FINAL REPORT

END TERM IMPACT EVALUATION OF ENVIRONMENTAL SAFEGUARDS IMPLEMENTATION UNDER WORLD BANK ASSISTED TAMIL NADU ROAD SECTOR PROJECT-II

Mar 2022

Administrative Staff College of India (ASCI)
Bellavista, Raj Bjavan Road, Hyderabad

ACKNOWLEDGEMENT

Administrative Staff College of India (ASCI), Hyderabad wished to record our deepest appreciation to TNRSP for commissioning the End Term Evaluation of Environmental Safeguards Implementation in TNRSP-II Project. We would like to express our sincere gratitude to TNRSP, Mr. Avinash Kant, Senior Environmental Specialist from World Bank and Senior officials of TNRSP-II for their wholesome support and facilitation in completing the study.

Our gratitude to the field level officials who spared their valuable time to join the focus group discussions and interviews with the study team.

ASCI STUDY TEAM

CONTENT SHEET

PART – I (STUDY REPORT)

ABBREVIATIONS

ASCI	Administrative Staff College of India
DPR	Detailed Progress Report
EIA	Environmental Impact Assessment
EMAP	Environmental Management Action Plan
EMP	Environmental Management Plant
EPC	Engineering Procurement Construction
PPP	Public Private Partnership
M&R	Monitoring & reporting
MOEFCC	Ministry of Environment, Forest and Climate Change
MPR	Monthly Progress Report
MTR	Mid Term Report
PCR	Project Closure Report
QPR	Quarterly Progress Report
RMC	Ready Mixed Concrete
HMP	Hot Mix Plant
WMM	Wet Mix Macadam
GOTN	Government of Tamil Nadu
TNPCB	Tamil Nadu Pollution Control Board
TNRSP	Tamil Nadu Road Sector Project

EXECUTIVE SUMMARY

The Highways Department, Government of Tamil Nadu (GoTN), has been undertaking road development work in the State of Tamil Nadu with the assistance of the World Bank(WB). This report has the environmental evaluation of 15 road projects of TNRSP Packages EPC 01- to EPC 10, covering 427.59 Kms and packages PPP1, PPP2, PPP3 covering 146. 46 km. PPP 1 is converted to EPC 16, PPP 3 in to EPC 14 and EPC 15.

TNRSP has focussed not only to improve the physical state of the project roads by improving the traffic capacity and conditions of existing roads but also to improve the environment of the corridors by introducing Environmental Management Action Plan (EMAP), comprising activity-wise impacts and mitigation measures identified for each environmental attribute like land, water, air, noise, flora, and fauna based on the Environmental Studies (EIA/EMP)

TNRSP has developed a management framework to ensure the execution of the projects and the EMP implementation in a systematic way. External resources such as monitoring agencies, third-party auditors for environment and safety have been engaged. A robust Monitoring and Reporting (M&R) system was introduced for various phases of the project activities. The project implementation was reviewed monthly and quarterly through project formats. The World Bank team also has conducted midterm reviews through site visits and tracked the progress during 2017 and 2018, beyond which the review was carried out through a virtual tour of the project under the pandemic situation. End-term environmental performance evaluation is conducted through the Administrative Staff College of India (ASCI), and this report is the outcome of this study.

TNRSP has a strong management commitment and has made an organizational structure headed by the Project Director and supported by a strong team of Superintending Engineer and his team members. It is noteworthy to mention that TNRSP involved senior-level officers Tamil Nadu State Pollution Control Board and State Forest Department in executing the environmental safeguards.

ASCI adopted a systematic approach for the study consisting of desk review, virtual / tele interactions, onsite visits, off-site review, and report preparation. The desk review includes EIA, EMP, monthly progress reports, quarterly progress reports, midterm World Bank mission reports, Project Closure report, and K Schedule. Based on the desk review and interactions, the team selected 20 attributes for this study that define environmental performance. These attributes are based on the mitigation plan as envisaged in the DPR/EIA/EMP reports.

The team visited more than 50% of the road projects, which are in different phases of construction and operation & maintenance—interacted with TNRSP officials and the contractors engaged in the execution of the project, with some of the beneficiaries like institutions, shop owners, bus travellers and localities who were using the facilities. There was positive feedback on the benefits due to the project implementation.

Observed environmental due diligence was carried out in the EIA / EMP studies emphasizing the need to obtain the environmental permissions, including for the contractors for stone crushers, hot mix plants, batch mix plants, quarry areas, etc.

The project was executed under a robust management framework oriented towards realizing the environmental safeguards committed in the EMP. Based on the review, the good practices implemented by the TNRSP are covered in the report.

As per the information available, an Environmental audit was conducted for EPC 01, EPC 02 and PPP 02 and safety audit was conducted for EPC 01, EPC 02, EPC 05, EPC 07 EPC 10 and PPP 02 reports were shared. These audits have brought excellent visibility of ground execution on environmental and safety safeguards and the compliance aspects. It is suggested to consider doing these audits for all projects in the future.

Considering the frequent changes in the regulations, it is suggested to carry out environmental due diligence for legal compliance at the project formulation stage and also at the starting of the project. Orientation program on legal compliance may be considered to all the concerned officials at the project planning stage. Considering the information on accidents, studies may be considered in future projects focusing on engineering aspects and also how to address the behavioural aspects of the road users; and further integrate Traffic Division of Police Department, a vital stakeholder for ensuring the road safety aspects from the planning stage onwards.

CHAPTER I INTRODUCTION

1.1 BACKGROUND:

The environmental end-term review is carried out for 15 road projects across Tamilnadu. Packages EPC 01- to EPC 10, covering 427.59 Kms, and package PPP1, PPP2, PPP3 is covering 146. 46 km. PPP 1 is converted to EPC 16 and PPP 3 in to EPC 14 and EPC 15. Administrative Staff College of India, Hyderabad (ASCI) was assigned the third party to evaluate the project by TNRSP.

1.2 OBJECTIVES AND SCOPE OF THE STUDY

The study's main objective is to evaluate the outcome of the Environmental management framework planned and implemented across different road projects of TNRSP-II. The focus of the study is on:

- Understanding the efforts of TNRSP in incorporating the environmental safeguards in the project cycle - planning, design, execution stages, and monitoring them.
- How the environmental attributes, including road safety for assessment of the environmental performance, were identified through the environmental studies (EIA) and planned action for mitigation as envisaged in the EIA and EMP's
- Contractor's environmental management plan for its implementation, including the covid safety measures
- Bank's recommendation during various supervision missions and planned action by the TNRSP
- Identify gaps and scope of improvement, project learnings, and replicability or scaling up with a note of good practices.
- Resource utilization - Budget allocation as committed and implemented.

1.3 DATA SOURCES AND STUDY METHODOLOGY

ASCI has adopted a systematic methodology for the collation of data and review and interpretation of the outcome. The mode of engagement for the review by the ASCI Team conducted is as depicted in **Diagram 1**. It is initiated with desk review after the collection of the data from project teams. The data includes EIA, EMP, monthly progress reports, quarterly progress reports, midterm World Bank mission reports, Project Closure report, and K Schedule. The desk review is followed with virtual or telephonic-interaction with the TNRSP and contractor team and continued with site visits to select roads. Initially, a visit to three roads was committed. However, the team visited eight roads - EPC 02, EPC, 05, EPC 06, EPC 07, EPC 10, PPP 02, EPC 14, and EPC 15

This visit allowed verifying on-ground details and a better understanding of the system followed for implementing and maintaining the environmental safeguards by TNRSP and the contractors engaged on the ground. Projects visited were in various phases EPC 14 & EPC 15 was in the beginning of the construction phase, PPP 02 was just completed, and EPC 02, EPC 05, EPC06 & EPC 07 were all in operation and are in the maintenance phase

