breast Height (GHB)																										
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm					
		LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot			
153+500	154+000	0	0	0	3	0	3	2	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
154+000	155+000	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
155+000	156+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
156+000	157+000	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
157+000	158+000	0	0	0	1	0	1	0	1	1	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1	1
158+000	159+000	0	0	0	0	0	0	0	3	3	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
159+000	160+000	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160+000	161+000	0	0	0	0	1	1	0	6	6	0	2	2	0	2	2	0	0	0	0	0	0	0	0	0	2	2	4
161+000	162+620	0	0	0	0		0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	5	1	6	4	10	14	2	5	7	1	2	3	1	0	1	0	0	0	0	0	0	3	5	8
<b>Sub Total</b>		<b>0</b>			<b>6</b>			<b>14</b>			<b>7</b>			<b>3</b>			<b>1</b>			<b>0</b>			<b>8</b>					
<b>Total Number of Trees to be Transplanted (GBH&lt;30 cm)</b>												<b>0</b>																
<b>Total Number of Trees to be Cut (GBH&gt;30 cm)</b>												<b>39</b>																

Summary of Government Trees Saved																									
Chainage		Girth Size at Breast Height (GHB)																							
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm		
		LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot	LHS	RHS	Tot
153+500	154+000	0	0	0	0	4	4	0	3	3	0	1	1	0	2	2	0	0	0	0	0	0	0	0	0
154+000	155+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155+000	156+000	0	0	0	0	2	2	0	3	3	0	0	0	0	2	2	0	0	0	0	1	1	0	1	1
156+000	157+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
157+000	158+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
158+000	159+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
159+000	160+000	0	0	0	6	2	8	2	0	2	2	0	2	2	2	4	1	3	4	1	1	2	2	0	2
160+000	161+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
161+000	162+620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	6	8	14	2	6	8	2	1	3	2	6	8	1	3	4	1	2	3	2	1	3
<b>Sub Total</b>		<b>0</b>			<b>14</b>			<b>8</b>			<b>3</b>			<b>8</b>			<b>4</b>			<b>3</b>			<b>3</b>		
<b>Total</b>		<b>43</b>																							



Public Consultation Notice

**பொது கலந்தாய்வு கூட்டம்**  
**நெடுஞ்சாலைத் துறை,**  
**தமிழ்நாடு சாலை மேம்பாட்டுத் திட்டம் (II).**

**பொருள்:**  
ஓமலூர்-மேச்சேரி சாலை கி.மீ 1/150 - கி.மீ 14/600 வரை  
இருவழிச்சாலையில் இருந்து நான்கு வழிச்சாலையாக மாற்றுதல்.

**இடம் :**  
K.S.V மஹால்,  
காமனேரி கிராமம், மேட்டுர் வட்டம்,  
சேலம் மாவட்டம்.

**நாள் :** 15.02.2020 காலை 10.30 மணிக்கு.

மேற்கொண்ட பொருள் தொடர்பான பொதுகலந்தாய்வு  
கூட்டத்தில் கலந்து கொள்ளுமாறு அன்புடன் அழைக்கிறோம்.

*Effumim*  
13/2/2020.  
கோட்டபொறியாளர்(நெ)  
தமிழ்நாடு சாலை மேம்பாட்டுத் திட்டம் (II).  
சேலம்.

## Annexure -7

### SPECIFICATION REPORT TO ACCOMPANY THE REALIGNMENT PROPOSAL FOR CONSTRUCTION OF ROB IN LIEU OF LC NO. 10 BETWEEN OMALUR AND MECHERI ROAD RAILWAY STATIONS ALONG THE ROAD SH 222 AT OMALUR

#### **NAME OF WORK:**

Consulting services for Updation/Preparation of DPR for various road improvement works under Tamil Nadu Road Sector Project - II (TNRSP-II) PPC06: Omalur to Mecheri Road Section of SH 222.

#### **AUTHORITY AND NAME OF THE SCHEME:**

TamilNadu Road Sector Project -II.

#### **LOCATION:**

Construction of ROB in lieu of LC no. 10 between Omalur and Mecheri road railway stations along the road SH 222 at Omalur

#### **EXISTING DETAILS:**

Existing Road starts from km 0/000 of SH-222. Alignment is crossing railway track at existing km. 0/250. Existing carriageway width is 7m with 1.0m earthen shoulder.

#### **NECESSITY:**

Near start Point of Project road near Omalur, existing road is crossing Railway track at existing km 0/250. Provision of ROB along the existing road leads to inadequate approaches length since the approach length available is about 250m only instead of 400m to 500m. Hence it is necessary to have realignment for the ROB with minimum approach length of 500m on either side.



Built up at start point at km 0/000 of SH  
222



Railway level crossing at km 0/250 of SH  
222

#### **ALIGNMENT STUDY**

##### **Right of way**

During the preliminary field Reconnaissance, the existing right of way along the project road was measured at regular intervals and it varies from 15.00m to 18.00m. The available right of way does not accommodate 4-lane wide road as per standards. Therefore, acquisition of additional land could be unavoidable, since the available ROW

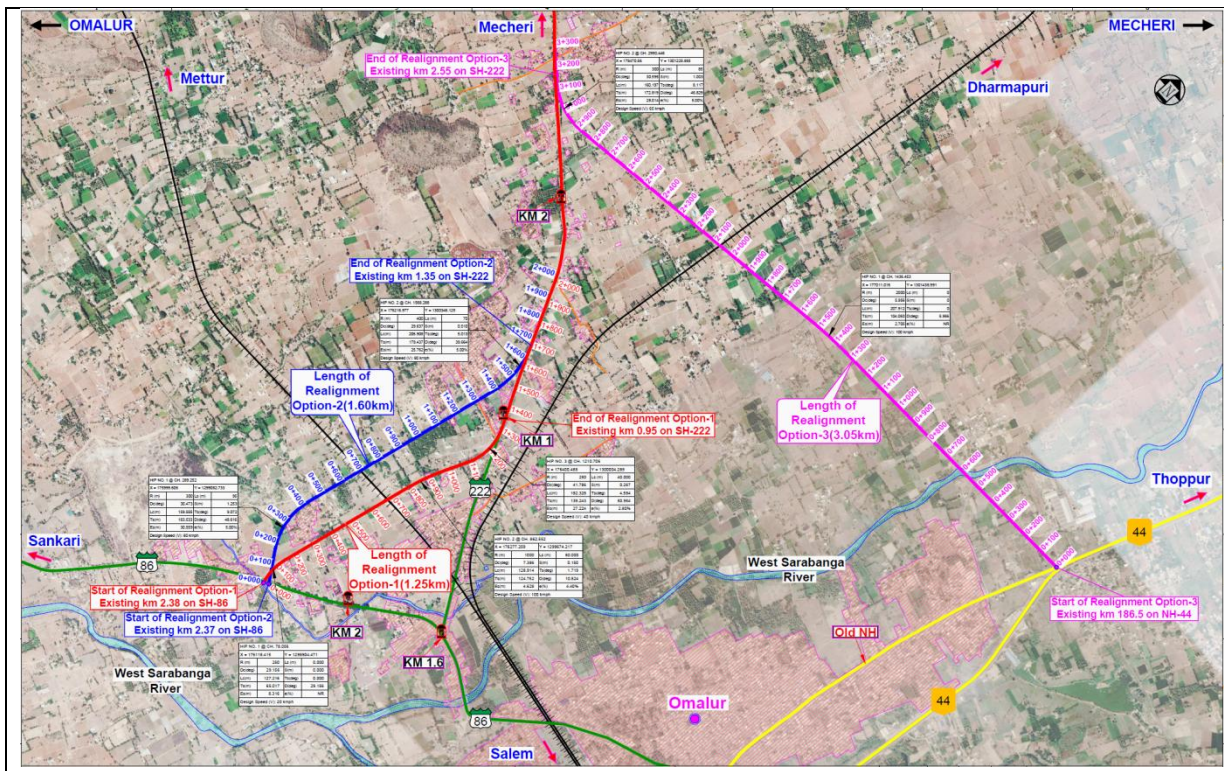
will not be adequate enough for providing 4 lane with/without paved shoulder configuration as per the requirement of IRC SP 84 - 2019.

### Existing Traffic Pattern

A mixed variety of traffic pattern is observed along the project road which mainly comprises of 2-wheelers, cars, Buses, LCVs, Mini Buses, Vans, Trucks, etc. as the existing route will be majorly used by traffic plying between Salem to Mettur and partially by traffic plying between, Salem to Thoppur and Thoppur to Sankagiri. Traffic congestion is observed at railway level crossing due to bottle neck at level crossing and frequent closure of the same.

### REALIGNMENT PROPOSAL

To avoid acquisition of buildings and to provide smooth flow of traffic, realignment options connecting SH-86 and SH-222, NH-44 and SH-222 are explored and details are given below.



### REALIGNMENT OPTION 1: (LHS) -MARKED IN RED COLOUR

- i. The Realignment starts at existing km 2/450 of SH - 86 and ends at km 0/950 of SH - 222 near Pachanamapatty village with a total length of 1.3km.
- ii. Realignment passes through Agricultural fields and Scattered built up.
- iii. Design speed of proposed realignment is between 80 to 100 kmph
- iv. Along the realignment, 2 nos. of curves have been proposed.
- v. In this Alignment, 4 culverts have been proposed.
- vi. Along the realignment portion 2 Major and 2 Minor Junctions have been proposed.

- vii. The proposed realignment crosses Railway Line at Km 0+690 (Proposed realignment Chainage) between Omalur and Mecheri road railway stations, where 4 lane ROB with slip road is proposed.
- viii. Due to scattered built up 25nos of structures are getting affected along the proposed road. (12nos RCC buildings, 4 nos sheet, 2 nos Tiled buildings, 4 nos Huts, 2 nos pump house, 2 nos open wells and one temple)
- ix. Realignment involves land acquisition to accommodate 45/50m ROW. Total area of proposed land to be acquired is Approx. 6.99 Ha.
- x. Realignment is proposed with Four Lane with paved shoulders configuration as per standards.

Geometric features of the realignment are given below,

S.No	Description	Feature Details
1	Total Length of the realignment	1.3 km
2	Design Speed adopted	80-100 kmph
3	Minimum Radius Proposed	250m
4	Number of Curves Proposed	2 nos
5	Maximum Vertical Gradient adopted	2.5% in ROB Approach
6	Vertical Sight Distance adopted	SSD/ISD
7	CD Structures	4 Culverts
8	Railway Crossings	1 no

- The alignment starts with a straight from Ch 0+000 (Ex km. 2.450 of SH 86) upto Ch 0+756.
- After Ch. 0+756 it takes curve towards right side with a radius of 1000m with 60m transition length for a design speed of 100kmph and ends at Ch. 1+004
- After Ch 1+004, the alignment takes straight and ends at Ch 1+042.
- After Ch 1+042 the alignment takes curve towards left side with a radius of 250m with 90m transition length for a design speed of 80kmph and ends at Ch. 1+357.

**Proposed Curve Details for Option 1- Red colour:**

S.No	Chainage	Curve Details
	Ch 0+000 to 0+756	<b>Straight Portion</b>
		<b>Curve No 1</b>
		Def. Angle = 7.27
		Radius = 1000m
		Speed =100kmph
		HIP Chainage = 0+880
		Curve Length = 127.820m
		Transition Length =60m
		Shift =0.15m
1	From Ch 0+756 to Ch 1+004	
2	Ch 1+004 to Ch 1+042	<b>Straight Portion</b>
		<b>Curve No 2</b>
		Def. Angle = 30.93
		Radius = 250m
		Speed =80kmph
		HIP Chainage = 1+199
		Curve Length = 135.108m
3	From Ch 1+042 to Ch 1+357	

S.No	Chainage	Curve Details
		Transition Length =90m
		Shift = 1.35m

#### Railway Crossings:

S. No	Chainage, Km	RUB/ROB	Remarks
1	1+690	ROB	ROB with Slip roads

#### Road Crossings:

S. No	Chainage	Type of Intersection	Cross Road Leads to	
			LHS	RHS
1	0+000	T	Sankagiri	Omalur
2	0+300	+	Village	Omalur
3	0+450	+	Village	Omalur
4	1+260	T	Mecheri	Omalur

#### REALIGNMENT OPTION 2: (LHS) -MARKED IN BLUE COLOUR

- i. The realignment option starts at existing km 2/370 of SH 86 and ends at km 1/350 of SH - 222 near Pachanamapatty village with the total length of 1.66 km.
- ii. Realignment passes through Agricultural fields and Scattered built up.
- iii. Design speed of proposed alignment is 100 kmph.
- iv. Along the realignment, 2 nos. of curves have been proposed.
- v. In this realignment, 4 culverts and 1 minor bridge with length 40m have been proposed.
- vi. Along the realignment portion 2 nos Major and 2 nos Minor Junctions has been proposed.
- vii. The proposed realignment crosses Railway Line at Km 0/700 (Proposed realignment Chainage) between Omalur and Mecheri road railway stations, where 4 lane ROB with slip road is proposed.
- viii. Due to scattered built up 16nos of structures are getting affected along the proposed road. (2 nos RCC Buildings, 6 nos sheet, 8 nos Tiled buildings, one grave yard, one pump house, 2 nos open wells)
- ix. Proposed realignment crosses the edge of pond for a length of 40m, Minor Bridge has been proposed.
- x. Realignment involves land acquisition to accommodate 45/50m ROW. Total area of proposed land to be acquired is Approx. 8.77 Ha.
- xi. Realignment is proposed with Four Lane with paved shoulders configuration as per standards.

Geometric features of the realignment are given below,

S.No	Description	Feature Details
1	Total Length of the realignment	1.66 km
2	Design Speed adopted	100 kmph

S.No	Description	Feature Details
3	Minimum Radius Proposed	400m
4	Number of Curves Proposed	2 nos
5	Maximum Vertical Gradient adopted	2.5% in ROB Approach
6	Vertical Sight Distance adopted	SSD/ISD
7	CD Structures	4 Culverts, 1 minor bridge
8	Railway Crossings	1 no.

- The alignment starts with a straight from Ch 0+000 (Ex. km. 2.370 of SH 86) upto Ch 0+115.
- After Ch. 0+115 it takes curve towards right side with a radius of 400m with 120m transition length for a design speed of 100kmph and ends at Ch. 0+595
- After Ch 0+595, the alignment takes straight and ends at Ch 1+306.
- After Ch 1+306 the alignment takes curve towards left side with a radius of 450m with 105m transition length for a design speed of 100kmph and ends at Ch. 1+736.

**Proposed Curve Details for Option 2- Blue colour:**

S.No	Chainage	Curve Details
1	From Ch 0+000 to Ch 0+115	<b>Straight Portion</b>
2	From Ch 0+115 to Ch 0+595	<b>Curve No 1</b>
		Def.Angle = 34.32 <sup>0</sup>
		Radius = 400m
		Speed =100kmph
		HIP Chainage = 0+355
		Curve Length = 239.971m
		Transition Length =120m
Shift = 1.5m		
3	From Ch 0+595 to Ch 1+306	<b>Straight Portion</b>
4	From Ch 1+306 to Ch 1+736	<b>Curve No 2</b>
		Def.Angle = 28.07 <sup>0</sup>
		Radius = 450m
		Speed =100kmph
		HIP Chainage = 1+521
		Curve Length = 220.61m
		Transition Length =105m
Shift = 1.02m		

**Railway Crossings:**

S. No	Chainage	RUB/ROB	Remarks
1	1+700	ROB	ROB with Slip roads

**Road Crossings:**

S.No	Chainage	Type of Intersection	Cross Road Leads to	
			LHS	RHS
1	0+000	T	Sankagiri	Omalur
2	0+440	+	Village	Omalur
3	1+310	+	Pachanampatty	Omalur
4	1+550	+	Mecheri	Omalur

**REALIGNMENT OPTION 3: (RHS) -MARKED IN MAGENTA COLOUR**

- i. The realignment option starts at existing km 186/500 of NH 44 and ends at Km 2/550 of SH - 222 near Karupanampatti with the total length of 3.05 km.
- ii. Realignment passes through Agricultural fields and Scattered built up.
- iii. Design speed of proposed realignment is 65-100 kmph.
- iv. Along the realignment, 2 nos. of curves has been proposed.
- v. In this realignment, 15 culverts, 1 major bridge cum VUP have been proposed
- vi. Along the realignment portion 03 nos Major and one Minor Junctions have been proposed.
- vii. The proposed realignment crosses Railway Line at Km 2/065 (Proposed realignment Chainage) between Omalur and Semmandampatti railway stations, where 4 lane ROB with slip road is proposed
- viii. Due to scattered built up apprx.29nos of structures are getting affected along the proposed road. (9 nos RCC Buildings, 3 nos sheet, 7 nos Tiled buildings, 8 nos huts, 2 nos pump house, 4 nos open wells)
- ix. Realignment involves land acquisition to accommodate 45/50m ROW. Total area of proposed land to be acquired is Apprx.15.65 Ha.
- x. Realignment is proposed with Four Lane with paved shoulders configuration as per standards.

Geometric features of the realignment are given below,

S.No	Description	Feature Details
1	Total Length of the realignment	3.05 km
2	Design Speed adopted	65-100 kmph
3	Minimum Radius Proposed	300m
4	Number of Curves Proposed	2 nos
5	Maximum Vertical Gradient adopted	2.5% in ROB Approach
6	Vertical Sight Distance adopted	Intermediate Sight Distance
7	CD Structures	15 Culverts, 1 major Bridge
8	Railway Crossings	1 no

- The alignment starts with a straight from Ch 0+000 (km 186/500 of SH-86) upto Ch 1+332
- After CH 1+332 alignment takes curve towards left side with a radius of 2000m with a design speed of 100 kmph and ends at Ch 1+540.

- After Ch 1+540, the alignment takes straight and ends at Ch 2+835.
- After Ch 2+835 the alignment takes curve towards right side with a radius of 300m with 85m transition length for a design speed of 65kmph and ends at Ch 3+050 (Ex km 2/550 of SH-222)

**Proposed Curve Details for Option 3 - Blue colour:**

S.No	Chainage	Curve Details
1	From Ch 0+000 to Ch 1+332	<b>Straight Portion</b>
2	From Ch 1+332 to Ch 1+540	<b>Curve No 1</b>
		Def.Angle = 5.956
		Radius = 2000m
		Speed =100kmph
		HIP Chainage = 1+436
		Curve Length = 207.912m
		Transition Length =0m
3	From Ch 1+540 to Ch 2+835	<b>Straight Portion</b>
4	From Ch 2+835 to Ch 3+05	<b>Curve No 2</b>
		Def.Angle = 30.595
		Radius = 300m
		Speed =65kmph
		HIP Chainage = 2+990
		Curve Length = 160.197m
		Transition Length =85m
	Shift = 1.003m	

**Railway Crossings:**

S. No	Chainage	RUB/ROB	Remarks
1	2+065	ROB	ROB with Slip roads

**Road Crossings:**

S.No	Chainage	Type of Intersection	Cross Road Leads to	
			LHS	RHS
1	0+000	T	Omalur	Dharmapuri
2	0+530	+	Omalur	Thathayampatti
3	1+550	+	Omalur	Thathayampatti
4	3+010	T	Omalur	Mecheri

**COMPARATIVE STATEMENT**

Sl.No	Description	Option 1	Option 2	Option 3
1	Realignment Color	Red	Blue	Magenta
2	Proposed Length	1.30 km	1.66 km	3.05 km
3	Existing Length along SH-222	0.95 Km	1.35 km	2.55 km
4	Proposed ROW	45/50 m	45/50 m	45/50 m
5	Existing ROW	15 to 20m	15 to 20 m	15 to 25m
6	Realignment proposed on	LHS	LHS	RHS



Sl.No	Description	Option 1	Option 2	Option 3
7	Land Passes through	Agricultural land and scattered built up	Agricultural land and scattered built up	Agricultural land and scattered built up
8	Starting & Ending Location	Start Km- 2/450 of SH 86	Start Km- 2/370 of SH 86	Start Km 186.500 of NH 44
		End Km - 0/950 of SH 222	End Km- 1/350 of SH 222	End Km- 2.550 of SH 222
9	Proposed Chainage	Start Km- 0+000 (SH222)	Start Km- 0+000 (SH222)	Start Km- 0+000 (SH222)
		End Km - 1+300 (SH 222)	End Km - 1+660 (SH 222)	End Km - 3+050 (SH 222)
10	Number of Existing curves	1Nos.	1 Nos.	2 Nos.
11	Existing Speed (Kmph)	20 to 100	20 to 100	20 to 100
12	Number of Proposed curves	2 Nos.	2 Nos.	2 Nos.
13	Proposed Speed (Kmph)	80 to 100	100	65 to 100
14	Number of CD Structures	4 Culverts	4 Culverts 1 Minor Bridge	15 Culverts 1 Major Bridge
15	Number of Building affected	25 Nos.	16 Nos.	29 Nos.
16	Number of Major/Minor Junctions	Major - 2 Minor - 2	Major - 2 Minor - 2	Major - 3 Minor - 1
17	Number of ROB/RUB	1 ROB	1 ROB	1 ROB
18	Environmental Impacts	Water Bodies	Nil	1 Nos - Pond (40m)
		Wildlife/Bird Sanctuary	Nil	Nil
		Reserve Forest	Nil	Nil
19	Social Impacts	Land Acquisition Approximately	6.99 Hectares	8.77 Hectares
				15.65 Hectares

**MERITS AND DEMERITS OF PROPOSED REALIGNMENT  
REALIGNMENT PROPOSAL NO-1 MARKED IN RED COLOUR**

**Merits:**

1. Provides better connectivity and smooth passage to through traffic and trucks.
2. Length of Alignment is comparatively less, Extent of Land Acquisition is less
3. Project cost is comparatively less
4. ROB is proposed across railway line which eases the movement of traffic

**Demerits:**

1. 25 no's of Buildings are getting affected due to scattered built up

#### **REALIGNMENT PROPOSAL NO-2 MARKED IN BLUE COLOUR**

##### **Merits:**

1. Provides better connectivity and smooth passage to through traffic and trucks.
2. Less number of buildings are getting affected compared to other options
3. ROB is proposed across railway line which eases the movement of traffic

##### **Demerits:**

1. 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.
2. Alignment affecting Grave yard, Social impact will be high
3. Length of alignment is high compared to option 1, Civil cost and LA cost is more.