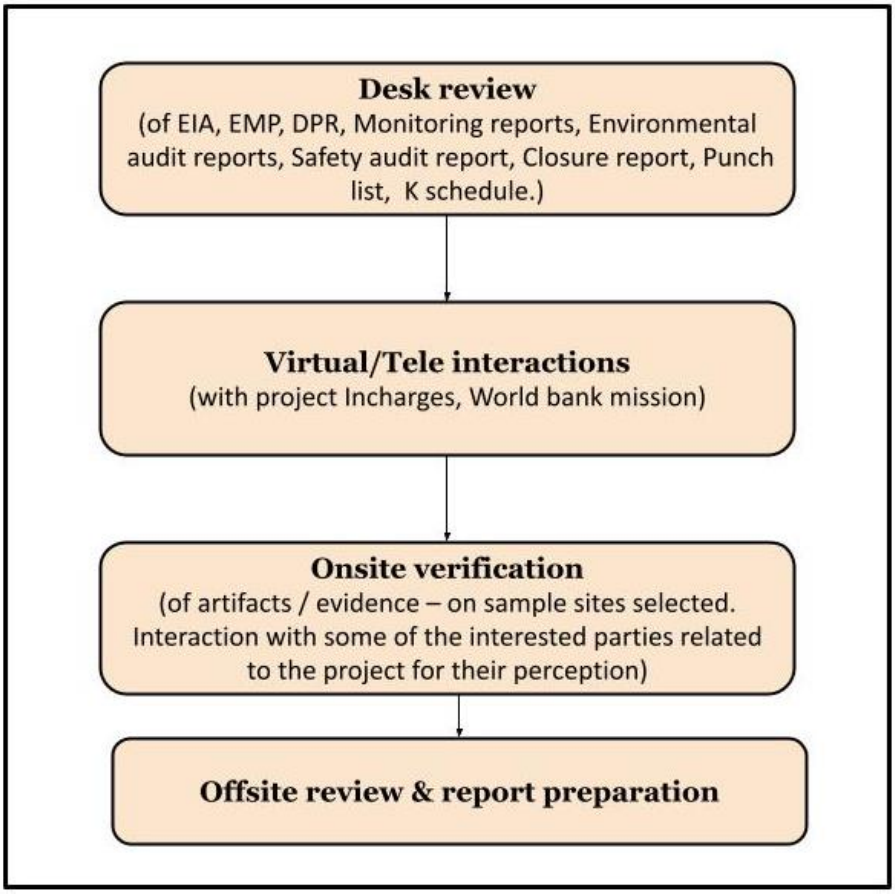


Diagram 1: Review methodology adopted

Based on the desk review and environmental aspects considered in the EIA and EMP reports, 20 attributes that define the environmental performance was selected for the present study. Diagram 1 specified the start of the review with documented information (EIA, EMP, Monthly progress reports, quarterly progress reports, Midterm World bank mission reports, Project Closure report, and K Schedule). This information was collected from the TNRSP project sites to carry out the desk review. The site review improved the understanding of project site condition and its connection with the commitment made in EMP, permits, and action reports submitted after midterm visits of the world bank. We were also able to go through the Monitoring reports conducted as per the monitoring plan for pre-construction, during the construction and operational phase of the project. Meeting with TNRSP officials demonstrated the Management structure and mechanism adopted to address the concerns and complaints of any stakeholders, and Interaction with contractors and supervisors working onsite gave us better insight into the project's Health and safety practices.

Desk review is limited to the documents that were provided to our team by the TNRSP officials. Annexure-I provides an overview of the essential documents collected.

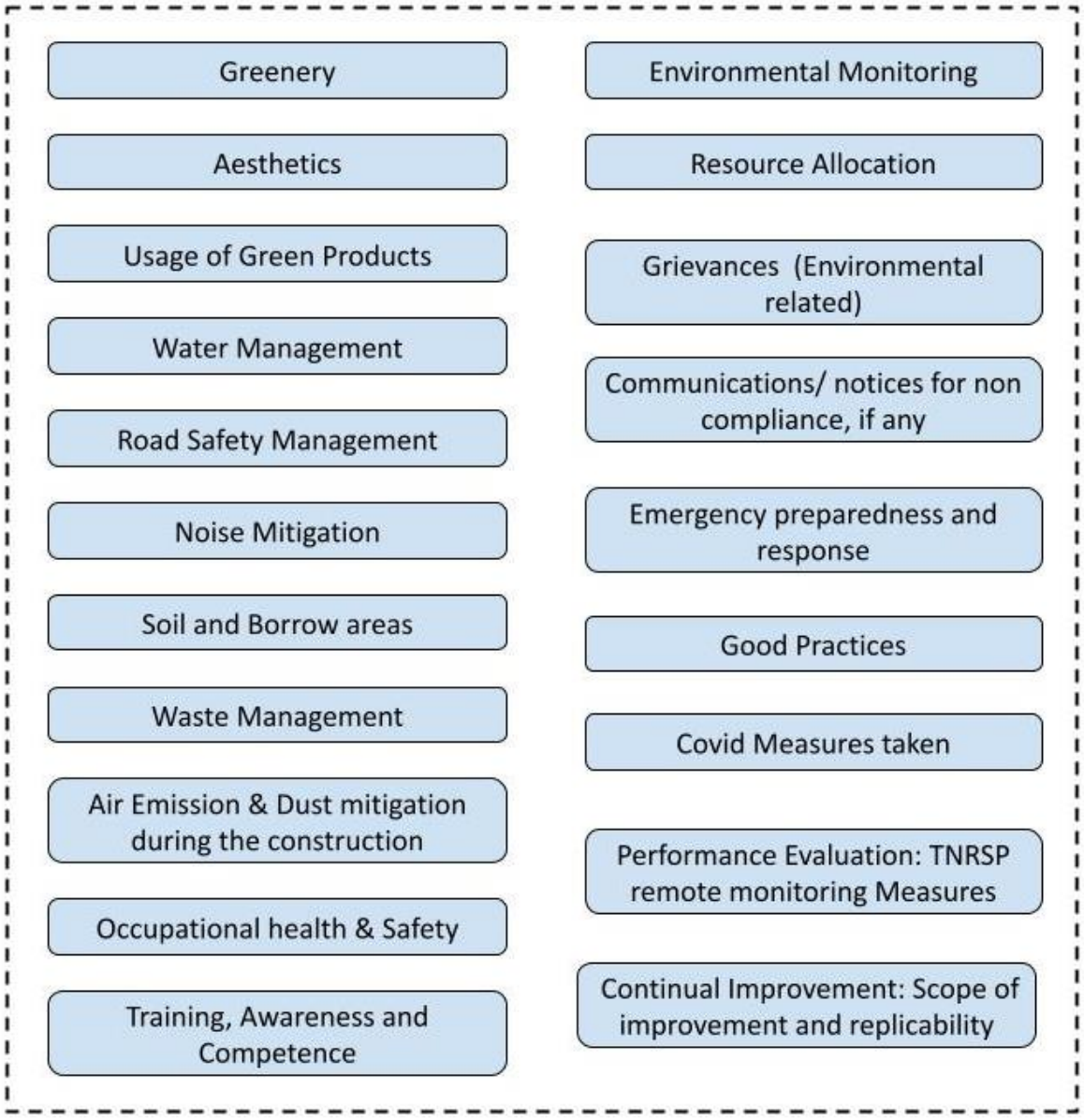


Diagram 2: Environmental attributes

1.4 ORGANISATIONAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT

TNRSP has a strong management commitment and has made an organizational structure as depicted in diagram 3 for effective control over the project from design to its execution, including the operation and maintenance. The Project Director is the Head of the project and is supported by Chief Engineer, Superintendent Engineer and Divisional Engineer. All these three officers are the officials posted from the related Government Departments of Tamil Nadu.

Environmental specialists mostly were hired, consultants. It is noteworthy that TNRSP involved the senior-level officers from the regulatory and implementing department such as Tamil Nadu State Pollution Control Board and State Forest Department, who became

part of the project enabling enhanced focus in the execution of the environmental safeguards. At the project level, the environmental management unit further has the organizational setup for ensuring the outcome's execution and monitoring, as depicted in diagram 4.