#### **REALIGNMENT PROPOSAL NO-3 MARKED IN MAGENTA COLOUR**

##### **Merits:**

1. Provides better connectivity and smooth passage to through traffic and trucks.
2. ROB is proposed across railway line which eases the movement of traffic
3. Direct Connectivity to NH-44 traffic, Thus through traffic is avoided entering Omalur town

##### **Demerits:**

1. Length of Alignment is more compared to other two options. Hence LA cost and Project Cost is High
2. As the alignment passes through highly cultivated farms involves acquisition of large extent of highly fertile farm land.
3. 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.
4. More number CD Structures are required

##### **CONCLUSION:**

Comparing the Merits and Demerits of the above three alignments, Alignment No 1 Marked in **RED** colour is approved.

## Annexure -8

### Land Area Available for Compensatory Plantation

Land available between PROW and EROW (Area extracted from Topo where PROW is within the EROW and minimum gap of 2 m is available)

#### 1. Omalur - Mecheri Road

Sl. No	LHS / RHS	Ex. Chainage (From)	Ex. Chainage (To)	Area of land available (Sq.m)
1	LHS	2.060	2.500	2045
2	RHS	2.060	2.200	300
			<b>Total</b>	<b>2345</b>

#### 2. Malliyakarai - Attur Road

Sl. No.	LHS / RHS	Ex. Chainage (From)	Ex. Chainage (To)	Area of land available (Sq.m)
1	LHS	81.560	81.960	4461
2	RHS	81.560	81.920	2238
3	LHS	82.040	82.265	348.283
4	RHS	82.040	82.265	751.01
5	RHS	82.310	82.470	855.148
6	LHS	82.330	82.600	2521.254
7	LHS	82.645	82.750	375.748
8	RHS	82.645	82.770	473.979
9	LHS	82.770	82.860	1020.999
10	RHS	82.860	82.960	327.183
11	LHS	83.310	83.450	736.944
12	RHS	84.025	84.285	1168.09
13	LHS	83.885	84.275	3376.196
14	RHS	84.515	84.625	690.681
15	RHS	84.655	84.760	682.062
16	RHS	84.825	84.960	544.667
17	LHS	84.920	85.480	3234.974
18	RHS	85.140	85.260	432.721
19	LHS	85.520	85.580	156.232
20	LHS	85.780	86.000	773.05
21	RHS	85.850	85.900	111.672
22	RHS	86.000	86.460	4550.153
23	LHS	86.355	86.495	378.585
24	RHS	86.720	86.820	891.672
25	LHS	86.820	87.040	844.412
26	RHS	87.040	87.200	1014.068
27	RHS	87.410	87.450	94.657
28	LHS	87.470	87.560	250.246
29	RHS	87.540	87.680	527.306
30	LHS	87.690	87.740	140.15
31	LHS	88.175	88.410	1075.677
32	LHS	88.485	88.645	505.859
33	RHS	88.675	88.950	778.716

Sl. No.	LHS / RHS	Ex. Chainage (From)	Ex. Chainage (To)	Area of land available (Sq.m)
34	LHS	88.730	88.770	220.398
35	LHS	88.890	89.025	411.088
36	RHS	89.115	89.295	1174.023
37	LHS	89.145	90.200	8162.589
38	RHS	90.300	90.360	396.997
			<b>Total</b>	<b>46696.489</b>

### 3. Chithode - Erode Road

Sr No	Existing Chainage, km	Area of land available (Sq.m)		
	From	To	LHS	RHS
1	153.520	153.530		28.6
2	153.530	153.540		49.24
3	153.540	153.550		49.66
4	153.550	153.560		37.63
5	153.560	153.570		26.86
6	153.580	153.590	20.37	
7	153.590	153.600	21.72	
8	153.600	153.610	22.44	
9	153.610	153.620	22.45	
10	153.620	153.630	22.46	
11	153.630	153.640	22.47	
12	153.640	153.650	22.48	20.83
13	153.650	153.660	22.49	24.01
14	153.660	153.670	22.5	27.18
15	153.670	153.680	22.51	30.36
16	153.680	153.690	22.52	33.54
17	153.690	153.700	22.56	36.69
18	153.700	153.710	22.97	39.44
19	153.710	153.720	24.4	41.18
20	153.720	153.730	27.51	41.35
21	153.730	153.740	32.95	39.37
22	153.740	153.750	41.01	35
23	153.750	153.760	51.72	28.2
24	153.760	153.770	64.86	
25	153.770	153.780	79.79	
26	153.780	153.790	75.6	
27	153.790	153.800	71.67	
28	153.800	153.810	67.84	
29	153.810	153.820	64.01	
30	153.820	153.830	60.18	
31	153.830	153.840	56.35	
32	153.840	153.850	52.51	
33	153.850	153.860	48.68	

Sr No	Existing Chainage,km	Area of land available (Sq.m)		
	From	To	LHS	RHS
34	153.860	153.870	44.85	
35	153.870	153.880	41.02	
36	153.880	153.890	37.18	
37	153.890	153.900	33.35	
38	153.900	153.910	29.5	
39	153.910	153.920	24.74	
40	153.970	153.980	31.33	
41	153.980	153.990	43.33	
42	153.990	154.000	53.34	
43	154.000	154.010	61.38	
44	154.010	154.020	67.48	
45	154.020	154.030	71.65	
46	154.030	154.040	73.92	24
47	154.040	154.050	74.55	27.32
48	154.050	154.060	73.88	31.16
49	154.060	154.070	72.23	35.98
50	154.070	154.080	69.96	41.4
51	154.080	154.090	67.42	46.63
52	154.090	154.100	62.68	44.28
53	154.100	154.110	56.06	41.92
54	154.110	154.120	49.44	39.57
55	154.120	154.130	42.83	37.21
56	154.130	154.140	36.21	34.86
57	154.140	154.150	37.74	32.5
58	154.150	154.160	40.03	30.15
59	154.160	154.170	42.33	33.85
60	154.170	154.180	44.63	38.78
61	154.180	154.190	46.93	43.72
62	154.190	154.200	49.31	48.56
63	154.200	154.210	48.88	52.97
64	154.210	154.220	47.11	56.57
65	154.220	154.230	46.54	59
66	154.230	154.240	47.57	59.89
67	154.240	154.250	48.98	58.92
68	154.250	154.260	49.58	55.73
69	154.260	154.270	52.78	43.84
70	154.270	154.280	58.6	27.87
71	154.280	154.290	67.06	32.8
72	154.290	154.300	63.58	41.44
73	154.300	154.310	51.52	47.65
74	154.310	154.320	42.13	51.46
75	154.320	154.330	35.37	52.87
76	154.330	154.340	31.22	51.89

Sr No	Existing Chainage, km	Area of land available (Sq.m)		
	From	To	LHS	RHS
77	154.340	154.350	29.67	48.52
78	154.350	154.360	28.92	42.94
79	154.360	154.370	28.71	35.49
80	154.370	154.380	30.02	26.5
81	154.380	154.390	32.45	
82	154.390	154.400	35.6	
83	154.400	154.410	39.07	
84	154.410	154.420	42.53	
85	154.420	154.430	45.99	
86	154.430	154.440	49.45	
87	154.440	154.450	52.91	26.24
88	154.450	154.460	56.37	34.98
89	154.460	154.470	59.83	43.72
90	154.470	154.480	63.29	51.47
91	154.480	154.490	66.75	55.25
92	154.490	154.500	70.21	59.04
93	154.500	154.510	62.49	62.82
94	154.510	154.520	49.81	66.6
95	154.520	154.530	37.13	70.39
96	154.530	154.540	24.45	74.17
97	154.540	154.550		77.96
98	154.550	154.560		81.74
99	154.560	154.570		85.52
100	154.570	154.580		89.31
101	154.580	154.590		92.48
102	154.590	154.600		94.87
103	154.600	154.610		97.25
104	154.610	154.620		99.64
105	154.620	154.630		102.02
106	154.630	154.640		104.41
107	154.640	154.650		106.8
108	154.650	154.660		109.18
109	154.660	154.670		111.57
110	154.670	154.680		113.95
111	154.680	154.690		114.07
112	154.690	154.700		100.28
113	154.700	154.710		86.48
114	154.710	154.720		72.69
115	154.720	154.730		62.34
116	154.730	154.740		58.41
117	154.740	154.750		54.47
118	154.750	154.760		50.53
119	154.760	154.770		46.6

Sr No	Existing Chainage,km	Area of land available (Sq.m)		
	From	To	LHS	RHS
120	154.770	154.780		42.66
121	154.780	154.790		38.73
122	154.790	154.800		34.79
123	154.800	154.810		30.85
124	154.810	154.820		26.92
125	154.820	154.830		22.98
126	154.920	154.930	23.86	
127	154.930	154.940	32.08	
128	154.940	154.950	41.49	
129	154.950	154.960	52.8	
130	154.960	154.970	66.76	
131	154.970	154.980	69.84	
132	154.980	154.990	64.43	
133	154.990	155.000	62.04	
134	155.000	155.010	62.66	
135	155.010	155.020	66.29	
136	155.020	155.030	68.47	
137	155.030	155.040	52.58	
138	155.040	155.050	39.81	
139	155.050	155.060	30.08	
140	155.060	155.070	22.98	
141	155.280	155.290		24.13
142	155.290	155.300		45.54
143	155.300	155.310		48.19
144	155.310	155.320		51.81
145	155.320	155.330		40.73
146	155.330	155.340		33
147	155.340	155.350		28.57
148	155.350	155.360		27.41
149	155.360	155.370		29.53
150	155.370	155.380		40.63
151	155.380	155.390		46.76
152	155.390	155.400		34.36
153	155.400	155.410		25.22
154	155.410	155.420	24.1	
155	155.420	155.430	28.07	
156	155.430	155.440	30.87	
157	155.440	155.450	33.12	
158	155.450	155.460	35.28	
159	155.460	155.470	37.44	
160	155.470	155.480	39.61	
161	155.480	155.490	29.28	
162	155.790	155.800	21.63	

Sr No	Existing Chainage, km	Area of land available (Sq.m)		
	From	To	LHS	RHS
163	155.800	155.810	41.73	
164	155.810	155.820	64.64	
165	155.820	155.830	61.83	
166	155.830	155.840	50.8	19.54
167	155.840	155.850	42.43	26.56
168	155.850	155.860	36.59	31.3
169	155.860	155.870	32.7	34.28
170	155.870	155.880	30.08	36.1
171	155.880	155.890	28.08	37.35
172	155.890	155.900	26.17	38.53
173	155.900	155.910	24.26	39.7
174	155.910	155.920	22.35	40.87
175	155.920	155.930	20.45	42.04
176	155.930	155.940		43.21
177	155.940	155.950		44.38
178	155.950	155.960		45.55
179	155.960	155.970		46.72
180	155.970	155.980		47.9
181	155.980	155.990		49.07
182	155.990	156.000		50.24
183	156.000	156.010		51.41
184	156.010	156.020		52.58
185	156.020	156.030		53.75
186	156.030	156.040		49.88
187	156.040	156.050		29.05
188	156.280	156.290	58.25	
189	156.290	156.300	46.37	
190	156.300	156.310	35.53	
191	156.310	156.320	25.73	22.14
192	156.320	156.330		24.64
193	156.330	156.340		26.15
194	156.340	156.350		26.67
195	156.350	156.360		26.21
196	156.360	156.370		24.77
197	156.370	156.380		22.34
198	156.480	156.490	20.1	
199	156.490	156.500	23.18	20.63
200	156.500	156.510	22.23	22.08
201	156.510	156.520	21.28	23.53
202	156.520	156.530	20.33	24.98
203	156.530	156.540		26.43
204	156.540	156.550		27.88
205	156.550	156.560		29.33



Sr No	Existing Chainage, km	Area of land available (Sq.m)		
	From	To	LHS	RHS
206	156.560	156.570		30.78
207	156.570	156.580		27.68
208	156.580	156.590		21.54
209	156.670	156.680	20.36	
210	156.680	156.690	23.75	
211	156.690	156.700	27.15	
212	156.700	156.710	30.54	
213	156.710	156.720	33.93	
214	156.720	156.730	37.33	
215	156.730	156.740	40.72	
216	156.740	156.750	44.11	
217	156.750	156.760	47.51	
218	156.760	156.770	50.9	
219	156.770	156.780	54.29	
220	156.780	156.790	57.69	
221	156.790	156.800	61.08	32.29
222	156.800	156.810	64.47	47.88
223	156.810	156.820	67.87	62.38
224	156.820	156.830	71.26	65.18
225	156.830	156.840	100.66	67.99
226	156.840	156.850	99.21	70.79
227	156.850	156.860	96.17	72.8
228	156.860	156.870	93.13	73.45
229	156.870	156.880	90.09	74.11
230	156.880	156.890	87.05	74.76
231	156.890	156.900	84.01	75.41
232	156.900	156.910	80.97	76.07
233	156.910	156.920	77.93	76.72
234	156.920	156.930	74.89	77.38
235	156.930	156.940	71.85	78.03
236	156.940	156.950	68.81	78.69
237	156.950	156.960	65.77	79.34
238	156.960	156.970	62.73	79.99
239	156.970	156.980	59.66	80.89
240	156.980	156.990	56.4	82.49
241	156.990	157.000	52.95	84.29
242	157.000	157.010	49.3	86.29
243	157.010	157.020	45.44	88.5
244	157.020	157.030	41.39	90.89
245	157.030	157.040	37.27	100.68
246	157.040	157.050	36.45	101.64
247	157.050	157.060	38.69	93.55
248	157.060	157.070	40.93	85.46

Sr No	Existing Chainage, km	Area of land available (Sq.m)		
	From	To	LHS	RHS
249	157.070	157.080	43.17	77.36
250	157.080	157.090	45.41	69.27
251	157.090	157.100	47.65	61.18
252	157.100	157.110	49.89	53.09
253	157.110	157.120	52.13	45
254	157.120	157.130	54.37	36.91
255	157.130	157.140	56.61	28.82
256	157.140	157.150	58.85	20.73
257	157.150	157.160	61.09	
258	157.160	157.170	63.33	
259	157.170	157.180	63.92	
260	157.180	157.190	63.34	
261	157.190	157.200	62.76	22.65
262	157.200	157.210	62.18	32.17
263	157.210	157.220	61.6	41.69
264	157.220	157.230	61.01	51.21
265	157.230	157.240	60.43	50.22
266	157.240	157.250	59.85	49.06
267	157.250	157.260	59.27	47.89
268	157.260	157.270	58.69	46.72
269	157.270	157.280	58.11	45.55
270	157.280	157.290	57.53	44.39
271	157.290	157.300	56.95	43.22
272	157.300	157.310	56.37	42.05
273	157.310	157.320	55.78	40.88
274	157.320	157.330	55.2	39.72
275	157.330	157.340	54.62	38.55
276	157.340	157.350	54.04	37.38
277	157.350	157.360	50.57	36.21
278	157.360	157.370	47.57	34.2
279	157.370	157.380	46.83	27.09
280	157.380	157.390	46.08	19.99
281	157.390	157.400	45.33	
282	157.400	157.410	44.58	
283	157.410	157.420	43.83	
284	157.420	157.430	43.08	
285	157.430	157.440	42.33	
286	157.440	157.450	41.58	
287	157.450	157.460	40.83	
288	157.460	157.470	40.08	
289	157.470	157.480	39.33	
290	157.480	157.490	38.59	
291	157.490	157.500	37.84	20.99

Sr No	Existing Chainage, km	Area of land available (Sq.m)		
	From	To	LHS	RHS
292	157.500	157.510	37.11	32.64
293	157.510	157.520	36.6	31.69
294	157.520	157.530	36.09	24.7
295	157.530	157.540	35.58	
296	157.540	157.550	35.07	
297	157.550	157.560	34.56	
298	157.560	157.570	34.05	
299	157.570	157.580	33.54	
300	157.580	157.590	33.03	
301	157.590	157.600	32.53	
302	157.600	157.610	32.02	
303	157.610	157.620	31.51	
304	157.620	157.630	31	19.91
305	157.630	157.640	30.49	20.32
306	157.640	157.650	29.98	20.74
307	157.650	157.660	29.47	21.16
308	157.660	157.670	28.96	21.57
309	157.670	157.680	28.45	21.99
310	157.680	157.690	27.94	22.41
311	157.690	157.700	27.43	22.82
312	157.700	157.710	27.23	23.24
313	157.710	157.720	27.44	23.66
314	157.720	157.730	27.65	24.07
315	157.730	157.740	27.85	23.72
316	157.740	157.750	30.73	22.44
317	157.750	157.760	33.87	21.16
318	157.760	157.770	37.01	19.88
319	157.770	157.780	40.14	
320	157.780	157.790	43.28	
321	157.790	157.800	46.62	26.35
322	157.800	157.810	50.15	29.82
323	157.810	157.820	53.69	32.92
324	157.820	157.830	57.22	36.03
325	157.830	157.840	60.75	39.13
326	157.840	157.850	64.29	42.23
327	157.850	157.860	67.82	45.34
328	157.860	157.870	71.35	48.45
329	157.870	157.880	74.53	51.9
330	157.880	157.890	77.21	55.87
331	157.890	157.900	79.4	49.13
332	157.900	157.910	81.09	41.81
333	157.910	157.920	83.21	34.99
334	157.920	157.930	85.02	28.69

Sr No	Existing Chainage, km	Area of land available (Sq.m)		
	From	To	LHS	RHS
335	157.930	157.940	86.34	27.14
336	157.940	157.950	87.16	26.1
337	157.950	157.960	87.5	25.57
338	157.960	157.970	87.65	25.23
339	157.970	157.980	83.98	24.88
340	157.980	157.990	73.66	24.53
341	157.990	158.000	63.34	24.19
342	158.000	158.010	53.03	23.84
343	158.010	158.020	42.73	23.45
344	158.020	158.030	32.84	22.56
345	158.030	158.040	24.05	20.56
346	158.090	158.100	29.69	
347	158.100	158.110	51.58	
348	158.110	158.120	77.21	
349	158.120	158.130	79.56	
350	158.130	158.140	62.6	
351	158.140	158.150	49.2	
352	158.150	158.160	39.29	
353	158.160	158.170	32.66	
354	158.170	158.180	28.64	
355	158.180	158.190	26.51	
356	158.190	158.200	25.58	
357	158.200	158.210	25.17	
358	158.210	158.220	24.82	
359	158.220	158.230	24.47	
360	158.230	158.240	24.12	
361	158.240	158.250	23.76	
362	158.250	158.260	23.41	
363	158.260	158.270	23.06	
364	158.270	158.280	22.71	
365	158.280	158.290	22.36	
366	158.290	158.300	22.01	
367	158.300	158.310	21.65	
368	158.310	158.320	21.06	
369	158.320	158.330	19.63	
370	158.500	158.510	20.69	
371	158.510	158.520	20.56	
372	158.730	158.740	65.79	
373	158.740	158.750	123.91	
374	158.750	158.760	113.07	
375	158.760	158.770	102.23	
376	158.770	158.780	91.39	
377	158.780	158.790	80.56	

Sr No	Existing Chainage,km	Area of land available (Sq.m)		
	From	To	LHS	RHS
378	158.790	158.800	69.72	
379	158.800	158.810	58.88	
380	158.810	158.820	48.04	
381	158.820	158.830	37.3	27.48
382	158.830	158.840	27.22	41.33
383	158.840	158.850		53.65
384	158.850	158.860		63.86
385	158.860	158.870		71.45
386	158.870	158.880		76.31
387	158.880	158.890		78.47
388	158.890	158.900		77.94
389	158.900	158.910		74.71
390	158.910	158.920	25.09	68.78
391	158.920	158.930	36.34	60.1
392	158.930	158.940	50.67	48.66
393	158.940	158.950	68.13	34.41
394	158.950	158.960	68.65	24.18
395	158.960	158.970	64.58	25.68
396	158.970	158.980	63.03	24.89
397	158.980	158.990	63.27	22.4
398	158.990	159.000	63.26	
399	159.000	159.010	54.63	
400	159.010	159.020	46.08	
401	159.020	159.030	37.52	
402	159.030	159.040	28.97	
403	159.040	159.050	20.41	
404	159.060	159.070		26.32
405	159.070	159.080		35.03
406	159.080	159.090		43.74
407	159.090	159.100		44.04
408	159.100	159.110	19.9	34.32
409	159.110	159.120	20.62	24.61
410	159.120	159.130	21.34	
411	159.130	159.140	22.06	
412	159.140	159.150	22.78	
413	159.150	159.160	23.5	
414	159.160	159.170	24.22	
415	159.170	159.180	24.94	
416	159.180	159.190	25.67	
417	159.190	159.200	26.39	
418	159.200	159.210	27.11	
419	159.210	159.220	25.73	
420	159.260	159.270		23.49

Sr No	Existing Chainage, km	Area of land available (Sq.m)		
	From	To	LHS	RHS
421	159.270	159.280		31.82
422	159.280	159.290		42.25
423	159.290	159.300		54.8
424	159.300	159.310		50.11
425	159.310	159.320		23.22
426	159.350	159.360	22.79	
427	159.360	159.370	28.3	
428	159.370	159.380	33.82	
429	159.380	159.390	40.39	
430	159.390	159.400	49.31	
431	159.400	159.410	52.86	
432	159.410	159.420	54.48	
433	159.420	159.430	55.49	
434	159.430	159.440	54.98	
435	159.440	159.450	52.73	
436	159.450	159.460	47.64	20.17
437	159.460	159.470	39.27	26.45
438	159.470	159.480	27.16	39.09
439	159.480	159.490		50.6
440	159.490	159.500		39.58
441	159.500	159.510		34.04
442	159.510	159.520		28.95
443	159.520	159.530		26.86
444	159.530	159.540		21.36
445	159.570	159.580	29.13	
446	159.580	159.590	59.88	
447	159.590	159.600	90.63	
448	159.600	159.610	139.58	
449	159.610	159.620	142.75	
450	159.620	159.630	122.27	
451	159.630	159.640	104.03	43.91
452	159.640	159.650	89.57	64.97
453	159.650	159.660	81.83	82.5
454	159.660	159.670	79.64	95.29
455	159.670	159.680	78.69	103.51
456	159.680	159.690	65.94	107.27
457	159.690	159.700	58.77	106.62
458	159.700	159.710	57.1	128.26
459	159.710	159.720	60.9	145.51
460	159.720	159.730	70.51	158.49
461	159.730	159.740	86.27	168.83
462	159.740	159.750	102.21	173.99
463	159.750	159.760	108.52	163.9

Sr No	Existing Chainage,km	Area of land available (Sq.m)		
	From	To	LHS	RHS
464	159.760	159.770	115.38	151.41
465	159.770	159.780	121.1	137.04
466	159.780	159.790	126.81	122.68
467	159.790	159.800	132.52	108.31
468	159.800	159.810	138.23	93.94
469	159.810	159.820	143.94	79.57
470	159.820	159.830	149.65	65.2
471	159.830	159.840	155.36	50.83
472	159.840	159.850	161.08	36.46
473	159.850	159.860	166.79	22.1
474	159.860	159.870	167.89	
475	159.870	159.880	163	
476	159.880	159.890	158.11	53.04
477	159.890	159.900	153.2	114.8
478	159.900	159.910	148	100.18
479	159.910	159.920	141.98	86.37
480	159.920	159.930	134.88	73.73
481	159.930	159.940	126.69	62.26
482	159.940	159.950	117.4	51.94
483	159.950	159.960	107	42.78
484	159.960	159.970	95.5	34.76
485	159.970	159.980	82.88	27.89
486	159.980	159.990	69.13	22.16
487	159.990	160.000	66.19	
488	160.000	160.010	62.5	
489	160.010	160.020	57.72	
490	160.020	160.030	51.84	
491	160.030	160.040	44.87	
492	160.040	160.050	36.79	
493	160.050	160.060	35.07	
494	160.060	160.070	50.68	
495	160.070	160.080	65.15	
496	160.080	160.090	78.48	
497	160.090	160.100	90.69	
498	160.100	160.110	101.79	25.24
499	160.110	160.120	111.78	32.6
500	160.120	160.130	120.66	41.11
501	160.130	160.140	128.45	50.76
502	160.140	160.150	135.15	61.58
503	160.150	160.160	140.76	73.55
504	160.160	160.170	130.55	82.67
505	160.170	160.180	93.89	75.97
506	160.180	160.190	55.83	70.42

Sr No	Existing Chainage, km	Area of land available (Sq.m)		
	From	To	LHS	RHS
507	160.190	160.200		65.52
508	160.200	160.210		59.35
509	160.210	160.220		54.32
510	160.220	160.230		50.43
511	160.230	160.240		47.68
512	160.240	160.250		45.94
513	160.250	160.260		44.71
514	160.260	160.270		43.56
515	160.270	160.280		42.41
516	160.280	160.290		41.26
517	160.290	160.300		40.1
518	160.300	160.310		38.95
519	160.310	160.320		37.8
520	160.320	160.330		36.65
521	160.330	160.340		35.5
522	160.340	160.350		34.34
523	160.350	160.360		33.19
524	160.360	160.370		32.04
525	160.370	160.380		30.89
526	160.380	160.390		29.74
527	160.390	160.400		28.58
528	160.400	160.410		27.43
529	160.410	160.420		26.28
530	160.420	160.430		25.13
531	160.430	160.440		23.98
532	160.440	160.450		22.82
533	160.450	160.460		21.67
534	160.460	160.470		20.28
535	160.660	160.670		22.18
536	160.670	160.680		34.84
537	160.680	160.690		50.17
538	160.690	160.700		71.5
539	160.700	160.710		92.83
540	160.710	160.720		114.16
541	160.720	160.730		132.63
542	160.730	160.740		144.93
543	160.740	160.750	21.52	157.22
544	160.750	160.760	24.81	169.52
545	160.760	160.770		181.81
546	160.770	160.780	24.83	194.1
547	160.780	160.790	30.66	170.14
548	160.790	160.800		134.59
549	160.800	160.810		99.19



Sr No	Existing Chainage, km	Area of land available (Sq.m)		
	From	To	LHS	RHS
550	160.810	160.820		63.52
551	160.820	160.830		26.73
552	160.940	160.950		31.99
553	160.950	160.960		46.15
554	160.960	160.970		149.2
555	160.970	160.980		143.78
556	160.980	160.990		103.75
557	160.990	161.000		74.42
558	161.000	161.010		47.47
559	161.010	161.020		27.45
560	161.550	161.560	22.05	
561	161.560	161.570	27.06	
562	161.570	161.580	32.4	
563	161.580	161.590	37.78	
564	161.590	161.600	42.13	
565	161.600	161.610	42.96	
566	161.610	161.620	46.63	
567	161.620	161.625	50.84	
<b>Sub Total</b>			<b>23139.59</b>	<b>19960.56</b>
			<b>Total</b>	<b>43100.15</b>

## Census and Socio Economic Survey Questionnaire

## Tamil Nadu Road Sector Project -II (TNRSP-II)

## PART - I CENSUS SURVEY

Date	Interviewer	Supervisor

## 1. Identification

1.1 Name of Road		Road No	
1.2 District Name			
1.3 Taluk Name			
1.4 Name of Revenue Village			
1.5 Hamlet/Settlement/Location Name			
1.6 Panchayat / Municipality Name			
1.7 Name of head of household		DoB of HH	
1.8 Name of Father / Husband			
1.9 ID Card Type		Pan Card - 1 Family Card - 3 Driving License - 5	Voter ID - 2 Aadhar Card - 4
1.10 ID Card Number			
1.11 Name of the respondent		1.12 Age of Respondent (as on 01.01.2019)	
1.13 Relationship to HH			
1.14 Street Name		1.15 Door No	
1.16 Contact Number (Mobile)			
1.17 Highway Chainage		Existing in km (in 3 decimals)	
1.18 Offset		(from proposed centreline to closest point of structure)	
1.19 Corridor of Impact (Col) (in meters + 2 decimals)		1.20 PRoW (in meters + 2 decimals)	
1.21 Asset No.		1.22 Survey No and Subdivision No	
1.23 Patta No		1.24 Left or Right (increasing chainage)	
1.25 Family size	Total	Male	Female TG
1.26 Occupation of HH		Use the Code given in Q.No.12.9	
1.27 Annual Family Income		Income from all sources	

**2. List of private assets affected (wholly or partly) by proposed project**

2.1 Impact Category		Land – 1, Building – 2, Both - 3		
2.2 Use of structure / property		Residential - 1 Agriculture / Cultivation – 4 None (vacant) – 6	Commercial - 2 *Others (specify.....) – 7	Res & Com - 3 Industrial – 5
2.3 Year of Construction		In completed years		
2.4 Number of years in use		Number of years in occupation of the affected building		
2.5 Type of structure		Permanent - 1 CW – 4	Semi-Perm - 2 Toilet/Shed etc. – 5	Temporary – 3 None - 6
2.6 Tenure		Owner-1 Encroacher-2 Squatter-3 Tenant-4 On HR&CE Land – 5 On Aadheenam/Mutt land – 6 On Wakf land - 7 Kiosk/ Street Vendor- 8 Squatter-Owner - 9 Squatter/Encroacher - Tenant – 10 Employee - 11		
2.7 If occupant is a tenant, then monthly rental paid		Record current monthly rent being paid		
<b>Affected Structure Details</b>		<b>Length (parallel to road)</b>	<b>Breadth (perpendicular to road)</b>	<b>Number of Storeys</b>
2.8 Dimension of Main Building (in m)	Total			
	Affected Portion			
2.9 Dimension of Other Building (in m)	Total			
	Affected Portion			
2.10 Length of Compound Wall		In running meters		
2.11 Extent of Loss	(i) Land	sq.m	(ii) Building	sq,m (iii) %
2.12(a) Is the remaining part of the Structure sufficient to continue to live				Yes – 1 No - 2
2.12(b) Is the remaining part of the Structure sufficient to continue the business/ commercial/ industrial activity				Yes – 1 No - 2
2.13 In case of Loss of land, if the remaining part of land is viable to continue cultivation?				Yes – 1 No - 2
2.14 If No, do you want to surrender the remaining land parcel				Yes – 1 No - 2

**Other affected assets**

2.15 Asset type	Item No.						Compound Wall-1 Hand pump - 2 Open well - 3 Bore well - 4 Tree - 5 Cattle Shed -6 Toilet – 7 Sump-8 Godown/Store room – 9 Septic tank -10 Other (specify) - 11
	Fruit Bearing			Timber			Indicate Number of affected trees
2.16 Tree Classification							
2.17 Do you have legal document to establish ownership of the affected structure						Yes – 1 No – 2	
If YES, specify what							

2.18 Do you have legal document to establish ownership of the affected land		Yes – 1	No – 2
If YES, specify what			
2.19 Name of the Land Owner as per records			
2.20 If different from 1.7 (HH), then relationship to HH			

2.21 Provide an estimate of loss of income due to affected asset / agricultural land	(i) Amount in Rs		(ii) % of Total Income	
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### 3. Overall Impact

3.1 Overall Impact		Major – 1	Minor – 2
3.2 Vulnerability		Yes - 1	No - 2
3.3 If Yes, category		WHH - 1 BPL - 4 Elderly HH – 6	SC - 2 HH with Disabled Member - 5 Minor with no support - 7 ST - 3
3.4 Marginal Farmer / Landless		Yes - 1 (Only for those losing agricultural land)	No - 2
3.5 Settlement Classification		Urban - 1	Rural - 2
3.6 Is affected HH a Tenant		Yes - 1	No - 2
3.7 If Yes, Q.No of Owner			

### 4. Bank Account Details (to be filled ONLY during verification)

4.1 Name as in bank account		Write in BOLD letters
4.2 Account Number		15-digit or 11-digit account number
4.3 Bank Name		
4.4 Branch Name		
4.5 Branch Address		
4.6 Branch IFSC Code		

Signature of the Head of Household or Respondent	
Signature of Interviewer	
Signature of Supervisor	
Signature of Team Leader	

# Tamil Nadu Road Sector Project -II (TNRSP-II)

## PART- II SOCIO-ECONOMIC SURVEY

(to be administered to Major DHs, such as impact to house or shop or agricultural land, irrespective of extent of impact to the structure)

### 5. General Particulars

5.1 Religion		Hindu – 1 Muslim – 2 Christian – 3 Others – 4 (specify)
5.2 Mother tongue		Tamil - 1 Telugu – 2 Kannada – 3 Malayalam – 4 Others – 5 (specify)
5.3 Social Category		OC / General – 1 BC – 2 MBC - 3 SC – 4 ST - 5
5.4 Specify Caste/ Tribe (SC & ST mandatory)		
5.5 Number of years living in this place		completed years
5.6 Have Family Card		Yes, Antyodaya (Green) – 1 Yes, Green – 2 Yes, White – 3 No - 4
5.7 HH Having Voter ID card		Yes - 1 No - 2
5.8 HH having Bank account		Yes - 1 No - 2
5.9 HH having Aadhar Card		Yes - 1 No - 2
5.10 HH having Passport		Yes - 1 No - 2
5.11 HH having PAN Card		Yes - 1 No - 2
5.12 HH having MGNREGA Card		Yes - 1 No - 2

### 6. Affected Business (Commercial) activity

Specify.....(name of shop/business)

6.1 Nature of Business		Hawker – 1 Eatery – 2 Tea stall – 3 Repair/Workshop – 4 Saloon – 5 Petty Shop – 6 Trading – 7 Others. .. - 8	
6.2 No. of partners			
6.3 No. of employees/ family workers	Employee	Family Workers	Excluding the shop owner
6.4 Investment in Business			Initial investment on goods & shop
6.5 Working Capital in Business			Monthly
6.6 Annual Net Income			Total income excluding expenses
6.7 Do you have record of your income			Yes - 1 No – 2 If Yes, Specify Income Tax Returns / Sales Tax Returns / Other
6.8 Is this the primary source of income			Yes - 1 No - 2
6.9 If NO, what is the OTHER Source of Income			Other Annual Income
6.10 Is there any outstanding loan taken for this business		Yes – 1 No - 2	If Yes, How Much

6.11	Name of Employees (not for family members)	Age	Sex	Monthly Salary	No of years working here	Family Size	No. of earning members including self in family
a							
b							
c							
d							
e							

**6B. Affected Building - RENTED OUT (to be asked to the owner of the building rented out)**

6B.1 Use of building		Residential - 1 Godown - 4	Commercial - 2 Industrial - 5	Res & Com - 3
6B.2 Number of units	Residential		Commercial (including godown and industry)	
6B.3 Number of owners / joint holders		Indicate the total number of owners who are entitled for the rental income		
6B.4 Annual Rental Income		From all affected units (buildings)		
6B.5 Is this the primary source of income		Yes - 1	No - 2	
6B.6 If NO, what is the other Source of Income			Other Annual Income	

**7. Cultivation / Agriculture Details (only for those losing agricultural land)**

7.1 Type of Ownership / Possession		Owned by Self - 1 Registered Tenant (Pvt Land) - 3 Registered Tenant (HR&CE Land) - 4 Occupier of Bhoodan Land - 5	Owned Jointly - 2 Assigned Land - 6
7.2 Extent of land owned (total land holding)		In Cents (1 acre = 100 cents; 1 ha = 247 cents)	
7.3 Extent of land proposed for acquisition		In Cents	
7.4 Remaining land in possession		In Cents (include all land holding)	
7.5 Type of land		Dry (Un irrigated) / Rain-fed - 1 Wet (Irrigated) - 2	
7.6 If wet, Source of irrigation		Open Well - 1 Tank - 3	Bore Well - 2 River - 4
7.7 Crops Cultivated		Main	Supplementary
7.8 Number of agricultural labourers working on the land		Those labourers who work in the field and live in the same village/panchayat and not migrant workers	
7.9 If the income from agricultural land is the primary source of income to you		Yes - 1	No - 2
7.10 If NO, what is the other Source of Income			Other Annual Income

**8. Family Income (Household Income from all Sources)**

(Ensure the income declared in Q.No.12 and income provided here should match)

8.1 Income from affected shop/business		Month
8.2 Rental Income from affected shop / commercial building		Month
8.3 Rental Income from affected residential building		Month
8.4 Agricultural Income from affected land		Month
8.5 Income from Livestock in affected land		Month
8.6 All other income		Month

8.7 Total Income		Month
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**9. Expenditure**

9.1 Expenditure on Food		Month
9.2 Expenditure on Education		Month
9.3 Expenditure on Health		Month
9.4 Other Expenditure (Rental, Transportation, etc..)		Month

9.5 Total Monthly Family Expenditure		Month
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**10. Indebtedness**

10.1 Do you have any debt		Yes – 1	No - 2
10.2 Loan outstanding in Banking institutions (in Rs)		10.3 Monthly Rate of Interest	
10.4 Purpose of Bank loan		Agriculture - 1 Medical Exp - 3 House construction / repair – 5 Others (specify) ..... - 7	Business / trade - 2 Wedding / family function - 4 Educational loan - 6
10.5 Private loan outstanding (Money lenders, relatives, etc) (in Rs)		10.6 Monthly Rate of Interest	
10.7 Purpose of Private loan		Agriculture - 1 Medical Exp – 3 House construction / repair - 5 Others (specify) ..... - 7	Business / trade - 2 Wedding / family function - 4 Educational loan - 6
10.8 Asset Pledged (specify)			

11. Household members

11.14 Income per year	Supple mentary									
	Main									
11.13 Physical / Mental disability (if any)										Specify
11.12 Place of work (main activity)										Same village/town - 1 Other (specify) - 2
11.11 Why no activity in last year (if 11.9 answer is 13 or 14)										Work not available-1      Lack of skill-5 Old age-2                      Student-6 Invalid / Handicapped-3      Housewife-7 Child-4                              Others-8
11.10 Supplementary activity in last year										Petty / Tea shop-1      Casual labourer-9 Eatery-2                      Cultivator-10 Repair/Spare part-3      Agricultural labourer-11 Business / Trade -4      Livestock / dairy - 12 Self employed - 5      Unemployed-13 Salaried / Pension- 6      Not in workforce-14 Professional-7 Industrial worker- 8
11.9 Main activity in last year										
11.8 If <18 years										Currently studying - 1 Discontinued - 2
11.7 Educational Qualification										Up to 5 <sup>th</sup> - 1      Graduate - 6 6 <sup>th</sup> - 8 <sup>th</sup> - 2      Post Graduate - 7 9 <sup>th</sup> - 10 <sup>th</sup> - 3      None - 8 11 <sup>th</sup> - 12 <sup>th</sup> - 4 Diploma/ITI - 5
11.6 Literacy										Can read and write-1 Cannot read and write-2
11.5 Marital status										Married-1                      Separated-3 Unmarried-2                      Widowed-4
11.4 Age										Completed Years (less than 1 year old child will be 0)
11.3 Sex										Male-1 Female-2, TG-3
11.2 Relationship to H of household		1								Spouse-2                      Parent-7 Son/Daughter-3                      Grand Child-8 Son/Daughter in law-4                      Other rel-9 Brother/Sister-5                      Other non rel-10 Brother/Sister in law-6
11.1 Names of family members										
		HH	2	3	4	5	6	7	8	



## 12. Health and Sanitation

12.1 Was any member of your family affected by serious disease in the last 1-year		Yes – 1	No - 2 (if No, go to 12.4)
If Yes, Who was affected		Disease	
12.2 Where did you take treatment		Govt Hospital - 1 Traditional healing-3 Did not take treatment-5	Private Clinic-2 Medical shop-4
12.3 Was the treatment covered through health Insurance		Yes, TN Govt Health Insurance – 1 Yes, Private Health Insurance – 2	No - 3
12.4 Have you heard of HIV AIDS		Yes – 1	No - 2
<b>If YES</b>			
12.5 Do you know how it spreads		Yes – 1	No – 2
12.6 Are you aware of AIDS prevention methods		Yes -1	No - 2
12.7 If Yes, what was the source of information		Print Media-1 Govt Campaign-4 Other (specify) - 6	Radio-2 TV-3

## 13. Economic indicators (house where the DP is living)

13.1 Roof type of the house (currently living)		Thatched –1	Tiled - 2	Concrete - 3
13.2 Wall type of the house		Thatched / Wooden / Tin - 1	Mud - 2	Brick – 3
13.3 Ownership of the house		Own - 1	Rented - 2	
13.4 Do you have a separate kitchen		Yes -1	No - 2	
13.5 Do you have a toilet		Yes -1	No - 2	
13.6 Do you have a bathroom		Yes -1	No - 2	
13.7 Do you have electricity connection		Yes -1	No - 2	
13.8 Access to drinking water		HSC – 1 Own bore/open well-3 Pond/Lake - 5	Public tap/Hand pump – 2 Common well – 4 Other (specify) - 6	
13.9 Fuel for Cooking		LPG Gas - 1 Firewood - 4	Gobar Gas - 2 Others (specify) - 5	Kerosene-3
13.10 How long have you been staying in this house		In completed years. If less than one year indicate it as '0'		

Do you have the following

13.11 TV		Yes-1	No -2
13.12 Fridge		Yes-1	No -2
13.13 Washing Machine		Yes-1	No -2
13.14 Cycle		Yes-1	No -2
13.15 Motor Cycles / Moped		Yes-1	No -2
13.16 Car		Yes-1	No -2
13.17 Truck / Lorry		Yes-1	No -2
13.18 Telephone		Yes-1	No -2

13.19 Mobile phone		Yes -1	No - 2
13.20 Cow		Number	
13.21 Buffalo		Number	
13.22 Goat / Sheep		Number	
13.23 Cart		Yes -1	No - 2
13.24 Tractor		Yes -1	No - 2

#### 14. Gender Aspects

14.1 Is the lady of the household / Female member involve in financial decisions of the household		Yes - 1	No - 2
14.2 Who fetches drinking water for the house		Lady of the house - 1	Girl child - 2 Other (specify) - 3.....
14.3 Do they have to cross the road to fetch water		Yes - 1	No - 2
14.4 Wages per day	Male		Female
14.5 Where did the last child-delivery take place		Govt Hospital - 1	Private Hospital - 2 Midwife at home - 3
		Other - 5 (specify).....	Village elder at Home - 4
14.6 Does the women have title for land or house			
(i) Land		Yes - 1	No - 2
(ii) House		Yes - 1	No - 2
(iii) Others (specify)		Yes - 1	No - 2
14.7 Does the women of the household possess a vehicle		Yes, Car of her own - 1	Yes, two-wheeler of her own- 2 Yes, access to family car / two wheeler -3 No - 4
14.8 Problems faced by the women / girl child of the household with the existing road (THREE most important)		Bad Road Condition -1	Shortage of public transport - 2
		Insufficient number of traffic signs - 3	Traffic jams - 4
		Safety - 5	Inadequate petrol bunks - 6
		Lack of Toilet - 7	Lack of Toilet separate for women - 8
		Lack of Facility for women with children - 9	Lack of Bus shelter - 10
14.9 How does women in the family commute to market / work / hospital etc.		Own cycle - 1	Own Car - 2
		Own 2-wheeler - 3	Family Car/2-wheeler-4
		Walk - 5	Public transport - 6
		Other mode .....	- 7

#### 15. Perceived Benefits / Impacts

15.1 Benefits (three most important)				Increased transport facility - 1 Access to employment - 2 Access to markets - 3 Access to health care - 4 Reduced travel time - 5 Lesser accidents / safety - 6 Increase in land value - 7 Other (specify) - 8.....
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15.2 Negative impacts			Loss of asset / structure to people - 1 Accidents due to high speed – 2 Noise/Air pollution – 3 Road crossing difficulty - 4 Other (specify) - 5.....
15.3 How does your family generally commute to Market / Hospital / Work (if outside the place of living).		Public / Pvt buses - 1 Taxi - 3 Motor cycle - 5 Walk - 7	Private share auto - 2 Own car - 4 Cycle - 6 Others – 8 (specify).....
15.4 How do you think women will affect or benefit differently from the project			