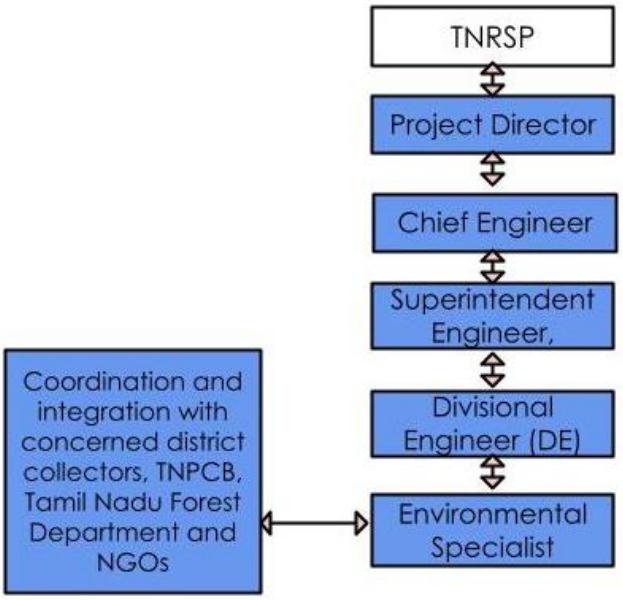


Diagram 3: Organisation Structure of TNRSP

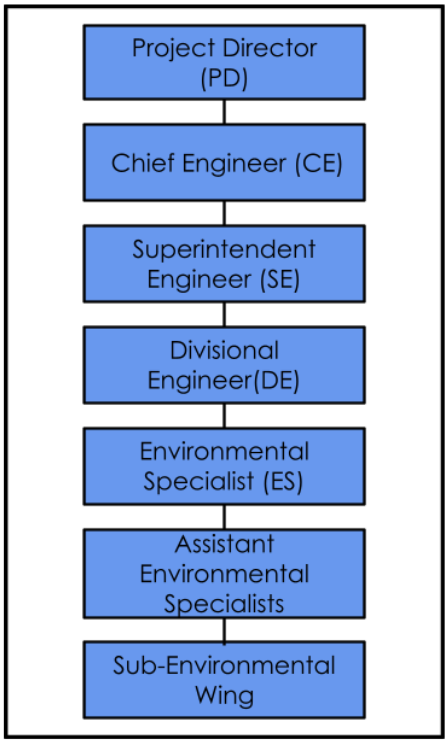


Diagram 4: Environmental management Unit

1.5 TNRSP PROJECT FRAMEWORK FOR EXECUTION OF ENVIRONMENTAL SAFEGUARDS

The project framework depicted in diagram 5 explains the approach followed by TNRSP to execute the environmental safeguards.

The Journey is backed by an in-depth scientific study across the various phases of the project, pre-construction, construction, and operation with maintenance phases. The EIA study details the project's impact on the environmental aspects, and the potential opportunities for mitigation are suggested. EMP is proposed as a mitigation action plan. Based on the actions needed in EMP, the concessionaire made a Detailed Project Report (DPR), and the projects were handed over to the Contractor by TNRSP for execution. The organizational setup explained in Diagram 1.4 would monitor the project execution closely and review periodically the progress reports (monthly& quarterly). The safety audit is seen to be initiated at the DPR stage for EPC 03, EPC 04, EPC 05, EPC 06, EPC 07, EPC 08, EPC 09 & EPC 10, and the end for EPC 01 & EPC 02. Environmental audits are desirable and are evident to be conducted at EPC 01, EPC 02 and PPP 02 at the end of the project. World bank had mid-term reviews and highlighted the concerns on each project with the status of the project progress until 2017 and 2018 they have visited PPP 02 and made detailed observations in their report; it was seen the visits further they continued review virtually due to covid limitation with a live video of the road project

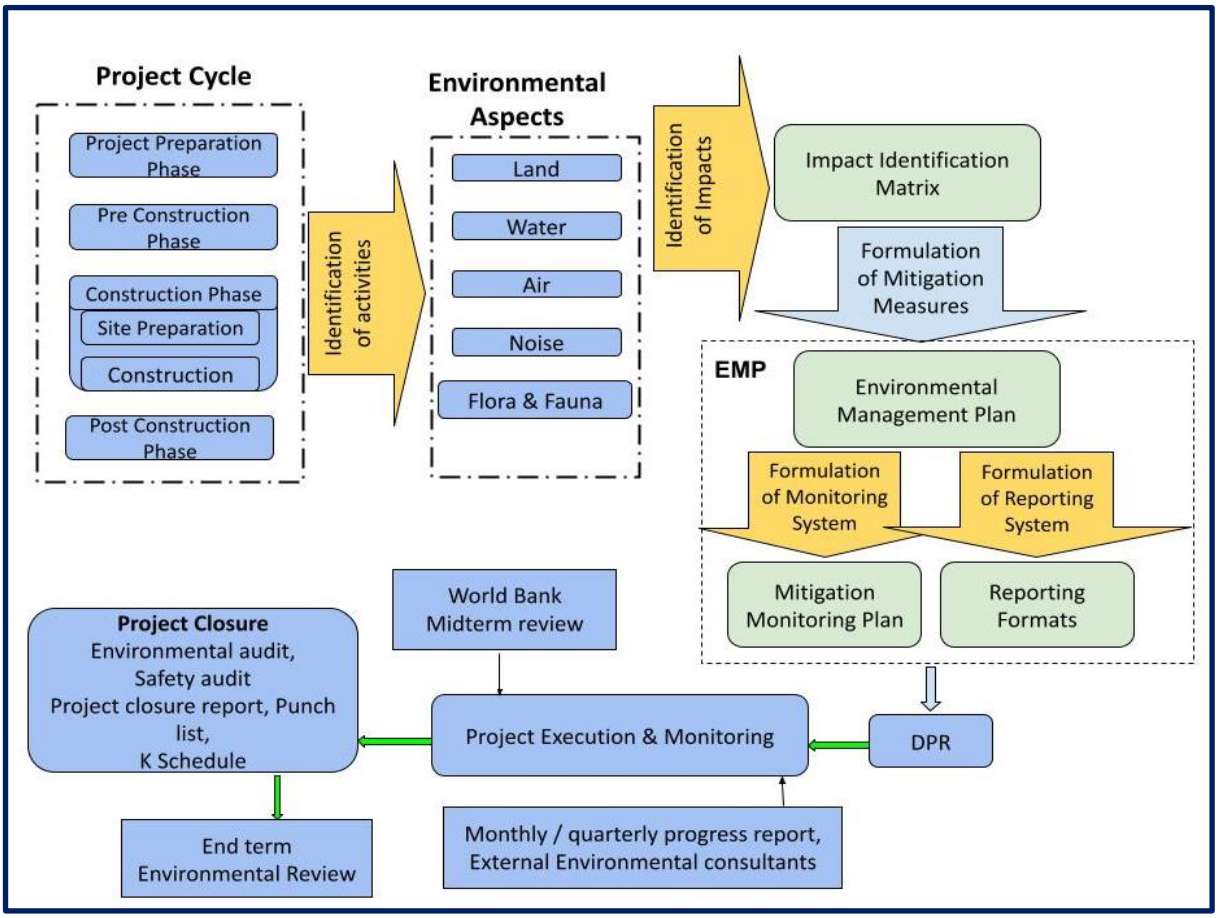


Diagram 5. Project framework for execution

CHAPTER II STATUTORY CLEARANCES & COMPLIANCE

The emerging environmental scenario calls for requisite attention to the identification of environmental aspects and planning for mitigation. Environmental Impact Assessment report (EIAs) gave the list of environmental permits / other licenses to be taken for road projects and associated ancillary units such as hot mix plants and others. Environmental clearance was verified as per EIA Notification 2006 and its amendments thereon for the road project. As per the study reports, these road projects do not require obtaining the environmental clearance and CRZ clearances under the Environment (Protection) Act, 1986 and its amendments and consent to establish for the road from the Tamilnadu State Pollution Control Board. EPC 01 SH 58 had obtained forest clearance. Annexure I gives the details of the legal compliances applicable, based on which the following table 1 & 2 are drawn.

Applicable environmental regulations to the roads: Consent to Establish under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for the road is not applicable to any of the TNRSP II roads – However EIA of EPC 01 & EPC 02 mentions in 3.5 table that consents are applicable while table 3.2 mentions it would be applicable to ancillary units. It appears contradicting statement calling for due diligence prior to DPR in future.

Sl. no	Roads	Environmental Clearance	Public Hearing	Air & water consent for the Road	Forest Clearance	CRZ	Archaeological
1	EPC 01	NA to all roads	NA to all roads	NA to all roads	Applicable only to EPC 01-SH 58	NA to all roads	NA to all roads
2	EPC 02						
3	EPC 03						
4	EPC 04						
5	EPC 05						
6	EPC 06						
7	EPC 07						
8	EPC 08						
9	EPC 09						
10	EPC 10						
11	PPP 1						
12	PPP 2						
13	PPP 3						

Table 1: Environmental regulations applicable for various roads

Forest Clearance - Applicable to EPC 01 - SH 58, 0.782 Ha of Forest land in Oragadum reserve forest of Chengalpattu forest division for widening and strengthening of Thirukazhukundram highway in favour of divisional engineer. Compensatory afforestation is paid, several operational conditions were provided compliance to this is not readily available for verification as the project is already closed. Closure report only mentions forest clearance being taken and no mention of compliance to the conditions specified in the clearance.

Coastal Regulation Zone Notification 2011- The project road does not fall under coastal regulation zone (CRZ).

Archaeological - It is not applicable to any of the roads.

Air & water consent CTE & CTO for the ancillaries: applicable to all roads for ancillary units consisting of hot mix plant, WMM plant, RMC Plant, crusher and borrow area

Sl. no	Roads	EC for Quarry	EC for Borrow Area	Hot Mix Plant		WMM		RMC		Quarry		Crusher		Concrete Batch Plant	
				CTE	CTO	CTE	CTO	CTE	CTO	CTE	CTO	CTE	CTO	CTE	CTO
1	EPC 01	yes	yes	yes	yes	yes	Yes	yes	yes	yes	yes	yes	yes		
2	EPC 02	NA	yes		yes & third party	yes	Yes		third party				third party		
3	EPC 03	yes	yes	NA	NA		Yes	yes	Yes	NA	yes	NA	yes		
4	EPC 04	On-going													
5	EPC 05	yes	Third party	yes	yes		Yes	yes	yes	yes	yes	yes	yes		
6	EPC 06	yes	Third party	yes	yes	yes	Yes	yes	yes	yes	yes	yes	yes		
7	EPC 07	yes	Third party	yes	yes	yes		yes	yes	yes	yes	yes	yes		
8	EPC 08	yes	Yes	yes	yes	yes	Yes			yes	yes	yes	yes	yes	yes
9	EPC 09	yes	Third party	yes	yes	yes	Yes			yes	yes	yes	yes	yes	yes
10	EPC 10	yes	Yes	yes	yes	yes	Yes			yes	yes	yes	yes	yes	yes
11	PPP 1	On-going													
12	PPP 2	Yes		yes	Yes	yes	Yes	Yes	Yes	Yes	Yes	yes	yes		
13	PPP 3	On-going													

Table 2: Environmental regulations applicable for ancillary units

Environmental clearance under EIA Notification 2006 as amended for quarry - EPC 01, EPC 03, EPC 05, EPC -06, EPC 07, EPC 08, EPC 09 & EPC 10, PPP 02 – environmental clearance under EIA notification 2006 as amended for quarry is available. While EPC 04, EPC 16, PPP 03 were are ongoing projects and closure report wouldn't be applicable and available at this stage.

Environmental clearance under EIA notification 2006 as amended for borrow area - In EPC 01, EPC 02, EPC 03, EPC 08, EPC 10 had their Borrow area approved while EPC 05, EPC 07, EPC 09 roads -contractor purchase Borrow material from approved private agency/third party

Consent to establish & operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for hot mix plant, HMP – EPC 01 & EPC 02 had the CTO however site environmental audit report mentions hot mix plant of third party having consent is used. EPC 05, EPC -06, EPC 07, EPC 08, EPC 09, EPC 10 and PPP 02 had the valid consents.

Consent to establish & operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for WMM Plant - EPC 01, EPC 02, EPC -06, EPC 08, EPC 09 & EPC 10 have CTE & CTO, while EPC 03 has CTO, PPP 02 & EPC 07 has CTE & no CTO.

Consent to establish & operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for RMC Plant - EPC 01, EPC 02, , EPC 05, EPC -06, EPC 07 & PPP 02 have CTE & CTO, while EPC 02 has used third party.

Consent to establish & operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for quarry - EPC 01, EPC 05, EPC -06, EPC 07, EPC 08, EPC 09, EPC 10 & PPP 02 have CTE & CTO. EPC 03 mentions CTE as not applicable and has CTO.

Consent to establish & operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for crusher - EPC 01, EPC 05, EPC -06, EPC 07, EPC 08, EPC 09, EPC 10 & PPP 02 have CTE & CTO. EPC 02 has used third party crusher. EPC 03 mentions CTE as not applicable and has CTO.

Consent to establish & operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for batching plant - 3 roads have concrete batch plant (EPC 08, EPC 09, EPC 10)

CHAPTER III ENVIRONMENTAL IMPACT AND MITIGATION IMPLEMENTATION

3.1 ENVIRONMENTAL IMPACT, MITIGATION IMPLEMENTATION REVIEW

The environmental attributes selected for review of the roads across TNRSP II areas are discussed in table 3 . An attempt has been made to review the parameters specified under each attribute. These attributes were reviewed from the documented information collated under desk review; the review is extended with site visits, and site photographs are taken where possible.

The impact on the environment was studied through a scientific tool such as Environmental Impact Assessment during the project initiation stage duly covering the aspects such as air, land, water, noise environment, and the flora/fauna and through the post-project monitoring system during the operation phase by the TNRSP. Based on the desk review, the following 20 parameters are considered for evaluation across the 15 roads.

3.1.1 Greenery:

The greenery is studied by reviewing the information related to the number of trees cut, trees planted, selection of native species, survival rate, the mechanism adopted to sustain the initiative.

Trees cut and planted: The performance on greenery starts with the fact that TNRSP has put extensive efforts into saving the existing trees by reducing 51% of the trees to be cut. In the overall TNRSP II project, the planned comprehensive plantation plan vs. actual is 100%. EPC 06 has planted 12980 trees more than the plan for plantation. Graph 1 gives a glimpse of the number of trees cut and planted against the program.

Plantation across EPC roads has happened through Forest Department. Forest department reports 161154 trees planted for EPC projects vs plan of 161110 given to them with 1,53,798 i.e. 95% survival rate. Graph 2 shows a glimpse of the number of trees planned to be planted and the data maintained in the closure report by TNRSP roads and the data maintained by the Forest department. It is seen from the data provided by the Forest department when compared with data provided by TNRSP, and there is a difference in numbers maintained. For EPC 03, TNRSP has planted 16270. In EPC 08, 6500 trees are reported by TNRSP while the Forest department shows 4990, 2000 trees are planted extra by the camp side.

PPP 02 has 16570 numbers pending planting, and the project is closed in Aug 2020. The environmental checklist reported 35810 trees; however closure report says 15000; According to the officials of PPP 02, the concessionaire was shown the branch roads to plant the balance saplings and the work is nearing completion. During site visit, some good examples of changing the pathway line to a certain angle to save an existing tree were observed in the same road as a positive effort.

1. Greenery	Flora & Fauna, No. of trees cut & planted, transplantation, native species, Survival rate
2. Aesthetics	Landscaping at major junctions, Meridian developments, Foot path developments. Junction improvement
3. Usage of Green Products	Usage of fly ash /slag, reused products, VOC free Paints, VOC free hoardings, treated water, solar power
4. Water Management	Silting of ponds, Pond protection, Rainwater harvesting pits, Drainage management,
5. Road Safety Management	Traffic Safety, Road safety provisions, Mobilization of traffic patrol officers Statistical data on road accidents, Traffic Management Plan, Community consultation, Awareness on road safety, Road safety audits
6. Noise Mitigation	Impact of noise on construction workers, Noise monitoring, Noise barriers
7. Soil & Borrow areas	Topsoil management, No Stagnation of water, Slope correction, Borrow area management Plans
8. Waste Management	Identification of waste, Segregation of wastes, Storage system Disposal system for various types of waste, Waste management at Construction workers camps, Hazardous Waste Management
9. Air Emission & Dust Mitigation	Emission certificates for vehicles, Dust control from crushing plant, Water sprinkling for dust control,
10. Occupational Safety	OHS practices, Labour camp with facilities, HIV/AIDS awareness and prevention program, Usage of PPE, Reporting of incidents, Emergency preparedness and response, Training and awareness on Safety
11. Competence, Training and Awareness	Skill mapping, Training Plan, Training topics, Training records Awareness methods adopted, Topics of awareness, Training materials
12. Environmental Monitoring	Ambient air quality, Noise, Water (Ground & surface), Soil
13. Resource Allocation	Budget for implementation of environmental safeguards, third party consultants / third party auditors etc.