**16. Resettlement Preferences**

<b>Due to improvements proposed, if your shop / house / land is affected and you have to relocate, and if the government proposes to provide assistance, what would be your preference</b>			
16.1 Relocation Options		Self managed - Cash assistance-1 Project constructed - House/Shop - 2 Undecided - 3 Other (specify) - 4 .....	
16.2 If project constructed, preferred location		Same settlement – 1    Anywhere - 2 Other (specify) - 3 .....	
16.3 Do you want the unviable remaining land / building also to be acquired by the project	Land		Yes - 1    No - 2    NA - 3
	House/Structure		Yes - 1    No - 2    NA - 3

**17. If Tenant, Name, address and phone number of the Owner**

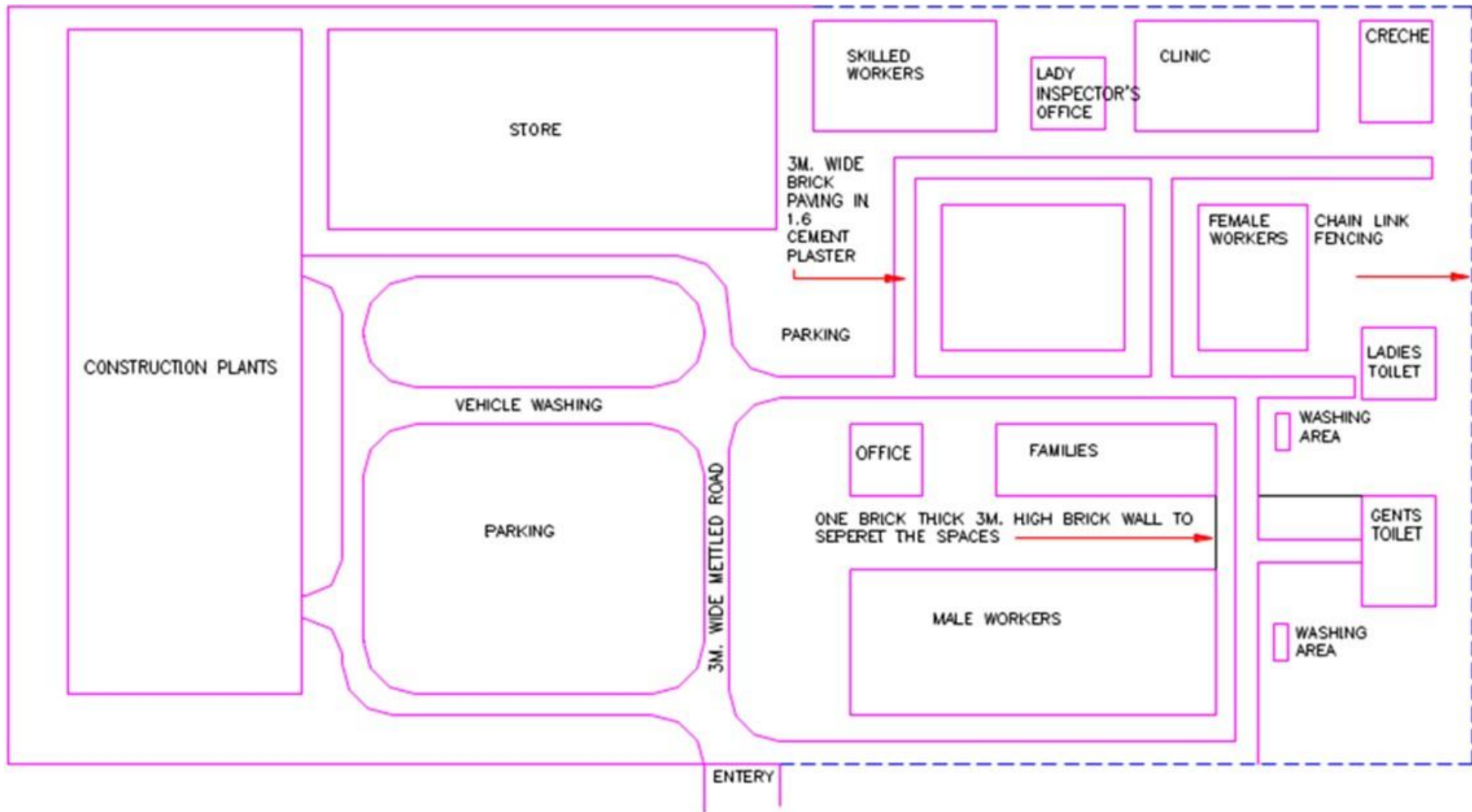
<b>Name</b>			
<b>Address</b>			
<b>Contact Details</b>	<b>Ph:</b>		
	<b>Email:</b>		

18 Do you think that the project should create/improve missing or deficient basic amenities in your settlement		Yes - 1	No - 2
	<b>If Yes Specify</b>		

**19. Any other information which DP wants to share which is not covered in the questionnaire**

Signature of the Head of Household or Respondent	
Signature of Interviewer	
Signature of Supervisor	
Signature of Team Leader	

Schematic Drawing of Construction Camp





**Environmental Monitoring Formats**

**Format EM1: Selection of disposal site locations**

From \_\_\_\_\_ To \_\_\_\_\_

(Give chainage and nearest settlements from both ends)

Criteria on which information for each site is to be collected	Site 1	Site 2	Site 3	Site 4
Area covered (m <sup>2</sup> )				
Total Material that can be dumped within the site (m <sup>3</sup> )				
Depth to which disposal is feasible (m)				
The distance of nearest watercourse (m)				
Nearest Settlement (m)				
Date/s of Community Consultation/s				
Whether the community is agreeable to siting of dumping site (Y/N)				
Date of Permission from Village Council President(VCP)				
Proposed future use of the Site				

Selected Site (tick anyone column only)

Certified that the above information is correct to the best of my knowledge and belief.

(Contractor)

Verified:

Date:

Recommendation on the suitability of the site

Signed:

Date:

Name & Designation:

Decision Taken (tick one):

Approved/Not Approved

Signed:

Date:

Name and Designation of Deciding Authority

Enclosures

(Tick as appropriate)

- 1 Maps of each location
- 2 Photographs
- a Each disposal location
- b Each community consultation
- 3 Photocopies of permissions from VCPs

Name and Designation of Verifier:

## Format EM2: Construction Camp and Storage Area

Construction Stage: Report - Date\_\_\_\_\_ Month\_\_\_\_\_ Year\_\_\_\_\_

(Site Layout of Construction camp and working drawings of dwelling units with allied facilities to be attached with format)

Format to be submitted before the target date (decided by PIU) of establishing camps

Location of Camp (km\_\_\_\_\_ )

Sl. No	Item	Unit	Details	Remarks
1	Detail of item camp			
a	Size of Camp	mxm		
b	Area of Camp	sq.m		
c	Distance from Nearest Settlement			
d	Distance from Nearest Water Source	Type/Size/Capacity/Present Use/Ownership		
e	Date of the camp being operational dd/mm/yy			
f	Present land use			
g	No other trees with girth > 0.3m.			
h	Details of Storage area(Availability of impervious surface)	mxm		
i	Availability of separate waste disposal from storage area	Cum		
2	Details of top soil stacking			
a	Quantity of top soil removed	sq.m		
b	Detail of storage of topsoil	Describe stacking arrangement		
3	Details of workforce			
a	Total No of Labourers	nos		
b	Total no of Male Workers	nos		
c	No of Male Workers below 18 years of age	nos		
d	Total No of Female Workers	nos		
e	No of Female workers below 18 years of age	nos		
f	No of children	nos		
4	Details of dwelling units			
a	No of dwellings/huts	nos		
b	Minimum Size of Dwelling	mxm		
c	No of openings per dwelling	nos		
d	Minimum size of opening	m x m		
e	Walls	specifications		
f	Roofing	specifications		
g	Flooring	specifications		
h	Drinking-Water Tank	specifications		
i	Capacity of Drinking water Tank	cum		
j	Size of Drinking Water Tank	m x m x m		
k	Total no of WC	nos		
l	No of Wcs for female workers	nos		
m	Minimum Size of WC	mxm		
n	Total No of Bathrooms for female workers	nos		
o	Size of septic tank for WC/Baths	m x m x m		
p	Capacity of Water Tank for WCs/ Bathrooms and general-purpose			
q	Fencing around camp	Y/N		
5	Details of facilities			
a	Availability of security guard 24 hrs a day	Yes/No		
b	Details of First Aid Facility	Yes/No		
c	Availability of Day Care Centre	Yes/No		
d	Availability of dust bins (capacity 60 ltr)	nos		

Certified that the furnished information is correct the quality of work is as per god practice and all relevant information as required is attached

Supervision Consultant



### Format EM3: Reporting for Borrow Areas

Construction Stage Report: Date \_\_\_\_ Month \_\_\_\_\_ Year \_\_\_\_\_ Site Layout of Borrow Area and Proposed Borrow Area Redevelopment Plan to be attached with format Format to be submitted before target date as (decided by PIU) for establishing Borrow Areas Borrow Area No. BA \_\_\_\_\_ Location of Borrow Area (Km \_\_\_\_\_)

Sl. No	Item	Unit	Details	Remarks by CSC, if any
1	Details of Borrow Area			
a	Date of Borrow Area becoming operational dd/mm/yy			
b	Current Landuse			
c	Distance from Nearest Settlement	Km		
d	No of settlements within 200m of Haul Road	No.		
e	No of settlements within 500m of Borrow Area	No.		
f	Total Capacity	cum		
g	No of Trees with girth more than 0.3 m	No.		
h	Length of Haul Road	km		
i	Width of Haul road	m		
j	Type of Haul Road	metal/dirt		
k	Size of Borrow Area	Sq.km		
l	Area of Borrow Area	km x km		
m	Quantity Available	cum		
n	The distance of Nearest Water Source	Type/Size/Capacity/Present Use/Ownership		
o	Quantity of top soil removed	cum		
p	Detail of storage of topsoil			
q	Daily/occasional use of the Borrow Area by the community, if any	-		
r	Probable reuse of Borrow pit-ask community	-		
s	Drainage channels/slope/characteristics of the area	-		
2	Enhancement Elements			
a	Quantity of top soil removed	sq.m		
b	Detail of storage of topsoil	sq.m		
c	Adjoining land use/Natural elements			
d	Nearby catchment for storing water			
e	Erosion Control Programme			
f	Preventive measures for			
i	Leaching			
ii	Mosquito Breeding			
iii	Water run-off/contamination			
iv	Any other environmental degradation			
3	Details of the workforce			
a	Total No of Labourers	No.		
b	Total no of Male Workers	No.		
c	No of Male Workers below 18 years of age	No.		
d	Total No of Female Workers	No.		
e	No of Female workers below 18 years of age	No.		
4	Details of redevelopment, Plan to be enclosed			

Certified that the furnished information is correct the quality of work is as per good practice and all relevant information as required is attached

Supervision Consultant

Contractor

### Format EM4: Tree Felling

S.No	Links	Physical Target				Completion Target		Reason for Delay if any
		Total	Target	Target Achieved	% of task completed	Target Date	Date of Completion if task completed	
		Unit						
1		nos						
2		nos						
3		nos						
4		nos						

(Signed)

PIU

### Format EM5: Tree Plantation

Construction Stage: Quarterly Report -Date\_\_\_\_ Month\_\_\_\_\_ Year\_\_\_\_\_

Sl. No	Activity	Physical Target				Financial Target			Completion Target			
		Target (tree/shrubs to be planted in Package) for this Quarter		Target Achieved		% of task completed	Total (lakhs)	Budget Spent	% used	Target Date	Date of Completion/% completed	Reason for Delay if any
		Km (From) / No.	Km (To) / No.	No. of Trees	Survival Rate (%)							
1	Tree Plantation along roadside											
2	Plantation at Locations identified for enhancement											

Certified that the above information is correct

PIU

### EM6: Topsoil Conservation Monitoring

Contract \_\_\_\_\_

Report No. \_\_\_\_\_

Date \_\_\_\_\_

Location (Chainage)	Original Use of Topsoil removed	Measures for preventing spillage of topsoil on Haul Roads(Earthen/ Metalled)	Present Method of Storage	Anticipated period of Storage  (Months)	Distance of nearest Water course (m)	Present Slope of Pile  (V: H)	Whether silt fencing provided?	Is any other covering / measure provided? If yes, what is it?	Improvements required	Extent of Compliance as on date of report

Certified that the above is true.

Signed \_\_\_\_\_

(Authorised Representative of the contractor)

Verified

Signed \_\_\_\_\_

(Environmental Specialist of the Supervision Consultant)

### EM7: Redevelopment of Borrow Areas

Operation Stage: Report: Date \_\_\_\_ Month\_\_\_\_\_ Year\_\_\_\_\_

To be monitored by Supervision Consultant during operation period

Details of remarks to be appended wherever necessary.

Sl.no	Activity	Particulars	Drawbacks Identified			Improvements Required		
			Construction	Financial	Others (Ask Community)	Technical	Financial	Remarks/ Suggestions
1	Details of Borrow area and Surrounding Landuse							
2	End use of the borrow area							
3	Whether rehabilitation has been carried out in line with owners request							
4	Erosion Control Measures							
5	Number of trees planted							
6	Reuse of topsoil							
7	Preventive measures taken for -Mosquito Breeding -Water runoff/ contamination -Other Environmental Degradation							
8	Any problems faced by owner							
9	Any problems faced by the local community							
10	If it has been developed as a fish pond							
a	Details of available catchment for storing water							
b	Economic Benefits/Utility							
11	If it has been developed as an orchard							
a	Details of suitability of soil and water.							
B	Type of Plantation							
c	Economic Benefits/Utility							
12	Any Other End use							
a	Particulars							
b	Economic Benefits/Utility							

Supervision Consultant

Contractor

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### EM8: Checklist for Construction Safety

Sl. No.	Safety Issues	Yes	No	Non compliance	Corrective Action	Penalty	Remarks
<b>Safety during Construction Stage</b>							
1	Appointment of qualified Construction safety officers						
2	Approval for Construction Safety Management Plan by the Engineer.						
3	Approval for Traffic Management/control Plan in accordance with IRC: SP: 55-2001						
4	Maintenance of the existing road stretches handed over to the Contractor.						
5	Provision of Temporary Traffic Barriers/Barricades/caution tapes in construction zones						
6	Provision of traffic sign boards						
7	Provision for flags and warning lights						
8	Provision of metal drum/empty bitumen drum delineator, painted in circumferential strips of alternate black and white 100mm wide 2 coats fitted with reflectors 3 Nos of 7.5cm diameter						
9	Providing plastic crash barrier						
10	Provision of adequate staging, form work and access (ladders with handrail) for works at a height of more than 3.0 m						
11	Provision of adequate shoring / bracing / barricading / lighting for all deep excavations of more than 3.0 m depth.						
12	Demarcations (fencing, guarding and watching) at construction sites						
13	Provision for sufficient lighting especially for night time work						
14	Arrangements for controlled access and entry to Construction zones						
15	Safety arrangements for Road users / Pedestrians						
16	Arrangements for detouring traffic to alternate facilities						
17	Regular Inspection of Work Zone Traffic Control Devices by authorized contractor personnel						
18	Construction Workers safety						

Sl. No.	Safety Issues	Yes	No	Non compliance	Corrective Action	Penalty	Remarks
	- Provision of personnel protective equipment						
19	A. Helmets						
	B. Safety Shoe						
	C. Dust masks						
	D. Hand Gloves						
	E. Safety Belts						
	F. Reflective Jackets						
	G. Earplugs for labour						
20	Workers employed on bituminous works, stone crushers, concrete batching plants etc. provided with protective goggles, gloves, gumboots etc.						
21	Workers engaged in welding work shall be provided with welder protective shields						
22	All vehicles are provided with reverse horns.						
23	All scaffolds, ladders and other safety devices shall be maintained in as safe and sound condition						
24	Regular health checkup for labour/ Contractor's personnel						
25	Ensuring the sanitary conditions and all waste disposal procedures & methods in the camps.						
26	The Contractor shall provide adequate circuit for traffic flow around construction areas, control speed of construction vehicles through road safety and training of drivers, provide adequate signage, barriers and flag persons for traffic control						
27	Provision for insurance coverage to the contractor's personnel						

Supervision Consultant

Contractor

### Format EC1: Target Sheet for Pollution Monitoring

Construction Stage: Report -                      Date\_\_\_\_\_                      Month\_\_\_\_\_                      Year\_\_\_\_\_

( Locations at which monitoring to be conducted as per EMP)

Sl. No	Chainage	Details of Location	Duration of Monitoring	Instruments Used	Completion Target		Reason for Delay if any
					Target Date	Date of Completion if task completed	
<b>Air Monitoring</b>							
1							
2							
3							
4							
5							
<b>Water Monitoring</b>							
1							
2							
3							
4							
5							
<b>Noise Monitoring</b>							
1							
2							
3							
4							
5							

Certified that the Pollution Monitoring has been conducted at all the locations specified in the EMP

Supervision Consultant

Contractor

## Format EC 2: Target Sheet for Pollution Monitoring

Operation Stage: Report -                      Date\_\_\_\_\_                      Month\_\_\_\_\_                      Year\_\_\_\_\_

( Locations at which monitoring to be conducted )

Sl. No	Chainage	Details of Location	Duration of Monitoring	Instruments Used	Completion Target		Reason for Delay if any
					Target Date	Date of Completion if task completed	
<b>Air Monitoring</b>							
1							
2							
3							
4							
5							
<b>Water Monitoring</b>							
1							
2							
3							
4							
5							
<b>Noise Monitoring</b>							
1							
2							
3							
4							
5							

Certified that the Pollution Monitoring has been conducted at all the locations specified in the EMP

Supervision Consultant





## Format OP2: Redevelopment of Borrow Areas

Operation Stage: Report: Date \_\_\_\_ Month\_\_\_\_ Year\_\_\_\_\_

To be monitored by PIU during operation period

Details of remarks to be appended wherever necessary.

Sl. No	Activity	Particulars	Drawbacks Identified			Improvements Required		
			Construction	Financial	Others (Ask Community)	Technical	Financial	Remarks/ Suggestions
1	Details of Borrow area and Surrounding Landuse							
2	End use of the borrow area							
3	Whether rehabilitation has been carried out in line with owners request							
4	Erosion Control Measures							
5	Number of trees planted							
6	Reuse of topsoil							
7	Preventive measures taken for -Mosquito Breeding -Water runoff/ contamination -Other Environmental Degradation							
8	Any problems faced by owner							
9	Any problems faced by the local community							
10	If it has been developed as a fish pond,							
A	Details of available catchment for storing water							
B	List of Fish species that can survive in that area							
C	Economic Benefits/Utility							
11	If it has been developed as an orchard							
A	Details of suitability of soil and water.							
B	Type of Plantation							
C	Economic Benefits/Utility							
12	Any Other End use							
A	Particulars							
B	Economic Benefits/Utility							

Signed

(Environmental Specialist of PIU )



### Guidelines for Environmental Management

#### GUIDELINE-1: SITE PREPARATION

##### 1. GENERAL

The preparation of site for construction involves: (i) clearing of land required for construction; and (ii) management of activities such as traffic during construction. These activities have been detailed out for road construction activities separately.

##### 2. ROAD CONSTRUCTION

###### 2.1 Site Preparation Activities

After obtaining the consent of the community on the alignment, the Project Implementation Unit (PIU) of the Divisional Office shall be responsible to stake out the alignment by establishing working benchmarks on ground. It shall be the responsibility of the PIU to take over the possession of the proposed RoW and hand over the land width required clear of all encumbrances to the Contractor. Activities pertaining to the clearance of land and relocation of utilities need to be initiated by the PIU well in advance to avoid any delays in handing over of site to the Contractor. Assistance of the Revenue Department shall be sought in accomplishing the task. To summarize, the PIU's responsibilities before handing over the site to the contractor include:

- Clearance of encroachments within proposed RoW;
- Initiation of process for legal transfer of land title;
- Alignment modification or Relocation of common property resources in consultation with the local community;
- Alignment modification or Relocation of utilities in consultation with the various government departments; and
- Obtain clearances required from government agencies for
  - Cutting of trees; and
  - Land Diversion of forestlands, etc.

###### 2.2 Site Preparation Activities by the Contractor

Site preparation shall involve formation of the road base wherein it is ready for construction of protective/drainage works, carriageway, shoulders, parapets and other road furniture. The PIU shall transfer the land for civil works to the Contractor after peg marking of the alignment.

The Contractor shall verify the benchmarks soon after taking possession of the site. The Contractor, prior to initiation of site preparation activities, shall highlight any deviations/discrepancies in these benchmarks to the PIU in writing. The contractor shall submit the schedules and methods of operations for various items during the construction operations to the PIU for approval. The Contractor shall commence operations at site only after the approval of the schedules by the PIU.

The activities to be undertaken by the contractor during the clearing and grubbing of the site are as follows:

The clearance of site shall involve the removal of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures: (i) Limiting the surface area of erodible earth material exposed by clearing and grubbing; (ii) Conservation of top soil and stock piling as per the measures suggested as part of **Guideline 4**, "Top Soil Salvage Storage and Replacement"; and (iii) Carry out necessary backfilling of pits resulting from uprooting of trees and stumps with excavated or approved materials to the required compaction conforming to the surrounding area.

To minimize the adverse impact on vegetation, only ground cover/shrubs that impinge directly on the permanent works shall be removed. Cutting of trees and vegetation outside the working area shall be avoided under all circumstances. In case the alignment passes through forest areas, The Forest Ranger shall be consulted for identification of presence of any rare/endangered species within the proposed road way. Protection of such species if found shall be as per the directions of the Forest Department.

The locations for disposal of grubbing waste shall be finalized prior to the start of the works on any particular section of the road. The selection of the site shall be approved by the PIU. The criteria for disposal of wastes shall be in accordance with the measures given in Guideline on, “Waste Management and Debris Disposal” (**Guideline 8**).

In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately, if the project conditions permit.

Dismantling of CD structures and culverts shall be carried out in a manner as not to damage the remaining required portion of structures and other surrounding properties. The disposal of wastes shall be in accordance with the provisions given in **Guideline 8**, “Waste Management and Debris Disposal”. The following precautions shall be adopted: (i) The waste generated shall not be disposed off in watercourses, to avoid hindrance to the flow, and (ii) All necessary measures shall be taken while working close to cross drainage channels to prevent earthwork, stonework as well as the method of operation from impeding cross drainage at rivers, streams, water canals and existing irrigation and drainage systems.