14. Grievances (Environment related Notices / directions / communications from District Authorities, TNPCB, MoEFCC, Labor	**16. Emergency Preparedness & response** List of emergencies, Emergency response plan, Training on Emergency, Mock drill	**18. Covid precautionary Measures -**Vaccination, Mask, awareness
15. Communications / notices for noncompliance, if any Nodal person, Procedure in place Review mechanism	**17. Good practices** Aspects of environment, planning of management framework, implementation of mitigation measure, communication, efforts to sustain	**19. Performance Evaluation** TNSRP remote monitoring **20. Continual Improvement**

Table 3: Environmental attributes with parameters considered for study

Details of permission obtained for tree cutting are as follows:

Road	Permission
EPC 01	SH 58: Lr.No.8579/14L/,dated 09.06.2015 SH 116: Lr.No.8139/2014/,dated 20.07.2015
EPC 02	Lr.No.8139/2014/Dated:31.07.2015 Lr.No.A3/4638/2014 Dated:18.05.2015 Lr.No.A3/4666/2015 Dated:30.09.2015 Lr.No.A3/4666/2015 Dated:25.10.2015
EPC 03	Procs.No.4416980/2014/dated 17.10.2015 Lr. No. 53/2015/L, dated 30.11.2015
EPC 04	Permission Obtained before trees cutting from DC/DFO
EPC 05	PPC03/2015/SDO/Dated 31.08.2015 A 65-A 66
EPC 06	Permission Obtained before trees cutting from DC/DFO
EPC 07	PPC03/2015/SDO/Dated 31.08.2015 A 65
EPC 08	Letter No.A2 9762-2014
EPC 09	Permission Obtained before trees cutting from DC/DFO
EPC 10	Lr. No: M(A4) 9206/ 2014/ Dt: 05.05.2015 Lr. No: A2/5912/2015 Dt: 28.05.2015 Lr. No: A6/7418/2014 Dt: 12.08.2015
PPP 1	Lr.No.2551/2021/A3/Dt. 22.7.2021 for 2979 Trees & Lr. No. 3682/2020/A3/Dt. 27.7.2021 for 553 Tress
PPP 2	Lr.No.353/2018/JDO Dated:16.04.2018 Lr.No.353/2018/JDO Dated:27.04.2018
PPP 3	Authority Letter No. Trees/2021/SH39/EPC14/Date:30.07.2021

Table 4. Permission obtained for tree cutting

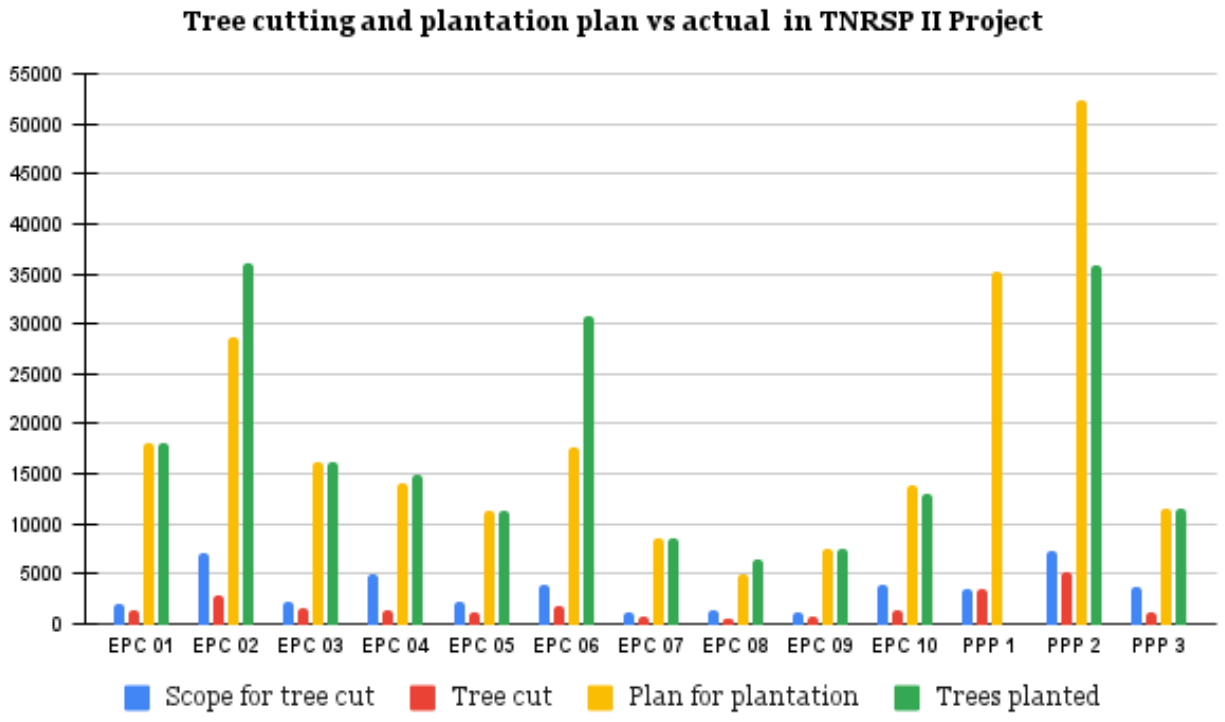
Vegetation: Removal of vegetation as indicated in EIA were for following roads –

1. EPC 01(SH 116 – 17.80 Ha, SH 58 – 18.7Ha),
2. EPC 02- 59.7 Ha,
3. EPC 03- 24 Ha,
4. EPC 04 -39 Ha,
5. EPC 07 -12.03 Ha.

Details on the number of trees cut and number of trees planted

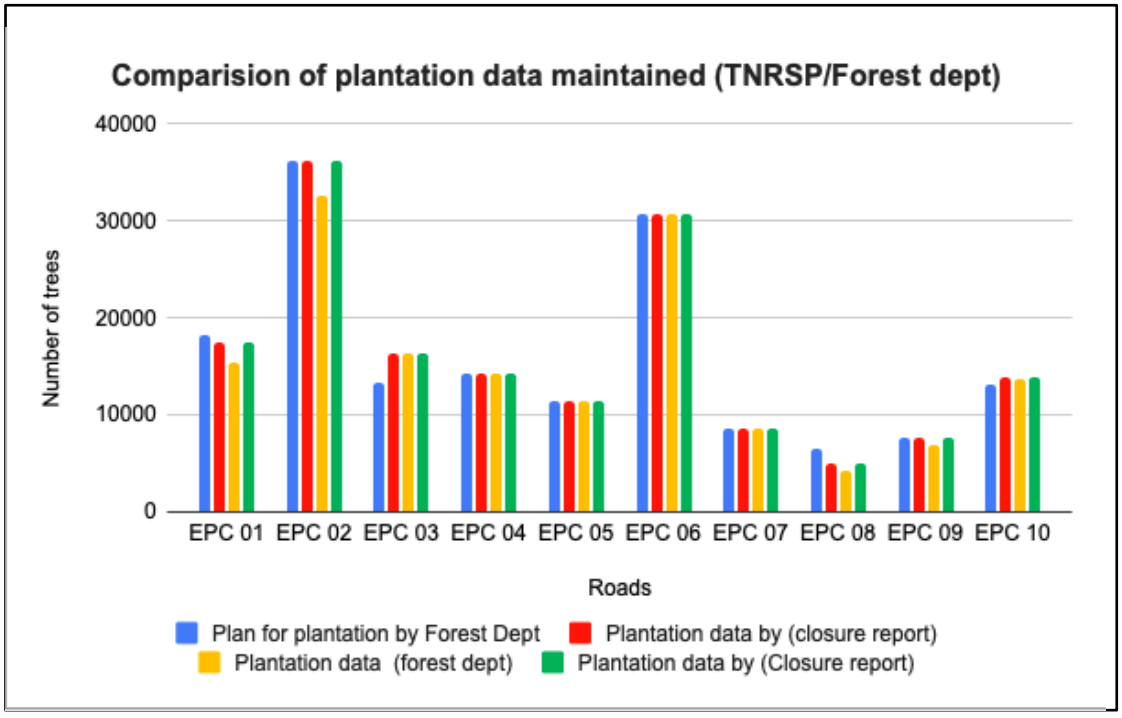
Road	Scope for trees cut	Trees cut	Plan for plantation	Trees Planted
EPC 01	1988	1491	18113	18113
EPC 02	7187	2866	28660	36130
EPC 03	2267	1627	16270	16270
EPC 04	5011	1418	14180	14878
EPC 05	2161	1135	11350	11350
EPC 06	3873	1776	17760	30740
EPC 07	1178	856	8560	8560
EPC 08	1316	499	4990	6500
EPC 09	1190	762	7620	7620
EPC 10	3923	1381	13810	13081
PPP 1	3532	3532	35320	-
PPP 2	7232	5238	52380	35810
PPP 3 – EPC 14 EPC 15	3781	41 1111	410 11110	410 11110

Table 5. Information on number of trees cut and planted



Graph 1: Statistics on Greenery

Photograph 1: Greenery effort



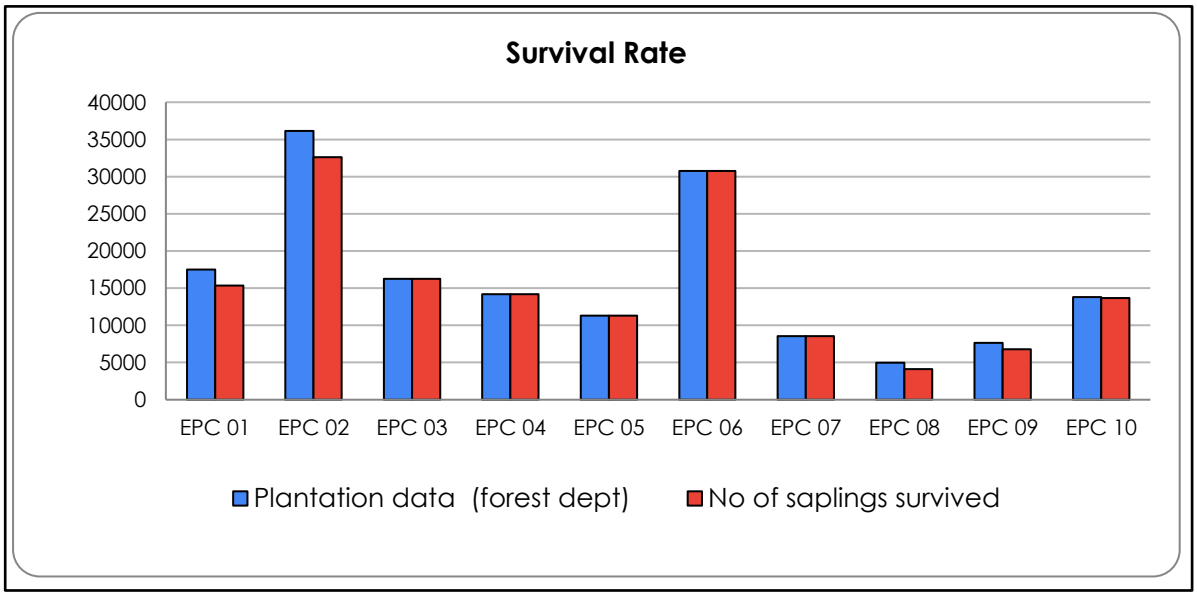
Graph 2: Comparison of plantation data maintained (TNRSP/Forest dept)

General native species recommended in EIA: the species preferred for plantation are local species and to name a few Azhadarticaindica, Pongamiapungann, Thespesiapopulnea, Tamarindus Indicus, Terminalia Arjuna, Albizia Procera, Borassus Flabellifer, Plyllanthusemblica, Terminalia Catappa, Ficus Sp, Sesbania grandiflora, Delonix Elata, Aegle marmelos, palarindus indicus pongamia, thespesia populnea, delonix regia, delonix elata melia dupia, moringa tomentosa peltophorum pterocarpum.

EPC 01	Azardiractaindia, Maducaindica, Dalbergiasisoo, Safed Siris, Fivusreligiosa, Pungamiapinnata, Mim usopselengi and Thespesia Populnea etc.,
EPC 03	Azardiractaindia, Maducaindica, Dalbergiasisoo, Safed Siris, Fivusreligiosa, Pungamiapinnata, Mim usopselengi and Thespesia Populnea etc.,
EPC 08	Azadirachtaindica, Albizlaebbeck, Pongamiapinata, Cassia Siamea, Holopeleaintegrifolia, Tamarindusindic, Thespesiapopulnea, Lanneacoromandelica, Pettophonorumpterocarpum, Ficusreligioşa, Syzyygiumcunini, Tehinaliaarjuna, Ficus Benhalensis, Prunusdulcis, Dalpergia, Sissii, Madhucatongifolia, Melia Dubia, Tectoragradis, Swietenia Mahagoni, Azadirachtaindica, Ficuscarlia, Ficus Nenghaleasis
EPC 09	Azaharditica indica, palarindus indicuspongamia, thespesiapopulnea, delonixregia, delonixelatamelia dupia,moringato mentosa, peltophorumpterocarpum
EPC 10	Azhadarticaindica, Pongamiapungann, Thespesiapopulnea, Tamaranidusindicus, Terminalia Arjuna, Albiziaprocera, Borassusflabifer, Plyllanthusemblica, Terminialiacatappa, Ficusspl, Sesbania grandiflora, Delonixelata, Aegle marmelos

Table 6– Native species planted in roads

Survival rate: Projects reported survival rate in the closure report, and they mentioned it to be more than 95 % (EPC 03 – 100, EPC 04 – 100, EPC 05 – 99.2, EPC 06 – 99.6, EPC 07 – 97.6, and PPP 02 – 85). Data was collected from the Forest department on survival rate, and its evident that on an average 93.5% survival as on date even with project closure happening on nearly 3 years for 9 roads.



Graph 3- Statistics on survival rate of plantation

Transplantation: As per DPR, the number of transplants reported to be carried out was 229 in EPC 05, 175 in EPC 06, and 114 in EPC 07. Transplantation was evidenced during site visits for the ongoing projects such as EPC 14 & EPC 15. In EPC 14 48 were transplanted and 29 were expected to be transplanted. In EPC 15 1213 were transplanted and 15 were expected to be transplanted.

Mechanism adapted to sustain: The very satisfactory survival rate is observed because of the mechanism TNRSP worked out in collaborating with the Forest department to take care of the tree plantation and its maintenance at EPC 01 to EPC 10 for at least initial 3 years as mentioned by Forest officers. Appropriate mechanism for PPP projects may be worked out. As we observe there is a big gap in number of trees planted in PPP 02.

3.1.2 Aesthetics

Aesthetics was studied for major and minor junctions, footpath developments, junction improvement, major and minor bridge, borrow pits management, and mechanisms to sustain the initiative. Table 7 below gives a glimpse of the efforts planned vs. executed across the roads.