The designated sites duly approved by Implementing Agency shall be cleared of its existing cover for setting up of the construction sites, camps and related infrastructure facilities, borrow areas and other locations identified for temporary use during construction. The contractor shall comply with all safety requirements in consideration as specified in the **Guideline 12** on, “Labour & Worker’s Health and Safety”. Before initiation of site preparation activities along these lands to be used temporarily during construction, it shall be the responsibility of the Contractor to submit and obtain approval of the site redevelopment plan from the implementing agency. The letter/contract agreement between the owner(s) of the land parcel for temporary usage shall include site redevelopment to its original status. The guidelines for the same are furnished in the Guideline on, “Construction Plants & Equipment Management”; guideline, “Construction and Labour Camps”; and “Borrow areas”.

### **2.3 Traffic management during construction**

Traffic management during construction is an activity specific to the contractors. Contractors must ensure a reasonably smooth flow of traffic during construction. The following are the general principles to be followed for traffic management during construction:

Partial pavement construction over long lengths will not be permitted. The contractor should concentrate his activities over sections such that he can complete continuous fronts of up to a maximum of 1 km before starting the adjacent front. The contractor may open more than one continuous 1 km front provided that he has the separate resources to do so. The resources working on a 1 km front may not be shifted to another front until no longer required on that front.

- The construction activities should be staggered over sub-sections to the extent that the use of plant and equipment is optimized to maximum efficiency and to avoid idling. For road widening operations, excavation **adjacent to the existing road shall not be permitted on both titles simultaneously**. Earthworks must be completed to the level of the existing road before excavation work on the opposite side will be permitted.

- The construction operations taking place on a particular front must be managed efficiently such that delays between successive pavement layers are minimized.
- Before the start of the monsoon season (June) the contractor shall ensure that the pavement over any front is complete, full width, at least upto Dense Bituminous Macadam, DBM level, but preferably with Asphaltic Concrete, AC wearing course. The contractor **should not start any sections of pavement that he cannot complete by the start of the monsoon season.**
- In the absence of permanent facilities, temporary drainage and erosion control measures, as required by the Specifications, are to be implemented prior to the onset of the monsoon.

In cases where separate traffic diversions are not essential or cost effective the construction methodology should be in accordance with the guidelines following:

On a 1km section, the pavement construction (except new alignments) should be limited to 500m subsections with a minimum of 1 to 1.5 km between successive sub-sections to ease traffic management and safety issues. The earthworks in the widening portions are not limited in, this respect. Excavation on both sides of the existing, road over the same sub-section simultaneously shall not be permitted for reasons of safety to the traffic, particularly at night.

Sub-sections longer than 500 m may be authorized by the Engineer if two-way traffic flow can be comfortably managed and the Contractor can demonstrate his ability to maintain dust control, proper road edge delineation, proper signage and traffic control. Where single file traffic is permitted ('only applicable to final wearing course operations), the sub-sections shall be reduced to a maximum length whereby safe traffic regulation can be physically managed. Single file traffic may not be permitted at certain locations or times of the day when traffic volumes are such that excessive congestion shall occur.

## GUIDELINE-2: CONSTRUCTION AND LABOUR CAMPS

### 1. INTRODUCTION

The scope of this guideline pertains to the siting, development, management and restoration of construction and labour camps to avoid or mitigate impacts on the environment. The area requirement for the construction camp shall depend upon the size of contract, number of labourers employed and the extent of machinery deployed. The following sections describe the siting, construction, maintenance, provision of facilities in the camps and finally rehabilitation of the construction and labour camps. These are described in three stages, pre-construction, construction and post-construction stage. The issues related to construction camps are similar in the case of road construction and hence have been taken together.

### 2. PRE-CONSTRUCTION STAGE

Identification of site for construction and labour camps is the first task. The Contractor shall identify the site for construction camp in consultation with the individual owners in case of private lands and the concerned department in case of Government lands. The suitable sites shall be selected and finalized in consultation with the PIU. **Table 1** gives the lands that could be avoided for construction camps and conversely those that could be preferred.

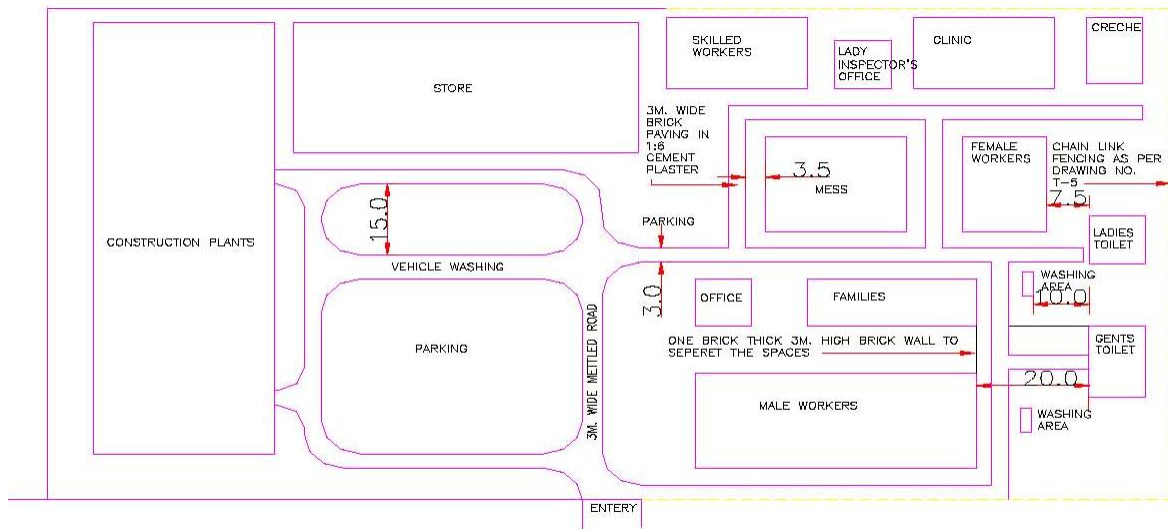
**Table 1: Selection Criterion for Construction Camps.**

Avoid the following ...	Prefer the following ...
<ul style="list-style-type: none"><li>• Lands close to habitations.</li><li>• Irrigated agricultural lands.</li><li>• Lands belonging to small farmers.</li><li>• Lands under village forests. Lands within 100m of community water bodies and water sources as rivers.</li><li>• Lands within 100m of watercourses.</li><li>• Low lying lands.</li><li>• Lands supporting dense vegetation.</li><li>• Grazing lands and lands with tenure rights.</li><li>• Lands where there is no willingness of the landowner to permit its use.</li></ul>	<ul style="list-style-type: none"><li>• Waste lands.</li><li>• Waste Lands belonging to owners who look upon the temporary use as a source of income.</li><li>• Community lands or government land not used for beneficial purposes.</li><li>• Private non-irrigated lands where the owner is willing.</li><li>• Lands with an existing access road.</li></ul>

The contractor will work out arrangements for setting up his facilities during the duration of construction with the land owner/concerned department. These arrangements shall be in the form of written agreement between the contractor and the land owner (private/government) that would specify:

- a) photograph of the proposed camp site in original condition;
- b) activities to be carried out in the site;
- c) environmental mitigation measures to be undertaken to prevent land, air, water and noise pollution;
- d) detailed layout plan for development of the construction and labour camp that shall indicate the various structures to be constructed in the camp including temporary, drainage and other facilities (**Figure 1** gives a layout plan for a construction camp); and
- e) Restoration plan of camp site to previous camp conditions.

The arrangements will be verified by the PIU to enable redressal of grievances at a later stage of the project.



**Figure 1: Layout Plan for Construction Camp**

## 2.1 Setting up of labour camp

The contractor shall provide, free of cost in the camp site, temporary living accommodation to all the migrant workers employed by him for complete construction/maintenance work is in progress. A minimum area of 6 sq.mts per person shall be provided. The rooms of labour shall be well lighted and ventilated. The facilities to be provided for the labour are discussed below:

### a) Drinking Water

Towards the provision and storage of drinking water at the construction camp, the contractor shall ensure the following provisions

- The contractor shall provide for a continuous and sufficient supply of potable water in the camps, in earthen pots or any other suitable containers.
- The contractor shall identify suitable community water sources for drinking. Only in the event of non-availability of other sources of potable water, the Contractor shall obtain water from an unprotected source only after the testing for its potability. Where water has to be drawn from an existing open well, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with dust proof trap door.
- Every water supply or storage shall be at a distance of not less than 15m from any wastewater / sewage drain or other source of pollution. Water sources within 15m proximity of toilet, drain or any source of pollution will not be used as a source of drinking water in the project.
- A pump shall be fitted to covered well used as drinking water source, the trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once a month.

### b) Washing and Bathing Facilities

In every site, adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labor employed therein. Separate and adequate bathing shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions.

### c) Toilets Facilities

Sanitary arrangements, latrines and urinals shall be provided in every work place separately for male and female workers. The arrangements shall include:



- A latrine for every 15 females or part thereof (where female workers are employed).
- A latrine for every 10 males.
- Every latrine shall be under cover and so partitioned as to secure privacy, and shall have a proper door and fastenings.
- Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers “For Men Only” or “For Women Only” as the case may be.
- The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times and should have a proper drainage system;
- Water shall be provided in or near the latrines and urinals by storage in suitable containers.

**d) Waste Disposal**

- Disposal of sanitary wastes and excreta shall be into septic tanks.
- Kitchen waste water shall be disposed into soak pits/kitchen sump located preferably at least 15 meters from any water body. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged per day. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit. New soak pits shall be made ready as soon as the earlier one is filled.
- Solid wastes generated in the kitchen shall be reused if recyclable or disposed off in land fill sites.

**e) Medical and First Aid Facilities**

Medical facilities shall be provided to the labour at the construction camp. Visits of doctor shall be arranged twice a month wherein routine checkups would be conducted for women and children. A separate room for medical checkups and keeping of first aid facilities should be built. The site medical room should display awareness posters on safety facilitation hygiene and HIV/AIDS awareness.

- First Aid Box will be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours. He shall be adequately trained in administering first aid-treatment. Formal arrangement shall be prescribed to carry injured person or person suddenly taken ill to the nearest hospital. The first aid box shall contain the following.
  - 6 small sterilized dressings
  - 3 medium size sterilized dressings
  - 3 large size sterilized dressings
  - 3 large sterilized burns dressings
  - 1 (30 ml) bottle containing 2 % alcoholic solution of iodine
  - 1 (30 ml) bottle containing salvolatile
  - 1 snakebite lancet
  - 1 (30 gms) bottle of potassium permanganate crystals
  - 1 pair scissors
  - Ointment for burns
  - A bottle of suitable surgical antiseptic solution
  - In case, the number of labour exceeds 50, the items in the first aid box shall be doubled.

**f) Provision of Shelter during Rest**

The work place shall provide four suitable sheds, two for meals and two for rest (separately for men and women). The height of the shelter shall not be less than 3.0m from the floor level to the lowest part of the roof. These shall be kept clean.

**g) Crèches**

In case 20 or more women workers are employed, there shall be a room of reasonable size for use of children under the age of six years. The room should have adequate light and realisation. A caretaker is to be appointed to look after the children. The use of the room shall be restricted to children, their mothers and the caretaker.

## **2.2 Storage of Construction Material in Construction Camps**

For storage of Petrol/Oil/Lubricants, brick on edge flooring or sand flooring will be provided at the storage places of Petrol/Oil/Lubricants to avoid soil and water contamination due to spillage. These should be kept away from labour residential areas. The storage of cement shall be at Damp-proof flooring, as per IS codes. All materials shall be stored in a barricaded area. In case of electrical equipments, danger signs shall be posted. The batch mix plant is to be located away from the residential area and not in the wind direction. Separate parking areas for vehicles and also workshop areas need to be provided.

## **2.3 Firefighting arrangement**

- The following precautions need to be taken:
- Demarcation of area susceptible to fires with cautionary signage;
- Portable fire extinguishers and/or sand baskets shall be provided at easily accessible locations in the event of fire;
- Contractor shall educate the workers on usage of these equipment's.

## **2.4 Interactions with host communities**

To ensure that there is no conflict of the migrant labor with the host communities, the contractor shall issue identity cards to labourers and residents of construction camps.

## **3. CONSTRUCTION STAGE**

Construction camps shall be maintained free from litter and in hygienic condition. It should be kept free from spillage of oil, grease or bitumen. Any spillage should be cleaned immediately to avoid pollution of soil, water stored or adjacent water bodies. The following precautions need to be taken in construction camps.

- Measures to ensure that no leaching of oil and grease into water bodies or underground water takes place.
- Wastewater should not be disposed into water bodies.
- Regular collection of solid wastes should be undertaken and should be disposed off safely.
- All consumables as the first aid equipment, cleaning equipment for maintaining hygiene and sanitation should be recouped immediately.
- The debris/scrap generated during construction should be kept in a designated and barricaded area.

The PIU will monitor the cleanliness of construction campsites and ensure that the sites are properly maintained throughout the period of the contract.

## **4. POST CONSTRUCTION STAGE**

At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

- Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas.
- Soak pits, septic tanks shall be covered and effectively sealed off.

- Debris (rejected material) should be disposed off suitably (Refer **Guideline - 10** on “Waste Management and Debris Disposal”).
- Ramps created should be levelled.
- Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed.
- If the construction camp site is on an agricultural land, top soil can be spread so as to aid faster rejuvenation.
- Proper documentation of rehabilitation site is necessary. This shall include the following:
  - Photograph of rehabilitated site;
  - Land owner consent letter for satisfaction in measures taken for rehabilitation of site;
  - Undertaking from contractor; and
  - Certification from Engineer in-charge of the PIU.

In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this guideline. Also, he would have to obtain a certificate for satisfaction from the landowner.

## GUIDELINE-3: BORROW AREAS

### 1. INTRODUCTION

Embankment fill material is to be procured from borrow areas designated for the purpose. Borrow areas cause significant adverse environmental impacts if appropriate mitigation measures are not taken. The scope of this guideline includes measures that are required during project planning and design stage, pre-construction, construction stage and post construction stage. Borrow areas are related only to road construction activities.

### 2. PROJECT PLANNING AND DESIGN STAGE

Design measures for reduction in the quantity of the earthwork will have to be undertaken to reduce the quantity of material extracted and consequently decrease the borrow area requirement. Borrow area siting should be in compliance with IRC: 10-1961. The DPR shall contain (i) Guidelines for locating site of borrow areas (ii) The arrangements to be worked out with the land owner/community for the site and (iii) Sample designs for redevelopment of borrow areas.

### 3. PRE-CONSTRUCTION STAGE

The contractor shall identify the borrow area locations in consultation with the individual owners in case of private lands and the concerned department in case of government lands, after assessing suitability of material. The suitable sites shall be selected and finalized in consultation with the PIU. Borrowing to be avoided on the following areas:

- Lands close to toe line.
- Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles. The subsequent Guidelines discuss in detail the conservation of topsoil.
- Grazing land.
- Lands within 0.8km of settlements.
- Environmentally sensitive areas such as Reserve Forests, Protected Forests, Sanctuary, wetlands (including beel). Also, a distance of 500 m should be maintained from such areas.
- Designated protected areas / forests.
- Unstable side-hills.
- Water-bodies.
- Streams and seepage areas.
- Areas supporting rare plant/ animal species;
- Ensure unsuitable soft rock is not prominent within the proposed depth of excavation which will render rehabilitation difficult.

#### 3.1 Arrangements for Borrow Area

The Contractor will work out arrangements for borrowing with the land owner/concerned department. The arrangements will include the redevelopment after completion of borrowing. The arrangements will be verified by the PIU to enable redressal of grievances at a later stage of the project. The Engineer of PIU shall approve the borrow area after inspection of the site to verify the reclamation plan and its suitability with the contractor and landowner. The contractor shall commence borrowing soil only after the approval by the PIU. The contractor shall submit to the PIU the following before beginning work on the borrow areas.

- Written No-objection certificate of the owner/cultivator;
- Estimate extent of earth requires;
- Extent of land required and duration of the agreement;
- Photograph of the site in original condition; and
- Site redevelopment plan after completion.

The depth of excavation should be decided based on natural ground level of the land and the surroundings, and rehabilitation plan. In case higher depth of excavation is agreed with backfilling by unsuitable excavated soil (from roadway), then filling should be adequately compacted except topsoil, which is to be spread on the top most layer (for at least 20m thick). The guidelines for location, depth, size and shape of the borrow areas are available in the following:

- Clause 305.2.2.2 of MoRTH specification for roads and bridge works of IRC;
- Guidelines for environmental impact assessment of highway projects, Indian Roads Congress, 1989; (IRC: 104-1988);
- IRC: 10-1961-Recommended practice for borrow pits for road embankments constructed by manual operations, as revised in 1989;
- IRC SP: 58-2001 guideline for use of fly ash in road construction;
- EIA manual of MoEF, 2001;
- MoEF notification on utilisation of fly ash dated 27 August, 2005.

### 3.2 Documentation of Borrow Pit

The contractor must ensure that following data base must be documented for each identified borrow areas that provide the basis of the redevelopment plan.

- Chainage along with offset distance;
- Area (Sq.m);
- Photograph of the pit from all sides;
- Type of access/width/kutcha/pucca etc from the carriageway;
- Soil type;
- Slope/drainage characteristics;
- Water table of the area or identify from the nearest well, etc;
- Existing landuse, for example barren/agricultural/grazing land;
- Location/name/population of the nearest settlement from borrow area;
- Present usage of borrow area; and
- Community facility in the vicinity of borrow pit.

### 3.3 Redevelopment Plans for Borrow Pits

The following checklist provides guidelines in order to ensure that redevelopment of borrow areas must comply with MoRTH, clause 305.2.2.2 and EMP requirement. Borrow areas can be developed as:

- Ponds (various types) (e.g. Drinking Water only; Washing and for other Domestic Chores; Only for Cattle; Mixed Uses etc.) (a large pond can be divided into two parts - each having a defined use)
- Farmland
- Water Recharging Zones
- Pastureland
- Fish Ponds (pisciculture)
- Waste disposal Sites (depending upon the location, distance from settlements, pollution risks, safety, associated environmental risks and hazards, regulations/ permissions of appropriate authority and other such factors)
- Plantation Zones
- Recreational Zones (depending upon location, size, potential of the site, willingness of the local bodies to develop it)
- Wildlife Refuge and Drinking Area (applicable only in case of sensitive environs with appropriate planning and understanding including regulation of depth for safety of animals etc.)

The rehabilitation measures for the borrow areas shall be dependent on the following factors:

- Land use objectives and agreed post-borrowing activities;
- Physical aspects (landform stability, erosion, re-establishment of drainage);
- Biological aspects (species richness, plant density,) for areas of native re vegetation;
- Water quality and soil standards; and
- Public safety issues.

**Rehabilitation should be simple and maintenance free.** Depending on the choice of the individual land owner/community, the contractor shall prepare redevelopment plans for the borrow areas. The options can be: (i) Restoring the productive use of the land (ii) Development of detention ponds in barren areas.

#### **Option I: Suitable in locations with high rainfall and productive areas**

Topsoil must be placed, seeded, and mulched within 30 days of final grading if it is within a current growing season or within 30 days of the start of the next growing season. Vegetative material used in reclamation must consist of grasses, legumes, herbaceous, or woody plants or a combination thereof, useful to the community for the fuel and fodder needs.

Plants must be planted during the first growing season following the reclamation phase.

Selection and use of vegetative cover must take into account soil and site characteristics such as drainage, pH, nutrient availability, and climate to ensure permanent growth. The vegetative cover is acceptable if within one growing season of seeding, the planting of trees and shrubs results in a permanent stand, or regeneration and succession rate, sufficient to assure a 80 % survival rate.

#### **Option II: In barren land, the borrow areas can be redeveloped into detention ponds.**

These will be doubled up as water bodies and also for removal of sediment from runoff flowing through the ponds. Design of the detention basin depends upon the particle size, settling characteristics, residence time and land area. A minimum of 0.02 mm size particle with a settling velocity of 0.02 cm/sec (assuming specific gravity of solids 2.65) can be settled in the detention basin.

Following parameters are to be observed while setting up a detention pond:

- Pond should be located at the lowest point in the catchment area. Care should be taken that the horizontal velocity should be less than settling velocity to prevent suspension or erosion of deposited materials.
- Minimum Effective Flow Path: 5 times the effective width
- Minimum Free Board: 0.15 m
- Minimum Free Settling Depth: 0.5 m
- Minimum Sediments Storage Depth: 0.5 m
- Maximum interior slope: 2H : 1V
- Maximum exterior slope: 3H : 1V

The inlet structure should be such that incoming flow should distribute across the width of the pond. A pre-treatment sump with a screen should provide to remove coarse sediments. Settled sediment should be removed after each storm event or when the sediment capacity has exceeded 33% of design sediment storage volume. Accumulated sediment must be disposed of in a manner, which will prevent its re-entry into the site drainage system, or into any watercourse.

## **4. CONSTRUCTION STAGE**

No borrow area shall be operated without permission of the Engineer. The procurement of borrow material should be in conformity to the guidelines laid down in IRC: 10-1961. In addition, the contractor should adopt precautionary measures to minimise any adverse impacts on the

environment. Checklists for monitoring borrow areas operation and management has been prepared (Table 1).

**Table 1: Checklist for Monitoring Borrow Area Operation and Management**

Attributes	Requirements
Access Road	Access road shall be used for hauling only after approved
Top soil preservation	To soil, if any, shall be stripped and stored at corners of the area before the start of excavation for material collection; Top soil should be reused / re-laid as per agreed plan; In case of riverside, borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood. In no case shall be borrow pit be within 1.5m from the Toe line of the proposed embankment.
Depth of excavation	For agricultural land, the total depth of excavation should be limited to 150cm including top 30 cm for top soil preservation; For river side borrow area, the depth of excavation shall be regulated so that the inner edge of any borrow pit, should not be less than 15m from the toe of the bank and bottom of the pit should not cut the imaginary line of 1:4 projected from the edge of the final section of the embankment. To avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the Engineer.
Damage to surrounding land	Movement of man and machinery should be regulated to avoid damage to surrounding land. To prevent damages to adjacent properties, the Contractor shall ensure that an undisturbed buffer zone exists between the distributed borrow areas and adjacent land. Buffer zone shall be 3 m wide or equal to the depth of excavation whichever is greater.
Drainage control	The Contractor shall maintain erosion and drainage control in the vicinity of all borrow pits and make sure that surface drains do not affect the adjacent land or future reclamation. This needs to be rechecked by the engineer of the PIU.
Dust Suppression	Water should be sprayed on kutchha haul road twice a day or as may be required to avoid dust generation during transportation of material; Depending on moisture content, 0.5 to 1.5% water may be added to excavated soil before loading during dry weather to avoid fugitive dust emission.
Covering material for transport material	Material transport shall be provided with tarpaulin cover
Personal Protective Equipment	Workers should be provided with helmet, gumboots and air mask and their use should be strictly enforced.
Redevelopment	The area should be redeveloped within agreed timeframe on completion of material collection as per agreed rehabilitation plan.