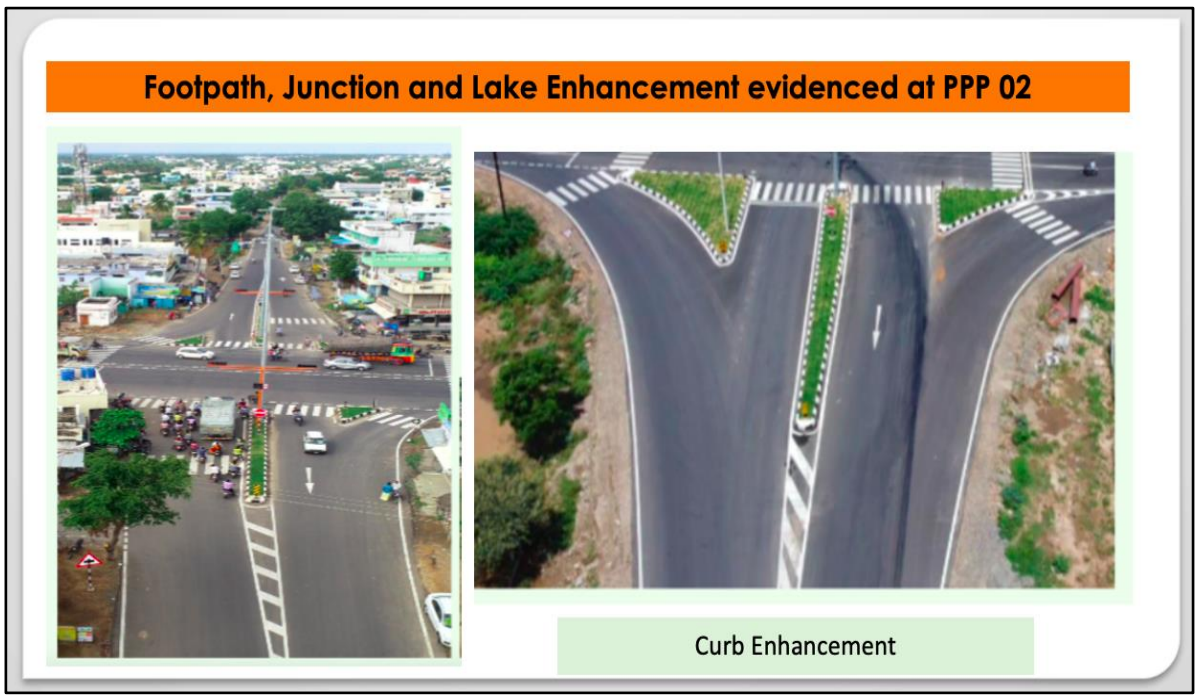
Major and Minor junctions:

From the closure report, we have evidenced the major junction being executed in numbers at the following roads EPC 02 – 5, EPC 03- 3, EPC 06 – planned was 2 while 3 were executed, EPC 08- planned and completed were 05, EPC 10-planned and completed were 3, PPP 2 – 20 while no information on plan was found. The projects in progress with plan as specified in DPR appeared to be EPC 04-4, EPC 16 -3 & PPP 03 -1.

From the closure report, we could figure out the execution of minor junctions in numbers at the following roads EPC 01- 124, EPC 02 – 190, EPC 03 planned was 17 while completed were 51, EPC 06 planned was 50 completed were 45, EPC 08 –50 (8 numbers improved under change of scope) were done, EPC 10 had planned 80 and completed all, PPP 2 – 73, limitation to compare the plan with closure report were found EPC 05, EPC 07, EPC 09.

Footpath developments: The closure report provided the data on the execution of footpath in numbers in following roads – EPC 01-45, EPC 02-27, EPC 03 – 08, EPC 05-10, EPC 06-11, EPC 07-01, EPC 08-planned is 1 but completed were 03, EPC 09-32 were done against plan of 6, EPC 10-17 were executed over a plan of 11. PPP 03 DPR reports 12 planned. DPR reports the plan for execution in a different unit meter square and closure report in numbers; hence comparison of plan vs. actual was not possible in all cases.

Junction improvement: In PPP 02, some of the native flowering plants were planted along the median, lake access roads were provided with paver blocks and seating benches. Photographs attached shows example of junction improvements.



Photograph 2: The improvement in junctions

Culverts and bridges: It has been observed that TNRSP made an effort to avoid alteration in cross drainage by constructing culverts, minor and major bridges. From the closure report, erosion preventive measures are taken by providing stone pitching/grassing in steep slopes and retaining wall to support soil at embankments laterally—majority of the project constructed a dissipation chamber across the slope to reduce water velocity soil erosion.

Facilities: The major facilities observed were bus bay, bus shelter, construction of water taps, water tanks, borewell, open well and soak pits across the various roads.

Water taps: Each project have undergone construction of new taps in the closure reports the number of taps constructed were EPC 03 - 47 taps, EPC 05 -44, EPC 06 -164.

Water tanks: Construction of Overhead tank, Syntax tank were reported in the project closure report EPC 05 - 5 syntax tank and EPC 06 - 36 of them. Whereas overhead tanks EPC 05 -5 numbers and EPC 06 – 6 numbers respectively.

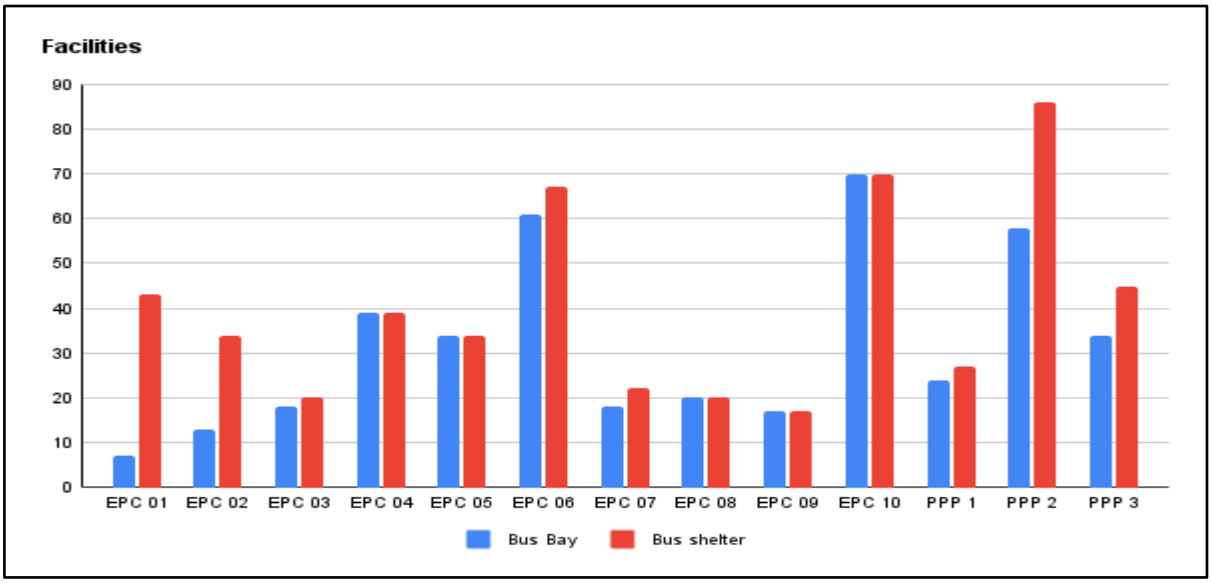
Photograph 3: Major and Minor junctions (EPC 05 and EPC 06)

Roads	Pipe culverts		Box culvert		Slab culvert		Minor Bridges		Major Bridges	
	Scope	Completed	Scope	Completed	Scope	Completed	scope	Completed	Scope	completed
EPC 01	55	11 +35 61	80	22+48 81	3	16		10		1
EPC 02		83	1	42		44		15		
EPC 03	12	12	32	30	11	7		1		
EPC 04	26				26					
EPC 05	19	26	6	6		2		1		
EPC 06	12	39	32	18	11	7		7		1
EPC 07	11	11	1	5	7	3		1		
EPC 08	17	18	13	19	12	6		3		
EPC 09	22	22	17	17	10	10		6		
EPC 10	57	57	21	24	32	31	29	29		
PPP 1	49		69				4			
PPP 2		59		43				9		3
PPP 3	21		44		9					

Table 7 - Improvements (Culverts and bridges)

Bus bay & Bus shelter: From the closure report it was observed that all roads put effort on providing the facilities of bus bays with bus shelter. Information on plan is picked from DPR for EPC 04, EPC 16, PPP 03 which are ongoing project. Graph 4 gives the statistical data of the bus shelters and bus bays. During the site visit this was evidenced in EPC 02, EPC 05, EPC 06, EPC 07, EPC 10 & PPP 02.