## **5. POST CONSTRUCTION STAGE**

All reclamation shall begin within one month of abandonment of borrow area, in accordance with the redevelopment plan. The site shall be inspected by the PIU after implementation of the reclamation plan. Certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that “the land is restored to his satisfaction”. The final payment shall be made after the verification by PIU.

## **6. CHECKLIST FOR INSPECTION OF REHABILITATION AREA**

Inspection needs to be carried out by the PIU for overseeing the redevelopment of borrow areas as per the plan. The checklist for the inspection by the PIU is given below.

- Compliance of post-borrowing activities and land use with the restoration plan;
- Drainage measures taken for inflow and outflow in case borrow pit is developed as a detention pond;
- Levelling of the bottom of the borrow areas;
  - In case the borrow area is on private property, the contractor shall procure written letter from landowner for satisfaction on rehabilitation. In case of no rehabilitation is desired by the landowner, the letter should include statement “no responsibility of R&BD on contractor in the event of accident.
- Condition of the reclaimed area in comparison with the pre-borrowing conditions.



## GUIDELINE-4: TOPSOIL SALVAGE, STORAGE AND REPLACEMENT

### **1. INTRODUCTION**

Loss of topsoil is a long term impact along roads due to (i) site clearance and widening for road formation (ii) development of borrow areas (iii) temporary construction activities such as construction camps, material storage locations, diversion routes etc. The environmental measures for both these activities during all stages of construction activity are discussed in the subsequent sections.

### **2. PROJECT PLANNING & DESIGN STAGE**

At the project preparation stage, the following shall be estimated: (i) Extent of loss of top soil due to widening and siting of construction activities (ii) Estimates of borrow area requirements and (iii) Area requirement for topsoil conservation. The bid document shall include provisions that necessitate the removal and conservation of topsoil at all locations opened up for construction by the Contractor.

### **3. PRE-CONSTRUCTION STAGE**

The arrangements for temporary usage of land, borrowing of earth and materials by the Contractor with the land owner/concerned department shall include the conservation / preservation of topsoil.

### **4. CONSTRUCTION STAGE**

It shall be the responsibility of the Contractor to strip the topsoil at all locations opened up for construction. The stripped topsoil should be carefully stockpiled at suitable accessible locations approved by the PIU. At least 10% of the temporarily acquired area shall be earmarked for storing topsoil. In case of hilly and desert areas, topsoil with humus wherever encountered while opening up the site for construction shall be stripped and stockpiled. The stockpiles shall be located at:

- Areas away from Grade, Subsoil & Overburden materials;
- Areas away from pit activities and day-to-day operations;
- Areas that do not interfere with future pit expansion; and
- Areas away from drainage paths and uphill of sediment barriers.

The stockpiles for storing the topsoil shall be designed such that the slope should not be less than 1:2 (Vertical to horizontal), and the height of the pile is restricted to 2m. A minimum distance of 1m is required between stockpiles of different materials.

In cases where the topsoil has to be preserved for more than a month, the stockpile is to be stabilised within 7 days of forming. The stabilisation shall be carried out through temporary seeding. It consists of planting rapid-growing annual grasses or small grains, to provide initial, temporary cover for erosion control.

After spreading the topsoil on disturbed areas, it must be ensured that topsoil is seeded, and mulched within 30 days of final grading. During construction, if erosion occurs from stockpiles due to their location in small drainage paths, the sediment-laden runoff should be prevented from entering nearby watercourses. The Contractor shall preserve the stockpile material for later use on slopes or shoulders as instructed by the Engineer.

**Vegetative material for stockpile stabilisation...**

Must consist of grasses, legumes, herbaceous, or woody plants or a mixture thereof • Selection & use of vegetative cover to take into account soil and site characteristics such as drainage, pH, nutrient availability, and climate to ensure permanent growth

**Vegetative material for stockpile stabilisation...**

Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur.

Divert runoff around stockpiles unavoidably located in drainage paths using a perimeter bank uphill.

The stockpiles shall be covered with gunny bags or tarpaulin immediately in case they are not stored for periods longer than 1 month

**5. POST CONSTRUCTION STAGE**

The topsoil shall be re-laid on the area after taking the borrow earth to maintain fertility of the agricultural field, finishing it to the required levels and satisfaction of the farmer. The area to be covered with vegetation shall be prepared to the required levels and slope as detailed in the DPR. The stockpile material shall be spread evenly to a depth of 5-15cm to the designed slopes and watering the same as required. The growth of the vegetation shall be monitored at frequent intervals. All temporary arrangements made for stockpile preservation and erosion control are to be removed after reusing the stockpile material. The top soil can also be used for the following purposes:

- a. Covering the borrow areas;
- b. Embankment and turfing;
- c. Median; and
- d. Rehabilitation of construction and labour camp.

## GUIDELINE-5: QUARRY MANAGEMENT

### 1. INTRODUCTION

This guideline pertains to the measures to be taken to address environmental concerns in quarry areas. The general practice adopted is to procure materials from existing quarries operating with the requisite permits. The measures to be taken for operation and management for quarries during all stages of construction have been discussed in this Guideline.

### 2. PROJECT PLANNING AND DESIGN STAGE

The PIU shall provide in the DPR / bid document, a list of licensed quarries operating within the district and adjoining districts. In addition, the DPR shall contain the following: (i) Quantity of materials available in quarries (ii) Lead from the various existing quarries and (iii) Adequacy of materials for the project in these quarries. Table 1 and 2 give the format for preparing a list of quarries.

**Table 1 Details of Sand Quarry**

Sample No.	Source of sand	Name of quarry area	Site Identification/ Location			Approximate Quantity (cum)	Approximate basic cost of the material (Rs.)	Remarks
			Nearest Chainage (Km.)	Left/ Right	Offset from nearest chainage (km)			

**Table 2 Details of Quarry Area for Aggregates**

Sample No.	Chainages (Km.)	Left/ Right	Name of Quarry Area	Name of Crusher	Lead from nearest chainage (Km.)	Basic cost of the material (Rs.)	Available land/terrian	Surrounding land Terrian	Remarks

Only in the event of non-availability of existing quarries, the Contractor shall open a new quarry in accordance with Mines and Minerals (Development & Regulation) Act, 1957. The bid document shall include the exhaust quarry reclaim plan per needs of the landowner / community.

### 3. PRE-CONSTRUCTION STAGE

The Contractor shall select an existing licensed quarry identified in DPR for procuring materials. The Contractor shall establish a new quarry with the prior consent of the PIU only in cases when: (i) Lead from existing quarries is uneconomical and (ii) Alternative material sources are not available. The Contractor shall prepare a Redevelopment Plan for the quarry site and get it approved by the PIU.

The construction schedule and operations plans to be submitted to the PIU prior to commencement of work shall contain a detailed work plan for procuring materials that includes procurement, transportation and storage of quarry materials.

## 4. CONSTRUCTION STAGE

### 4.1 Development of Quarry Area

To minimize the adverse impact during excavation of material following measures are need to be undertaken:

- Adequate drainage system shall be provided to prevent the flooding of the excavated area
- At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff.
- Construction of offices, laboratory, workshop and rest places shall be done in the up-wind of the plant to minimize the adverse impact due to dust and noise.
- The access road to the plant shall be constructed taking into consideration location of units and also slope of the ground to regulate the vehicle movement within the plant.
- In case of storage of blasting material, all precautions shall be taken as per The Explosive Rules, 1983.

### 4.2 Setting up of Crushers and other equipment's

The following measures shall be undertaken for setting up of crushers are other equipment's.

- The contractor shall obtain "No Objection Certificate (NoC)" from the Tamil Nadu Pollution Control Board.
- All vehicles must possess Pollution Under Control (PUC) Certificate and shall be renewed accordingly
- All machinery, equipment's, and vehicles shall comply with existing CPCB noise and emission norms.
- The PIU must ensure that contractor shall submit the copy of NoC and PUC Certificate before the start of work.

### 4.3 Quarry operations

The followings precautions shall be undertaken during quarry operations. vii) Overburden shall be removed and disposed as per **Guideline 8** "Waste Management and Debris Disposal".

- During excavation slopes shall be flatter than 20 degrees Guideline 8 on to prevent their sliding
- In case of blasting, the procedure and safety measures shall be taken as per The Explosive Rules, 1983
- The Contractor shall ensure that all workers related safety measures shall be done as per measures for, "Labour & Workers Health & Safety" (**Guideline 12**).
- The Contractor shall ensure maintenance of crushers regularly as per manufacturer's recommendation.
- Stockpiling of the excavated material shall be done as per stockpiling of topsoil explained in **Guideline 4**, "Topsoil Salvage, Storage& Replacement."
- During transportation of the material, measures shall be taken as per **Guideline 11** "Construction Plants and Equipment Management" to minimize the generation of dust and to prevent accidents
- The PIU and the concerned authority shall review the quarry site for the management measures during quarry operation, including the compliance to pollution norms.

## 5. POST CONSTRUCTION STAGE

A quarry redevelopment plan shall be prepared by the Contractor. All haul roads constructed for transporting the material from the quarries to construction site shall be restored to their original state.

The PIU and the concerned authority shall be entrusted the responsibility of reviewing the quarry site for the progress of implementation of Redevelopment Plan.

The plan shall include:

- Photograph of the quarry site prior to commencement
- The quarry boundaries as well as location of the materials deposits, working equipments, stockpiling, access roads and final shape of the pit.
- Drainage and erosion control measures at site
- Safety measures during quarry operation
- Design for redevelopment of exhaust site.

**Two options for redevelopment of quarry areas are given below:**

**Option A: Revegetating the quarry to merge with surrounding landscape.** This is done by conserving and reapplying the topsoil for the vegetative growth.

**Option B: Developing exhausted quarries as water bodies.** The pit shall be reshaped and developed into pond, for harvesting rainwater. This option shall only be considered where the location of quarry is at the lowest point, i.e. surrounding areas/natural drainage slopes towards it.

## GUIDELINE-6: WATER FOR CONSTRUCTION

### 1. INTRODUCTION

The scope of this guideline includes the procurement of water required for construction of roads. Except bituminous works, water is required during all stages of road construction such as Embankment Sub-Grade; Granular sub-base (GSB) and Water Bound Macadam (WBM). Management of water in various stages of construction is given in the following sections.

### 2. PROJECT PLANNING & DESIGN STAGE

- The Detailed Project Report for both road constructions shall contain the following information:
- Estimate of water requirement during different seasons based on construction schedule of various stages of construction.
- Identification of potential sources of water for construction,
- Arrangements to be worked out by the contractor with individual owners, when water is obtained from private sources, and
- Whether scarcity of water would have any impact on schedule of construction.

#### **In water-scarce regions, provide the following additional information in Project Reports...**

- Exploring possibilities for use of existing perennial sources, through interactions with water user groups as the villagers, relevant Government Departments, keeping in view that the water extraction does not infringe upon the usufruct rights of the existing water users.
- Identification of potable water source for domestic use of workers and for use in cement - based construction such as cement concrete roads, culverts and other cross drainage works.
- Identification of alternate water sources, water-harvesting techniques will be explored to avoid water extraction from the existing community sources.

In water scarce regions, if water-harvesting structures are to be constructed, suitable locations and mechanism for siting these structures will be identified. These are envisaged to be permanent water tanks for collection of stream water. Detailed drawings of water harvesting structures based on site conditions will need to be worked out and presented in the DPR. No extra payment shall be generally made for these works and the Contractor has to include the cost of these items in his offer while quoting his tendered rate.

**Scheduling Construction in Water Scarce Areas:** As part of the project preparation, the PIU shall conduct an assessment of water requirement and availability in water scarce regions. As far as possible, schedule for construction in these water scarce areas shall be prepared such that earthwork for embankment is carried out just before monsoon, so that water requirement for subsequent construction works such as granular sub-base and water bound macadam are met in monsoon and post monsoon season. Carrying out these activities even during the monsoon is possible as the rainfall may not be high enough to disrupt construction.

### 3. PRE-CONSTRUCTION STAGE

Prior to commencement of extraction of water for construction, the contractor shall work out arrangements as specified in the DPR.

**In water-scarce regions, provide the following additional information in Project Reports...**

- Exploring possibilities for use of existing perennial sources, through interactions with water user groups as the villagers, relevant Government Departments, keeping in view that the water extraction does not infringe upon the usufruct rights of the existing water users.
- Identification of potable water source for domestic use of workers and for use in cement - based construction such as cement concrete roads, culverts and other cross drainage works.
- Identification of alternate water sources, water-harvesting techniques will be explored to avoid water extraction from the existing community sources.  
from any septic tank/soak pit or other source of pollution.
- **In case of water harvesting structures** (if required), the Contractor shall in consultation with the residents, identify suitable locations for siting the structure and construct the same.
- **In case of perennial sources**, the Contractor shall adhere to all administrative procedures pertaining to procurement of water from such sources.

#### **4. CONSTRUCTION STAGE**

During construction, the Contractor shall be responsible to monitor the following:

- The arrangements worked out with the Panchayat/individual land owners for water extraction is adhered to;
- Extraction of water is restricted to construction requirement and domestic use of construction workers;
- Water requirement for curing of concrete shall be minimized by pooling of water over the concrete or by covering with wet gunny bags; and
- The potable water used for drinking purposes of construction workers shall be as per the Indian Standard for Drinking Water IS: 10500, 1991.

## GUIDELINE-7: SLOPE STABILITY AND EROSION CONTROL

### 1. INTRODUCTION

Stability of slopes is a major concern in locations of high embankment. In cases of high embankment, water retention at the embankment base initially causes toe failure and subsequently failure of the whole embankment. Soil erosion is consequent to high runoff on hill slopes. Embankments made up of silty and sandy soils get eroded, in the absence of vegetative cover, when the slopes are steep say more than 20 Degree.

The scope of this guideline includes measures to minimize the adverse environmental impacts due to slope instability and soil erosion. The adverse environmental impact can be: (i) Damage to adjacent land, (ii) Silting of ponds and lakes disturbing the aquatic habitat (iii) Erosion of rich and top fertile top layer of soil (iv) Contamination of surface water bodies and (v) Reduction in road formation width due to erosion of shoulders/berms.

### 2. PROJECT PLANNING AND DESIGN STAGE

During the detailed project preparation phase, the following investigations shall be carried out prior to finalisation of alignment.

- Topographical;
- Hydrological;
- Geo-technical; and
- Geological Investigation (in case of roads in hill areas and areas of high seismic activity)

In addition to the slope stability analysis the alignment should be such that (i) steep as well as heavy cuts are avoided, (ii) Flora and fauna of the area are not disturbed and (iii) Natural drainage pattern is not obstructed.

For high embankments, geo-technical investigations (determination of C,  $\phi$ , density etc.) of the available material need to be done to check its suitability as fill material.

In case of the CD structures, measures for preventing siltation and scouring shall be undertaken as per Guideline on, "Drainage".

Following guidelines shall be followed in desert areas while using cohesion-less soils for embankment construction.

- The alignment should follow the natural ground level to the extent possible and the embankment shall be restricted to minimum to achieve ruling grades.
- Slope of the embankment should be 3 (H): 1(V) or flatter.
- The corners of the embankment should be rounded for better aerodynamic performance.

### 3. PRE-CONSTRUCTION STAGE

Interceptor ditches are constructed along hilly slopes or areas with high rainfall to protect the road bench and hillside slope from erosion due to heavy rainfall and runoff. Interceptor ditches are very effective in the areas of high intensity rainfall and where the slopes are exposed. These are the structures designed to intercept and carry surface run-off away from erodible areas and slopes, thus reducing the potential surface erosion. The PIU must ensure that the layout and siting of ditches is as per specifications.

### 4. CONSTRUCTION STAGE

When alternative material such as fly ash is used for embankment formation, it needs to be ensured that sufficient filter bed is provided along with the top cap. All tests as per IS: 2720



(Parts: 4, 5, 8 & 40) and IRC: SP: 20-2002 are to be conducted on the embankment to keep a check on the compaction achieved. Slope stabilisation techniques and erosion control measures such as vettiver grass, stone pitching, use of geotextile and turfing.

#### Box-1: Detailed specifications for Vegetative cover

##### *Description:*

The vegetative cover should be planted in the region where the soil has the capacity to support the plantation and at locations where meteorological conditions favours vegetative growth.

##### *Site Preparation:*

- To prevent the seeds from being washed away subsequent to sowing, the area should be protected with surface roughening and diversions.
- Soil samples should be taken from the site and analysed for fertiliser and lime requirements.

##### *Seed Application:*

- The seed should be sown uniformly as soon as preparation of the seedbed has been completed.
- No seed should be sown during windy weather. The best time for seeding would be during monsoon.

##### *Maintenance:*

During first six weeks, the planting should be inspected by the PIC, to check if the growth is uniform and dense. Appropriate moisture levels shall be maintained. There may be requirement of watering the plantings regularly during the dry seasons.

## 5. POST CONSTRUCTION STAGE

All the exposed slopes shall preferably be covered with vegetation using grasses, brushes etc. Locally available species possessing the properties of (i) good growth (ii) dense ground cover and (iii) deep root shall be used for stabilization.

In case of steep and barren slopes, in order to retain the seedling to the ground asphalt mulch treatment shall be given. Seedling are covered with asphalt emulsion and spread into a thin layer. The asphalt film gradually disintegrates and a carpet of green vegetation and deep-rooted species of grass and clovers, takes its place. Anchoring shall be carried out as per IRC: SP: 48-1998.

Regular inspection of check dams and repositioning/replacement of dislodged or stolen stones need to be carried out.

Repair and maintenance of eroded side drain inverts is to be done in order to arrest retrogradation of levels in side drains. Slopes of high embankment can give a fertile base for growth of vegetative cover / sodding.

In arid areas, in order to avoid the deposition of sand over or near the road surface, shrubs are to be planted at an appropriate distance from the formation. The shrubs should not be abutting the road and the distance for carrying out plantation shall be determined based on prevalent wind speeds as well as quantity of sand being carried amongst various other factors. There should be a clear gap between the roadway and shrubs to allow the wind to pick up its velocity and carry along with it any sand that is deposited.

## GUIDELINE-8: WASTE MANAGEMENT AND DEBRIS DISPOSAL

### 1. INTRODUCTION

This guidance describes procedures for handling, reuse and disposal of waste materials during road construction. The Guideline describes waste management measures in all stages of construction. Also, the Guideline discusses the measures to be taken for debris disposal.

### 2. PROJECT PLANNING AND DESIGN STAGE

As part of DPR preparation, the PIU shall carry out the following measures

- Finalize road design and alignment to minimize waste generation through balancing of cut and fill operations and minimizing excess cuts requiring disposal.
- Identify the type of wastes as well as sources of waste during construction and suggest options for possible reuse
- Provide guidelines to the contractor for locating waste disposal sites for non-toxic wastes
- Identify existing landfill sites if available for disposal of toxic materials.
- In case no existing landfill sites are available, identification of landfill site as well as identification of the clearance requirements.
- Identify sites of disposal of debris.

### 3. PRE-CONSTRUCTION STAGE

The contractor shall identify the activities during construction, that have the potential to generate waste and work out measures for reducing, reusing and proper disposing of the generated waste in the construction schedule to be submitted to the PIU. A sequential listing of the activities during road construction and the nature of wastes together with the possible options for reuse are specified in **Table-1**. For the disposal of excess cut and unsuitable (non-toxic) materials, the contractor shall identify the location for disposal in consultation with the community / concerned department. Any toxic materials shall be disposed in existing landfill sites that comply with legislative requirements. Prior to disposal of wastes onto private/community land, it shall be the responsibility of the Contractor to obtain a No-objection Certificate (NOC) from the land owner/community. The NOC shall be submitted to the PIU prior to commencement of disposal.

The Contractor shall educate his workforce on issues related to disposal of waste, the location of disposal site as well as the specific requirement for the management of these sites.

Practices to avoid - waste disposal ...
<ul style="list-style-type: none"><li>• Tipping of waste into stream channels, water bodies, forests and vegetated slopes</li><li>• Non-cleaning of wastes after day's work</li><li>• Leaching of wastes</li><li>• Littering in construction camps / sites</li><li>• Storing wastes on private land</li></ul>

### 4. CONSTRUCTION STAGE

The contractor shall either reuse or dispose the waste generated during construction for roads depending upon the nature of waste, as specified in **Table 1**. The reuse of waste shall be carried out by the contractor only after carrying out the specific tests and ascertaining the quality of the waste materials used, and getting the same approved by the PIU. Wastes that were not reused shall be disposed off safely by the contractor. The contractor shall adopt the following precautions while disposing wastes:

- Bituminous wastes shall be disposed off in 60mm thick clay lined pits and covered with 30cm good earth at top, so as to facilitate growth of vegetation in long run.
- In case of filling of low-lying areas with wastes, it needs to be ensured that the level matches with the surrounding areas. In this case care should be taken that these low lying areas are not used for rainwater storage

- In case oil and grease are trapped for reuse in a lined pit, care shall be taken to ensure that the pit should be located at the lowest end of the site and away from the residential areas.

The waste management practices adopted by the Contractor, including the management of wastes at construction camps etc shall be reviewed by the PIU and the Pollution Control Board (PCB) during the progress of construction.

## 5. POST CONSTRUCTION STAGE

On decommissioning of construction sites, the Contractor shall hand over the site free of all debris/wastes to the satisfaction of PIU. In case of any temporary disposal of wastes on private land, certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that “the land is restored to his satisfaction”. The same is to be submitted to the PIU before final payment is claimed.

**Table 1: Type of wastes and scope for reuse- road construction**

S. No	Activity	Type of waste	Scope for possible reuse	Disposal of waste
I	<b>CONSTRUCTION WASTES</b>			
1.	Site Clearance and grubbing	Vegetative cover and top soil	Vegetating embankment slopes	
		Unsuitable material in embankment foundation	Embankment Fill	Low lying areas Land fill sites
2.	Earthworks			
a)	Overburden of borrow areas	Vegetative cover and soil	Vegetating embankment slopes	
b)	Overburden of quarries	Vegetative cover and soil	Vegetating embankment slopes	
		Granular material	Embankment Fill, Pitching	
c)	Accidental spillages during handling	Dust		
d)	Embankment construction	Soil and Granular Material	Embankment Fill	
e)	Construction of earthen drains	Soil	Embankment Fill	
3.	Concrete structures Dust			
a)	Storage of material	Dust, Cement, Sand	Constructing temporary structure, embankment fill	
		Metal Scrap		Scrap Yard
b)	Handling of materials	Dust		
c)	Residual wastes	Organic matter	Manure, Re-vegetation	
		Cement, sand	Constructing temporary structure, embankment fill	
		Metal scrap	Diversion sign, Guard Rail	
4	Reconstruction works			
a)	Dismantling of existing pavement	Bitumen Mix, granular material	sub-base	
		Concrete	Road Sub-base, reuse in concrete, fill material and as rip rap on roads	
		Guard rail sign post,	Reuse for same	

S. No	Activity	Type of waste	Scope for possible reuse	Disposal of waste
		guard stone		
b)	Dismantling of cross drainage structures	Granular material & bricks	Constructing temporary structure, embankment fill	
		Metal scrap	Diversion sign, Guard Rail Culvert	
		Pipes	Culvert	
5	Decommissioning of sites			
a)	Dismantling of temporary structures	Granular material and bricks	Constructing temporary structure, embankment fill	
6	Maintenance operation			
a)	Desilting of side drains	Organic matter and soil	Re-vegetation	
<b>II</b>	<b>OIL AND FLUIDS</b>			
1	Construction machinery maintenance and refueling	Oil and Grease	Incineration, Cooking, Illumination	
2	Bituminous works			
a)	Storage	Bitumen	Low Grade Bitumen Mix	
b)	Mixing and handling	Bitumen	Low Grade Bitumen Mix	
		Bitumen Mix	Sub-base, Paving access & cross roads	
c)	Rejected bituminous mix	Bitumen Mix	Sub-base, Paving access & cross roads	
<b>III</b>	<b>DOMESTIC WASTES</b>			
1	Construction camps	Organic waste,	Manure	
		Plastic and metal scrap		Scrap Yard
		Domestic effluent	Irrigation	

## 6. DISPOSAL OF DEBRIS

For the purpose of disposal of debris, dumping sites need to be selected. The criteria for selection of dumping sites include:

- No residential areas are located downwind side of these locations;
- Dumping sites are located at least 1000 m away from sensitive locations;
- Dumping sites do not contaminate any water sources, rivers etc; and
- Dumping sites have adequate capacity equal to the amount of debris generated;
- Public perception about the location of debris disposal site has to be obtained before finalizing the location;
- Permission from the Village Panchayat is to be obtained for the dumping site selected;
- Productive lands are avoided; and
- Available waste lands shall be given preference

## GUIDELINE-9: WATER BODIES

### 1. INTRODUCTION

Water bodies may be impacted when the road construction is adjacent to it or the runoff to the water body is affected by change of drainage pattern due to construction of embankment. The following activities are likely to have an adverse impact on the ecology of the area:

- Earth moving;
- Removal of vegetation;
- Vehicle/Machine operation and maintenance;
- Handling and laying of asphalt; and
- Waste disposal from construction camps.

Impacts on water bodies impairs ...
• Change in Catchment area of the water body
• Drainage system
• Flood level and water logging
• Flora and fauna dependant on the water body
• Ground water recharging
• Animal husbandry as water bodies are used by animals
• Water quality &
• Runoff (increase/decrease)

### 2. PROJECT PLANNING AND DESIGN STAGE

All efforts are to be taken to avoid the alignments passing adjacent or close to water bodies. Where possible, it should be realigned away from the water body without cutting its embankment, decreasing the storage area or impairing the catchment area. Adequate drainage arrangements as per IRC guidelines have to be provided. Stream bank characteristics and hydrology of the area are to be studied before finalizing the alignment, the profile and cross-drainage structures.

Complete filling of water body with soil is not contemplated in the project. The DPR and its cost estimates have to accommodate costs of rehabilitation (to be estimated as lump sum at DPR stage) of water bodies impacted by the project. Water body rehabilitation shall be as per the Rehabilitation Plan prepared by the Contractor which should have approval of the PIU. Details of the tasks to be performed as per the sequence of activities during the project planning and design are as follows:

- Consultations with the people regarding alternate routes that were devised to avoid the pond. If alternate routes are not available, consent of the villagers is to be sought for affecting the pond and also the measures that would be taken to mitigate the impacts.
- Final design is to be prepared indicating the pond location in the alignment drawings.
- If impacting the pond, the extent of impact is to be clearly indicated on a separate drawing showing blown up portion of the pond. The drawing should aid the contractor in setting up exact lines for cutting the pond.
- All necessary measures for mitigation of impacts and precautionary measures while working close to the water body are to be incorporated into the DPR and cost estimates. The measures to be incorporated shall be as per this guideline.

### 3. PRE-CONSTRUCTION STAGE

The Contractor after an assessment of the likely impacts on the water body and review of the provisions of this guideline shall prepare a detailed work plan at the pre-construction stage. The Contractor shall prepare a Rehabilitation Plan for rectifying the likely impact to be caused and approval of PIU shall be sought prior to commencement of work. The Rehabilitation Plan should include:

- Locations of erosion protection works and silt fencing to prevent sediment laden runoff entering the water body;

- Location of side drains (temporary or otherwise) to collect runoff from the embankment before entering the water body in accordance with IRC guidelines;
- Work program in relation to the anticipated season of flooding/overflowing of the water body;
- Obstructions likely to cause temporary flooding and information to seek clearance to remove the obstruction; and
- Drawings in Rehabilitation Plan should indicate the landscape details along with species to be planted in the surrounding environs of the water body.

The rehabilitation of water body should be with the objective of restoring it to its original state or to a better state with necessary enhancement of its environs. Rehabilitation Plan shall include:

- Reconstruction and stabilization of embankment in case it is impacted;
- If storage area is lost, then the water body is to be deepened to regain an equivalent volume;
- Further enhancement of the water body as a focal point with place for seating and provision of shade; and
- Costs of rehabilitation

Concurrence of the community has to be sought on the Rehabilitation Plan prepared by the Contractor. Concerns of the community have to be incorporated into the plan before submitting it for approval of the PIU.

The PIU shall scrutinize the Rehabilitation Plan, verify the implementation on site and finally approve the plan. The Rehabilitation Plan should be implemented by the Contractor immediately after completion of construction at the stretch near the water body.

<b>Working near Water Bodies – Precautions</b>	
•	Avoid locating roads on pond embankment
•	Collect road runoff before entering the water bodies
•	Runoff to be filtered of sediments before letting into water bodies
•	Avoid debris disposal into water bodies
•	Avoid disposal of oil/grease/other contaminants into water bodies

When there is interruption to regular activities of villagers near water body due to construction or rehabilitation work, following are the Contractor’s responsibilities:

- Restriction on use of water, if any, should be intimated to the community in advance;
- Alternate access to the water body is to be provided in case there is interruption to use of exiting access. The access provided should be convenient for use of all the existing users whether community or cattle; and
- If the water body affected is a drinking water source for a habitation, alternate sources of water are to be provided to the users during the period for which its use is affected.

#### **4. CONSTRUCTION STAGE**

It should be ensured by the contractor that the runoff entering the water body is free from sediments

Silt fencing and/or brush barrier shall be installed in the drainage channels for collecting the sediments before letting them into the water body Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Cutting of embankment reduces the water retention capacity and also weakens it, hence:

- The contractor should ensure that the decrease in water retention should not lead to flooding of the construction site and surroundings causing submergence and interruption to construction activities.
- Any perceived risks of embankment failure and consequent loss/damage to the property shall be assessed and the contractor should undertake necessary precautions as provision of toe protection, erosion protection, sealing of cracks in embankments. Failure to do so and

consequences arising out of embankment failure shall be the responsibility of the contractor. The PIU shall monitor regularly whether safe construction practices near water bodies are being followed.

Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body. Movement of machinery and workforce shall be restricted around the water body, and no waste from construction camps or sites shall be disposed into it.

## **5. POST CONSTRUCTION STAGE**

With the completion of construction, the PIU has to ensure implementation of rehabilitation/restoration plan for the water body, as indicated by the Contractor in the bid submission. The precincts of the water body have to be left clean and tidy with the completion of construction. Drainage channels of adequate capacity shall be provided for the water body impacted.

## GUIDELINE-10: DRAINAGE

### 1. INTRODUCTION

Inadequate and faulty drainage arrangements during road construction result in obstruction to natural drainage pattern. The problem is further aggravated in the low-lying areas and flood plains receiving high intensity rainfall, which can lead to the instability of embankment, damage to pavement, sinking of foundation, soil erosion, safety hazards and disruption in traffic. Provision of cross-drainage and longitudinal drainage increases the life of the road and consequently reduces water logging and related environmental impacts. The functioning of the drainage system is therefore a vital condition for a satisfactory road.

However, construction or upgradation of CD structures and longitudinal drains is likely to increase sediments, scour the banks, change water level and flow, and also affect the ecology of the surrounding area. The guideline shall address the environmental concerns related to drainage aspects during different stages of the project execution.

### 2. PROJECT PLANNING AND DESIGN

Drainage shall be broadly divided as (i) Cross-Drainage and (ii) Longitudinal Drainage both surface & subsurface drainage. The alignment shall be routed such that minimum drainage crossings are encountered. Also the geometric design criteria as per IRC 73, guidelines for effective surface drainage should be ensured.

All drains crossing the alignment shall be identified on site and marked on map while undertaking transect walk. Basic information on the width of channel, frequency of traffic holdup and flow would provide inputs into screening of alternate alignments as well as fixing the alignment. Consultations with the community shall provide information on the HFL in the area.

In areas of high and medium intensity rainfall (>400 mm/year), flood prone areas and hilly areas, detailed hydrological studies will need to be conducted. The studies shall be conducted as per IRC: SP-13: 1973 "Guidelines for the Design of Small Bridges & Culverts" and IRC: SP-33:1989 "Guidelines on Supplemental Measures for Design, Detailing & Durability of Important Bridge Structures".

Design of cross-drainage structures shall be based on the inputs from the hydrological studies as per clause 12.2.3 and in other areas, the C-D structure design shall be as per IRC: SP-13. Design of C-D structure shall be such that:

- Normal alignment of the road is followed even if it results in a skew construction of culverts and stream bank protections are incorporated.
- Afflux generated is limited to 30 cm in plains with flat land slopes.
- It is fish friendly - fish passage is not interrupted either in upstream or downstream direction.
- Adequate scour protection measures for stream bank, roadway fill as head walls, wing walls and aprons are included.
- Reinforced road bed (of concrete or rock) for protection against overflow in case of low water crossing (floods/causeways) is included.
- The design of C-D structure (minor and major bridge) should have stairs leading to the bed of the drainage channel, for regular inspection of the sub-structure.
- Schedule of construction of C-D structures should be confined to dry months to avoid contamination of streams.

Longitudinal drains are to be designed to drain runoff from highest anticipated rainfall as per rainfall data for the past 20 years or 50 years as per hydrological analysis in high rainfall areas (annual rainfall >1000 mm) and hill areas. For design of longitudinal drains in other areas, the design shall be as per IRC: SP-20:2002.



Outfall of the roadside drains shall be into the nearby stream or culvert. The outfall should be at such a level that there would be no backflow into the roadside drain. Wherein pond/low lying areas exist in the vicinity, the flow may be diverted into them after removal of sediment for possible ground water recharge.

In case of high embankment (>1.0m) or bridge approaches, lined channels shall be provided to drain the surface runoff, prevent erosion from the slopes and avoid damage to shoulders and berms. Detailed specifications shall be as per IRC: SP-20:2002. The type of drains that can be constructed include bricklined, pucca with RCC, covered drain with RCC slabs and piped drain.

### **3. PRE-CONSTRUCTION STAGE**

Following measures are to be undertaken by the contractor prior to the commencement of CD/Bridge construction:

- The downstream as well as upstream user shall be informed one month in advance
- The contractor shall schedule the activities based on the nature of flow in the stream.
- The contractor should inform the concerned departments about the scheduling of work. This shall form part of the overall scheduling of the civil works to be approved by PIU.
- Erosion and sediment control devices are to be installed prior to the start of the civil works.
- Interceptor drains to be dug prior to slope cutting to avoid high runoff from slopes entering construction sites in case of hill roads
- Runoff from temporary drains and interceptor drains to be directed into natural drains in hill roads
- In case of up-gradation of the existing CD Structures, temporary route / traffic control shall be made for the safe passage of the traffic, depending upon the nature of the stream
- All the safety/warning signs are to be installed by the contractor before start of construction

In case of utilization of water from the stream, for the construction of the CD structures, the contractor has to take the consent from the concerned department (refer Guideline on “Water for Construction”)

### **4. CONSTRUCTION PHASE**

Drainage structures at construction site shall be provided at the earliest to ensure proper compaction at the bridge approach and at the junction of bridge span and bridge approach. Velocity of runoff to be controlled to avoid formation of rills/gullies as per guideline, “Slope stability & erosion control”

While working on drainage channels, sediment control measures shall be provided. Silt fencing (as per the detailed specifications of guideline, “Slope Stability & Erosion Control”) shall be provided across the stream that carries sediment.

The sediments collected behind the bunds shall be removed and after drying, can either be reused or disposed off as per guideline, “Waste Management and Debris Disposal”. Safety devices and flood warning signs to be erected while working over streams and canals.

### **5. POST CONSTRUCTION**

Inspection and cleaning of drain shall be done regularly to remove any debris or vegetative growth that may interrupt the flow. HFL should be marked as per hydrological data on all drainage structure. Temporary structure constructed during construction shall be removed before handing over to ensure free flow through the channels. The piers and abutments should be examined for excessive scour and make good the same if required. The upstream and downstream areas should be cleared of all CD works.

In case of Causeway following aspect shall be taken into consideration:

- Dislocation of stones in stone set pavements, scouring of filler material due to eddy currents.
- Floating debris block the vents. In case of large amount of floating material, debris arrestor shall be provided in upstream side.
- Damage to guide stones, information board shall be inspected and replaced accordingly.

Schedule of Inspection shall be drawn up for checking cracks, settlements and unusual backpressures. It must be ensured that all the rectification shall be undertaken as and when required. Following are broadly the items to be checked:

- Settlement of piers/abutments & settlement of approach slabs have to be checked;
- Cracks in C-D structures or RCC slabs;
- Drainage from shoulders to be ensured;
- Ditches & drains to be kept clean of debris or vegetation growth; and
- Repairs to parapet of culverts whenever required are to be undertaken.

**GUIDELINE-11: CONSTRUCTION PLANTS & EQUIPMENT  
MANAGEMENT**

**1. GENERAL**

During execution of the project, construction equipment's, machinery and plants are likely to cause adverse impact on the environment. The impact can be due to the emissions, dust, noise and oil spills that concern the safety and health of the workers, surrounding settlements and environment as a whole. This guideline describes the activities during the project stages where pollution control measures are required.

**2. PROJECT PLANNING AND DESIGN STAGE**

Selection criteria for setting up a plant area and parking lot for equipment's and vehicles shall be done as per siting criteria for construction camp specified in Guideline on "Construction and Labour Camps".

**3. PRE-CONSTRUCTION STAGE**

The Contractor must educate the workers to undertake safety precaution while working at the plant / site as well as around heavy equipment's. Before setting up the crusher, hot-mix plant and generator, the Contractor shall acquire "No Objection Certificate (NOC)" from the Tamil Nadu Pollution Control Board for the same. The Contractor shall ensure all vehicles must possess Pollution under Control (PUC) Certificate, which and shall be renewed regularly. The Contractor must ensure that all machinery, equipment's, and vehicles shall comply with the existing Central Pollution Control Board (CPCB) noise and emission norms. The PIU must ensure that the Contractor shall submit a copy of the NOC and PUC Certificates before the start of work. The Contractor shall design the service road with protection measures as black topping at vulnerable points as in low lying areas.

**4. CONSTRUCTION STAGE**

The Contractor shall undertake measures as per **Table 1** to minimize -the dust generation, emissions, noise, oil spills, residual waste and accidents at the plant site as well as during transportation of material to construction site.

**Table 1: Measures at Plant Site**

Concern	Causes	Measures
Dust Generation	Vehicle Movement	<ul style="list-style-type: none"> <li>• Water sprinkling</li> <li>• Fine Materials shall be Transported in Bags or Covered by Tarpaulin during Transportation</li> <li>• Tail board shall be properly closed and sealed to be spill proof</li> </ul>
	Crushers	<ul style="list-style-type: none"> <li>• Regular Water Sprinkling to keep the dust below visibility level</li> </ul>
	Concrete-Mix Plant	<ul style="list-style-type: none"> <li>• Educate the workers to follow/adopt good engineering practices while material handling</li> </ul>
Emissions	Hot-Mix Plant	<ul style="list-style-type: none"> <li>• Site Selection as per Clause 6.5.2, Section 6.5, IRC's Manual for Construction &amp; Supervision of Bitumen Work</li> <li>• Regular maintenance of Dust Collector as per manufacture's recommendations</li> </ul>
	Vehicles	<ul style="list-style-type: none"> <li>• Regular maintenance as per manufacture's recommendation</li> </ul>
	Generators	<ul style="list-style-type: none"> <li>• Exhaust vent of long length and emission to confirm to PCB norms.</li> </ul>
	Heavy Load Vehicles	<ul style="list-style-type: none"> <li>• Exhaust silencer, Regular maintenance as per manufacture schedule</li> </ul>

Concern	Causes	Measures
Noise	Crushers	• Siting as per guideline, “Construction and Labour Camps”
	Generators	• All generators should have mandatorily acoustic enclosures and confirms to PCB norms.
Oil Spills	Storage and Handling	• Good practice, guideline, “Waste Management and Debris Disposal”
Residual waste	Dust Collector and Pits	• Guideline , “Waste Management and Debris Disposal”
Concrete waste	Concrete-Mix plant	• Guideline, “Waste Management and Debris Disposal”
Bitumen and bitumen mix	Hot-mix Plant	• Guideline, “Waste Management and Debris Disposal”
Stone chips	Crushers	• Guideline, “Waste Management and Debris Disposal”
Safety	Trajectory of Equipments	• No worker shall be present in the vicinity of the equipments
	Movable Parts of Equipments	• Caution Sign, awareness among workers
	Plant Area / Site	• Caution Sign, Safety Equipments
	Accidents /Health	• First Aid Box, Periodic Medical Checkup Break down of
	Break down of vehicles	• Arrangement for towing and bringing it to the workshop

During site clearance, all cut and grubbed materials shall be kept at a secured location so that it does not raise any safety concerns. During excavation, water sprinkling shall be done to minimize dust generation. Frequent water sprinkling shall be done on the haul roads to minimize dust generation. In case of loose soils, compaction shall be done prior to water sprinkling. Cautionary and informatory sign shall be provided at all locations specifying the type of operation in progress. The contractor must ensure that there is minimum generation of dust and waste while unloading the materials from trucks. The construction waste generated shall be disposed as per Guideline on, “Waste Management and Debris Disposal”. The equipments, which are required to move forward and backward, shall be equipped with alarm for backward movement. It shall be ensure that the workers shall remain away from the working areas at such times. Also, equipments at construction camp should be barricaded and kept away from residential quarters of workers.

The PIU shall carry out periodic inspections to ensure that all the pollution control systems are appropriately installed and comply with existing emission and noise norms.

## 5. POST-CONSTRUCTION STAGE

### Safety Measures During Bitumen Construction Work...

- The Contractor shall ensure that bitumen storing, handling as well as mixing shall be done at hot-mix plant or designated areas<sup>1</sup> to prevent contamination of soil and ground water.
- Skilled labour shall be used while hand placing the pre-mixed bitumen material. The hand placing of pre-mixed bituminous material shall be done only in following circumstances:
  - For laying profile corrective courses of irregular shape and varying thickness
  - In confined spaces where it is impracticable for a paver to operate and
  - For filling potholes
- The Contractor shall provide safety equipments i.e. gumboots and gloves to the workers while handling bitumen.
- While applying Tack Coat, spraying of bitumen shall be done in the wind direction. The labour shall wear jacket while spraying the bitumen.
- All the bituminous work shall be done as per IRC’s Manual for Construction and Supervision of Bituminous Works.

The PIU shall ensure that all the haul roads are restored to their original state. In case any inner village road is damaged while transporting the procured material; the contractor shall restore the road to its original condition. The PIU must ensure that the decommissioning of plant shall be done in environmentally sound fashion and the area to bring its original state.

Designated area refers to paved surfaces and barren parcels of land, with adequate drainage and disposal system. It must be ensure that these are away from agriculture land, water body and other sensitive areas.

## GUIDELINE-12: LABOUR AND WORKER'S HEALTH AND SAFETY

### 1. INTRODUCTION

The safety and health concerns of the workers and the community are impacted due to the hazards created during the construction of road. **Box: 1** gives the safety concerns during construction. This Guideline describes the hazards and measures that need to be taken to mitigate the impacts.

### 2. PROJECT PLANNING AND DESIGN STAGE

To address health and safety concerns, the DPR shall contain selection criteria for setting up:

- Construction Camps (as per guideline);
- Borrow Areas (as per guideline); and
- In case of opening new quarry areas (as per guideline).

To address the safety concerns to road user during operational phase, the DPR shall contain the following:

- Selection and location of regulatory as well as inforamatory signs as per IRC: 67-2001, depending upon the geometry of the road.

Box 1: Safety Concerns during Construction
<p><b>Community due to:</b></p> <ul style="list-style-type: none"><li>• Improper scheduling of construction activities especially near the settlements and sensitive areas;</li><li>• Parking of equipments and vehicles at the end of the day likely to cause accidents to the general public especially during night hours;</li><li>• Transportation of uncovered loose material or spillage of material increases the chances of accidents to road users and surrounding settlements.</li></ul> <p><b>Workers due to:</b></p> <ul style="list-style-type: none"><li>• Improper handling of materials like bitumen, oil and other flammable material at construction sites, likely to cause safety concerns to the workers;</li><li>• Lack of safety measures such as alarm, awareness and safety equipment result in accidents, especially working with or around heavy machinery / equipments.</li></ul>

### 3. PRE-CONSTRUCTION STAGE

In order to incorporate public health and safety concerns, the PIU and the Contractor shall disseminate the following information to the community:

- Location of construction camps, borrow areas and new quarry areas;
- Extent of work;
- Time of construction;
- Diversions, if any;
- Precaution measures in sensitive areas;
- Involvement of local labours in the road construction;
- Health issues - water stagnation, exposure to dust, communicable disease; and
- Mechanism for grievances.

Health Concerns are adversely impacted.....
<p><b>Public due to:</b></p> <ul style="list-style-type: none"><li>• Unhygienic conditions due to water logging (improper drainage of waste water), either by improper decommissioning of Construction Camps and parking lots, or improper disposal of construction wastes, leading to the breeding of vectors that are likely to impact the health of the general public</li><li>• Interaction between workers and host community is likely to increase the risk of spread of communicable diseases.</li></ul> <p><b>Workers due to:</b></p> <ul style="list-style-type: none"><li>• Low quality drinking water as well as inappropriate storage of drinking water likely to cause water borne diseases among workers.</li><li>• Absence of proper sanitary facility likely to act as a breeding ground for vectors raising health concerns among workers.</li></ul>

The information dissemination could be through the local newspaper, billboards, panchayats meetings, etc. The Contractor must educate the workers to undertake the health and safety precautions. The contractor shall educate the workers regarding:

- Awareness on HIV/AIDS awareness and usage of safety measures such as condoms;
- Awareness on hygienic sanitary practices;
- Personal safety measures and location of safety devices;
- Interaction with the host community;
- Protection of environment with respect to:
  - Trampling of vegetation and cutting of trees for cooking;
  - Restriction of activities in forest areas and also on hunting;
  - Water bodies protection;
  - Storage and handling of materials;
  - Disposal of construction waste.

#### 4. CONSTRUCTION STAGE

During the progress of work, following are the safety requirements that need to be undertaken by the contractor at the construction site:

- Personal Protective Equipments (PPE) for the workers. **Table 1** gives the safety gear to be used by the workers during each of the construction activities.
- All measures as per bidding document shall be strictly followed.
- Additional provisions need to be undertaken for safety at site:
  - Adequate lighting arrangement;
  - Adequate drainage system to avoid any stagnation of water;
  - Lined surface with slope 1:40 (V:H) and provision of lined pit at the bottom, at the storage and handling area of bitumen and oil, as well as at the location of generator (grease trap); and
  - Facilities for administering first aid.

FIRST AID FACILITIES	
•	First Aid Kit, distinctly marked with Red Cross on white back ground and shall contain minimum of following: <ul style="list-style-type: none"> <li>○ 6 small-sterilized dressings</li> <li>○ 3 medium and large sterilized dressings</li> <li>○ 1 (30 ml.) bottles containing 2 % alcoholic solution of iodine</li> <li>○ 1(30 ml) bottle containing salvolatile</li> <li>○ 1 snakebite lancet</li> <li>○ 1 pair sterilized scissors</li> <li>○ 1 copy of first-aid leaflet issued by the Director General, Factory Service &amp; Labour Institute, Government of India</li> <li>○ 100 tablets of aspirin</li> <li>○ Ointment for bums</li> <li>○ A suitable surgical antiseptic solution</li> </ul>
•	Adequate arrangement shall be made for immediate recoupment of the equipments, whenever necessary.
•	A trained personnel incharge of first aid treatment to be readily available during working hours at construction site
•	Suitable transport to the nearest approachable hospital should be made available.
•	Tetanus injection must be made compulsory for all workers every 6 months.

**Table 1: Worker Safety Measures**

Sl. No.	Activity	Safety Requirement
1.	Setting out and levelling	<ul style="list-style-type: none"> <li>• Luminous jackets;</li> <li>• Helmets;</li> <li>• Boots for protection against insect bite; and Dust Mask</li> </ul>
2.	Tree cutting	<ul style="list-style-type: none"> <li>• Helmet Boots</li> <li>• Luminous safety jackets</li> </ul>
3	Reinforced yard/ carpentry/ reinforcement cutting/ bending work.	<ul style="list-style-type: none"> <li>• Hand gloves</li> </ul>
4.	Shuttering work	<ul style="list-style-type: none"> <li>• Goggles Hand gloves</li> </ul>
5.	Plant and Machinery	<ul style="list-style-type: none"> <li>• Hand gloves</li> </ul>

Sl. No.	Activity	Safety Requirement
		<ul style="list-style-type: none"> <li>• Boots</li> <li>• Helmets</li> <li>• Dust Mask</li> </ul>
6.	Material handling	<ul style="list-style-type: none"> <li>• Hand gloves</li> <li>• Dust mask</li> </ul>
7.	Batching plant	<ul style="list-style-type: none"> <li>• Goggles</li> <li>• Hand gloves</li> <li>• Dust mask</li> </ul>
8.	Weeding	<ul style="list-style-type: none"> <li>• Goggles</li> </ul>
9.	Binding reinforcement	<ul style="list-style-type: none"> <li>• Safety belt</li> <li>• Boots</li> </ul>
10.	Manual concrete laying	<ul style="list-style-type: none"> <li>• Gum boots</li> <li>• Hand gloves</li> <li>• Helmet</li> </ul>
11.	Piling	<ul style="list-style-type: none"> <li>• Helmet</li> <li>• Hand gloves, gumboots.</li> </ul>

The following measures need to be adopted by the contractor to address public safety concerns:

- The Contractor shall schedule the construction activities taking into consideration factors such as:
  - Sowing of crops;
  - Harvesting;
  - Local hindrances such as festivals etc.; and
  - Availability of labour during particular periods.
- All the cautionary signs as per IRC: 67-2001 and traffic control devices (such as barricades, etc) shall be placed as soon as construction activity get started and shall remain in place till the activities get completed.
- Following case specific measures need to be followed during the progress of the activity:
  - In case of blasting, the Contractor must follow The Explosives Rules, 1983.
  - In case of construction activity adjoining the water bodies, measures shall be taken as per measures suggested in Guideline on “Water Body”.
  - If construction of road is within the settlement, the contractor must ensure that there shall not be any unauthorized parking as well as storage of material, adjacent to road.
  - Approved chemicals should be sprayed to prevent breeding of mosquitoes and other disease-causing organisms, at all the water logging areas

The PIU shall carry out periodic inspections in order to ensure that all the measures are being undertaken as per the guideline.

## 5. POST-CONSTRUCTION STAGE

During this stage a major concern is on road user safety. Following are the measures that need to be undertaken by the PIU to ensure safer roads:

- Inspection and maintenance of installed regulatory and informatory signs.
- Ensure that the location of signage does not obstruct the visibility
- In case of hill roads, maintenance of parapet wall as well as of overtaking zones.

The PIU must ensure that during the maintenance operation of road, road materials are stored at a location such that they shall not create any risk to road users.

The construction site shall be cleaned of all debris, scrap materials and machinery on completion of construction for the safety of public and road users, as per the measures given in Guideline on “Construction and labour Camp” and “Waste Management and Debris Disposal.”





## GUIDELINE-13: CULTURAL PROPERTIES

### 1. INTRODUCTION

The cultural properties located close to the road are likely to be impacted by the road construction. Most of the properties are avoided in general during finalization of alignment. This Guideline discusses the mitigation measures for cultural properties.

### 2. PROJECT PLANNING AND DESIGN STAGE

Measures for mitigation of impacts on cultural properties during project preparation shall be as per the following steps:

- Identification of locally significant cultural properties should be done;
- Assessment of likely impacts on each cultural property due to project implementation;
- The extent of impact on the identified culture property should be assessed and possible measures for avoidance should be devised based on the site investigation. In case impact is not avoidable, identification of alternative routes or possibility of relocation of the culture property shall be assessed in consultation with the local public, based on the economic feasibility.

In case of relocation, relocated site should be suggested by the local people and the size of relocated structure should at least be equal to the original structure. A written consent letter is to be obtained from the community regarding the relocation site of the cultural property in the form of resolution on the letter pad of the sarpanch/gram panchayat or with the signatures of community members.

A detailed design of the relocated structure and its site plan along with the necessary BoQ are to be presented DPR. The relocation and other avoidance measures should be carried out before the start of the road work

It must be ensured by the PIU that the BoQ and rates are incorporated into the contract document.

Information to be collected...
• Location
• Direction (North/ South/East/West) With Respect to Road
• Distance of the structure from existing centerline of the road
• Type of Property eg: temple/mosque/shrine/dargah etc
• Plan of the structure
• Importance of the structure – historical/social/archeological
• Ownership of the property
• Probable loss to the property
• Specific periods/ durations in which large congregations as festivals/mela take place causing hindrance to vehicular movement
• Choice of community, issue of relocation

### 3. CONSTRUCTION STAGE

Major impacts on the properties during this stage are mainly due to movement of construction machinery as well as due to construction activity in the vicinity of the cultural property. Following are precautionary measures that need to be undertaken by the contractor while working near these structures:

- Restrict movement of heavy machinery near the structure
- Avoid disposal or tipping of earth near the structure
- Access to these properties shall be kept clear from dirt and grit

During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archeological significance, the same shall be intimated to the Engineer. Work shall be suspended until further orders from PIU. The State Archeological Department shall be intimated of the chance find and the Engineer shall carry out a joint inspection with the department. Actions as appropriate shall be intimated to the Contractor along with the probable date for resuming the work.

The PIU must ensure that the contractor implements the precautionary measures as suggested. Also, the PIU must conduct monitoring for the enhancement of cultural property.



## GUIDELINE-14: TREE CUTTING AND AFFORESTATION

This Guideline discusses the issue of tree cutting and afforestation. Loss of trees creates adverse environmental impacts. In order to mitigate these impacts, suitable measures have been suggested as part of this Guideline. These measures have been given for each of the stages of the road construction activities.

### 1. PROJECT PLANNING AND DESIGN STAGE

During alignment finalisation, due consideration shall be given to minimise the loss of existing tree cover, encroachment of forest areas / protected areas etc as specified in guideline on, "Site preparation". Tree felling, if unavoidable, shall be done only after compensatory plantation of ten saplings for every tree cut is done.

The plantation/afforestation would be carried out by the Contractor. It should be ensured that plantation is carried out only in areas where water can be made available during dry seasons and the plant can be protected during the initial stages of their growth. The species shall be identified giving due importance to local flora (suggested in Table 1). It is recommended to plant mixed species in case of both avenue or cluster plantation.

The plantation strategy shall suggest the planting of fruit bearing trees and other suitable trees. Development of cluster plantations will be encouraged in the community lands, at locations desired by the community. The choice of species will be based on the preferences of the community. The PIU shall oversee the plantation to check the following:

- Whether trees are obstructing line of sight at junctions;
- Whether trees are at the inside of the junctions;
- Whether trees are within 5 mts of the proposed centerline.

### 2. POST-CONSTRUCTION STAGE

The maintenance of the saplings (including activities such as weeding, watering, planting of replacement saplings, etc application of manure etc) shall be the responsibility of the contractor. The PIU shall ensure the following:

- Shoulder of roads to be kept clear of weeds/undesirable undergrowth; and
- Branches of trees do not obstruct clear view of the informatory and caution signs.

**Table 1: Endemic Species of Tamil Nadu**

Sl.no	Local name	Botanical name
1.	Neem	<i>Azadirachta indica</i>
2.	Pungan	<i>Pongamia glabra</i>
3.	Kadam Tree	<i>Neolamarkia cadamba</i>
4.	Bullet Wood	<i>Mimusops elangii</i>
5.	Fry Wood Tree	<i>Albizia lebbek</i>
6.	Tamarind	<i>Tamarindus indica</i>
7.	Indian Almond Tree	<i>Terminalia Catappa</i>
8.	North Indian Rose wood Tree	<i>Dalbergia sissoo</i>
9.	Flame of the Forest	<i>Butea Monosperma</i>
10.	Dita Bark Tree	<i>Alstonia scholaris</i>
11.	Mahua	<i>Madhuca Longifolia</i>
12.	Bael	<i>Aegle marmelos</i>
13.	Indian tulip tree	<i>Thespesia populnea</i>
14.	Joy perfume tree	<i>Magnolia champaca</i>
15.	Arjun tree	<i>Terminalia arjuna</i>
16.	Bahera	<i>Terminalia bellerica</i>
17.	Peepal tree	<i>Ficus religiosa</i>

Sl.no	Local name	Botanical name
18.	Purple orchid tree	<i>Bauhinia variegata</i>
19.	Banyan tree	<i>Ficus benghalensis</i>
20.	Mango	<i>Mangifera indica</i>
21.	Jamun	<i>Syzigium cumini</i>
22.	Indian Laurel Fig	<i>Ficus retusa</i>

**GUIDELINE-15: FORESTS AND OTHER NATURAL HABITATS**

**1. INTRODUCTION**

This guideline envisages measures to be undertaken during blacktopping / widening of road sections passing through natural habitats. These measures shall be undertaken in addition to the measures laid down in the other Guidelines.

Conservation of natural habitats is essential for long-term sustainable development. A precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development has been adopted for the project.

Natural Habitats means...
<ul style="list-style-type: none"> <li>• National Park</li> <li>• Reserve Forest</li> <li>• Sanctuaries</li> <li>• Notified Wetlands</li> <li>• Fisheries and Aquatic Habitats</li> </ul>

**2. PROJECT PLANNING AND DESIGN**

To minimize the adverse impact on the ecology of the natural habitats, selection of alignment should be as per guideline. An officer of at least the rank of a forest ranger shall be deputed for detailed inventory of ecological features along the road. The nature and type of impact on natural habitats due to road construction shall be identified. Magnitude of the impact to the extent feasible on the ecological features shall also be assessed.

Ecological Features...	Adverse Impacts...
<ul style="list-style-type: none"> <li>• Area of natural habitat;</li> <li>• Type and number of endangered species of flora and fauna;</li> <li>• Stream and water bodies;</li> <li>• Breeding ground and seasons;</li> <li>• Migration season of bird species; and</li> <li>• Animal crossing;</li> </ul>	<ul style="list-style-type: none"> <li>• Diversion of forest land;</li> <li>• Cutting of trees;</li> <li>• Trampling of vegetation;</li> <li>• Contamination of water due to the usage of water from the source within the natural habitat;</li> <li>• Loss of breeding grounds; and</li> <li>• Interruption to animal crossings during the construction.</li> </ul>

Impacts identified on the natural habitats shall be minimized to the extent required. Minimization shall be through precautionary measures or through appropriate mitigation measures. Following are the measures should be undertaken along the road passing through natural habitats:

- Constricting the road width to 6.0 m and embankment height to 0.5 m to minimize the extent of diversion of forest land and cutting of trees
- Drainage Structures shall be designed strictly in accordance with guideline on “Drainage”.
- Rumble strips shall be provided at every kilometer along the length of the natural habitat and invariably at the start and end of the natural habitat
- Signage (viz. speed limit, animal crossing, switch of headlight etc) shall be provided as per IRC: 67-2001 Code of Practice for road sign (first revision)

In addition to the above measures, specific impacts identified on site shall be mitigated as per the recommendation of the forest department / officer in charge of the identified natural habitat.

In case proposed alignment falls within the catchments of a water body or a stream, a flush causeway shall be constructed without impacting the drainage system. The length of the causeway shall be as per the existing water spread. The causeway shall be strictly in compliance with IRC:SP-20:2002. In no circumstances a water body within the natural habitat shall be cut across or filled for the purpose of laying the road.

### **3. PRE-CONSTRUCTION STAGE**

No Construction Camps, Stockyards, Concrete Batching or Hot Mix Plants shall be located within the natural habitat or within 500m from its boundary.

Contractor in consultation with forest ranger or any other concerned authority shall prepare a schedule of construction within the natural habitat. Due consideration shall be given to the time of migration, time of crossing, breeding habits and any other special phenomena taking place in the area for the concerned flora or fauna.

### **4. CONSTRUCTION STAGE**

Procurement of any kind of construction material (as quarry or borrow material) from within the natural habitat shall be strictly prohibited. No water resources within the natural habitat shall be tapped for road construction. Use of mechanized equipment shall be kept minimum within the natural habitat. Contractor must ensure that there will be no parking of vehicles machine and equipment within the natural habitat. Disposal of construction waste within the natural habitat shall be strictly prohibited and as far as possible reuse shall be undertaken as per **Table -1** type of waste of guideline, "Waste Management and Debris Disposal".

### **5. POST CONSTRUCTION STAGE**

The road passing through the natural habitat shall be declared as a silence zone. Compensatory tree plantation within the available Right of Way shall be done in accordance with guideline, on "Tree Cutting and Afforestation". The PIU must ensure maintenance of drainage structure shall be undertaken as per guideline, "Drainage"

## GUIDELINE-16: AIR AND NOISE POLLUTION

### 1. INTRODUCTION

This guideline deals with the mitigation of adverse impacts due to air and noise pollution. Both of these have been discussed in the subsequent sections respectively.

### 2. AIR POLLUTION

The types of air pollution due to construction activities might include generation of dust, emission from hot mix plants and batching plants, odour from construction labour camps, emission from construction machinery/vehicles etc. The measures for mitigation of impacts from each of these are given below.

#### 2.1 Generation of Dust

- All vehicles delivering materials to the site shall be covered to avoid spillage of materials.
- The Contractor shall take every precaution to reduce the level of dust emission from the hot mix plants and the batching plants up to the satisfaction of the Engineer in accordance with the relevant emission norms.
- All existing highways and roads used by vehicles of the contractor, or any of his sub-contractor or supplies of materials or plant 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 or their tyres.
- Spillage shall be cleared immediately by manual sweeping and removal of debris or if so directed by the Engineer, by mechanical sweeping and clearing equipment, and all dust, mud and other debris shall be removed completely. Additionally, if so directed by the Engineer, the road surfaces shall be hosed or watered using necessary equipments.
- Plants, machinery and equipment shall be so handled (including dismantling) so as to minimize generation dust.
- All earthwork shall be protected in a manner acceptable to the Engineer to minimise generation of dust.
- The hot mix plant is sited at least 1000m from the nearest habitation. The hot mix plants shall be fitted with dust extraction units in order that the exhausts comply with the requirements of the relevant current emission control legislation.
- Generation of dust should be suppressed during unloading of construction material and also during storage of the construction material.

#### 2.2 Emission from Hot-Mix Plants and Batching Plants

- Hot mix plants and batching plants shall be located sufficiently away from habitation, agricultural operations or industrial establishments. Where possible such plants will be located at least 1000m away from the nearest habitation.
- The exhaust gases shall comply with the requirements of the relevant current emission control legislation. All operations at plants shall be undertaken in accordance with all current rules and regulations protecting the environment.

#### 2.3 Odour from Construction Labour camps

- Construction labourers camp shall be located at least 500 m away from the nearest habitation.
- The waste disposal and sewerage system for the camp shall be properly designed, built and operated so that no odour is generated. Compliance with the Factory Act, the construction workers (regulation of employment and conditions of service) Act, 1996 and all other relevant legislation shall be strictly adhered to.



## 2.4 Emission from 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 used for construction shall conform to the relevant Indian Standard (IS) norms.
- All vehicles, equipment and machinery used for construction shall be regularly maintained to ensure that pollution emission levels comply with the relevant requirements of SPCB & the Engineer.

## 2.5 Pollution from Crusher

- All crushers used in construction shall conform to relevant dust emissions control as legislated. Clearance for siting shall be obtained from the SPCB. Alternatively, only crushers already licensed by the SPCB shall be used.
- Dust screening vegetation will be planted on the edge of RoW for all existing roadside crushers.
- If crusher owned by contractor, the suspended particulate matter contribution value at a distance of 40m from a controlled isolated as well as from a unit located in a cluster should be less than 600 ug/Nm<sup>3</sup>. The monitoring is to be conducted at least twice a month for all the 12 months in a year during the crushing operation for the project.

## 3. NOISE POLLUTION

### 3.1 Noise from Vehicles, Plants and Equipment

- The plants and equipment used in construction (including the aggregate crushing plant) shall strictly conform to the Govt noise standards.
- All vehicles and equipment used in construction shall be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced. Notwithstanding any other conditions of contract, noise level from any item of plant(s) must comply with the relevant legislation for levels of sound emission. Non-compliant plant shall be removed from site.
- Noise limits for construction equipment used in this project (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB(A), as specified in the Environment (Protection) Rules, 1986.
- Maintenance of vehicles, equipment and machinery shall be regular and proper, to the satisfaction of the Engineer, to keep noise from these at a minimum.
- In construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing and batching, mechanical compaction, etc., will be stopped between 2200 hours to 0600 hours. In silence zone (areas up to 100 m around such premises as hospitals, educational institutional and courts) no hot-mix, batching or aggregate crushing plant will be allowed. No construction shall take place within 100m around hospitals between 21.00 hours to 06.00 hours.
- Workers in vicinity of strong noise, and workers working with or in crushing, compaction, batching or concrete mixing operations shall wear earplugs.

### 3.2 Noise from Blasting (or) Pre splitting Operations.

- Blasting shall be carried out only with permission of the Engineer. All the statutory laws, regulators, rules, etc., pertaining to acquisition, transport, storage, handling and use of explosives shall be strictly followed.
- Blasting shall be carried out during fixed hours (preferably during mid-day), as permitted by the Engineer. The timing should be made known to all the people within 500m (200m for pre-splitting) from the blasting site in all directions. People, except those who actually light the

fuse shall be excluded from the area of 200m (50m for pre-splitting) from the blasting site in all directions at least 10m minutes before the blasting.