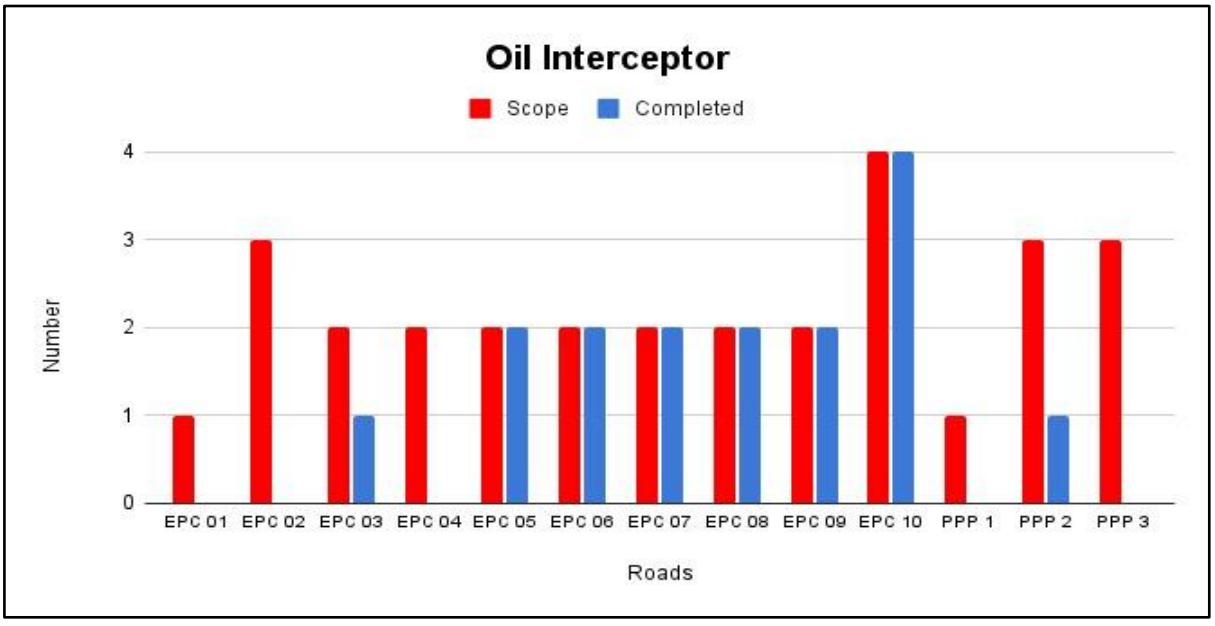
The public were randomly interviewed during the site visit and there was satisfaction with the facility provided.



Graph 4- Statistics on Facilities (Bus bays and Bus shelters)

Mechanism to sustain the initiative: All the road project is evidenced to be roped with operation and maintenance phase with a contactor in most of the cases same contractor is awarded the O &M operations.

Oil Interceptors: Oil interceptors are provided at construction camps having re-fuelling stations, oil and lubricants storage places were designed to have one oil receptor to stop and separate floating oils. The graph below depicts the plan vs actual installation of the oil interceptors.



Graph 5 – Plan vs Actual – Oil Interceptors

3.1.3 Usage of green materials

Green material in TNRSP II road construction projects relates to usage of fly ash, re-use of material such as scarified Bituminous material or earthwork. While there is no specific commitment in EIA / EMP, the focus has been on using re-used material in the project. From the closure report, it was evident that the following projects used waste material such as scarified Bitumen.

Scarified Bitumen:

In EPC 03 4698 cum of bitumen waste generated was re-used at:

1. Ch 52+150 RHS – Village Road- 225 cum
2. Ch 54+800 LHS- Vinayaga School Interior Roads – 135 cum
3. Ch 54+800 LHS- Vinayaga School Vehicle Parking – 900 cum
4. Thollamur Debris Pit 468 cum
5. Thollamur Access Quarry to Crusher Road - 2520 cum
6. Thollamur Plant Road – 450 cum

In EPC 05 Scarified Bitumen quantity generated is 19909 MT, was disposed at approved site located in N Pudupatti village.

In EPC 06 construction material consumed – Bitumen 7740 MT.

In EPC 07 construction waste material generated and disposed to approved site at Pottanam village – 8890 cum.

In EPC 09 5800 cum was reused at approved locations NPC for dump sites KM 23+500 LHS; Km 26+600 LHS, 54+100 LHS, 55+600 RHS

In EPC 10 50295 cum was used at approach road, temple, graveyard, vehicle parking yard, an access road to villages, houses, ramp for Plants. Requisition from landowners for re-used material recorded.

In summary EPC 03 has attempted to reuse 28% of the bituminous waste, EPC 08, EPC 09 & EPC 10 have reused the bituminous waste 100%.

There is also evidence of the use of terracotta bricks in constructing the toll administrative building of the PPP 02 project, which has a positive impact on energy conservation. Felt the difference in temperature outside and inside the building during the visit. In the Bituminous waste dumping yard, green thorn plants were used as natural fencing, cow dung mixed with red soil was used as manure to improve plant growth.

The use of solar street lights provided at different chainages in urban and rural premises as committed in EMP in EPC 02 and PPP 02 was also evidenced during site visit. There was a theft of the whole unit in EPC 02; hence arrangements for securing it might be planned in PPP 02 and future projects.

3.1.4 Water management:

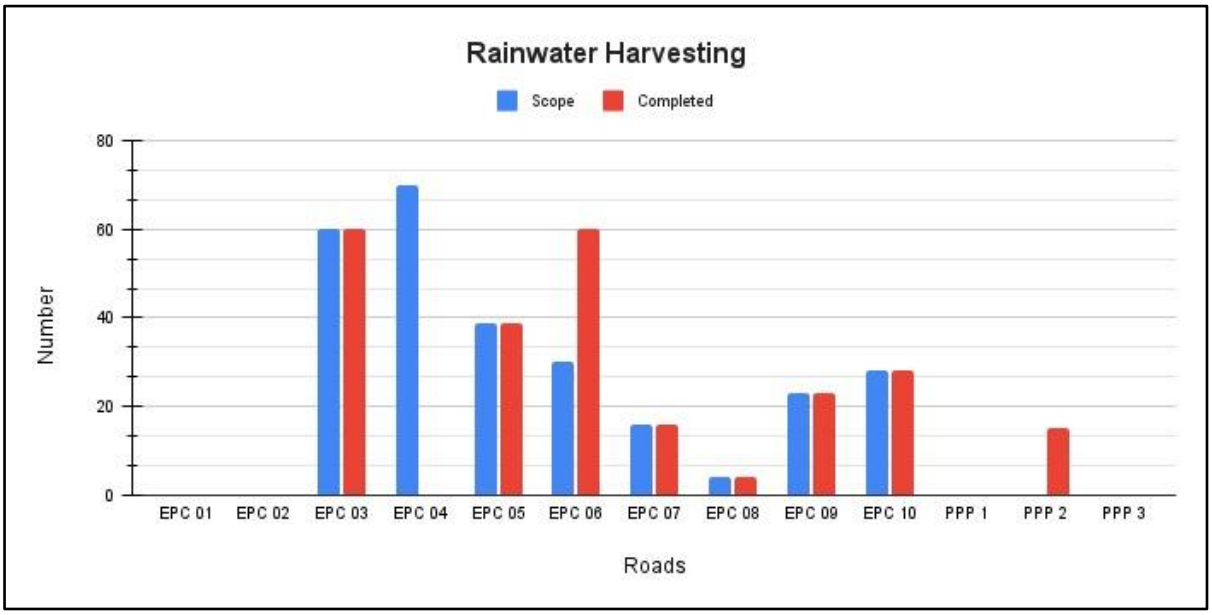
Water attribute is studied for the water source, rainwater harvesting, stormwater management, Erosion protection in various roads.

The source of water is reported to be from surface and ground or procured from a third party. When the water is taken from third-party groundwater, the clearance is also taken from them.
The summary of mitigation measures suggested in EIA and actioned in EMP across various roads for water management and provision/relocation of enhancements are as follows

- EPC 02 – Relocation of 82 of bore wells displaced and 34 no of open wells
- EPC 03 – Relocation – 34 Nos of taps, 17 Nos of OHT/water Tank
- EPC 04 – Relocation -53 Nos of taps, 1 No of OHT/water Tank
- EPC 05- Relocation -44 Nos of taps, 3 borewells, 6 open wells, 2 OHT/ water tank
- EPC 06- Relocation -164 Nos of taps, 50 borewells, 36 syntax tanks, 6 overhead tank
- EPC 08- Relocation -40 Nos of taps, 2 OHT/ water tan
- In EPC 10 – A total of 17 check dams and 10 ponds fall within ROW of project road, out of which 4 ponds (pond wall impacted) and 8 check dams (bund wall impacted) are partially impacted due to the proposed development. Out of the 41nos. Impacted groundwater sources, 8 nos. are hand pumps, 23 nos. are water taps, 3 nos. are open wells, 2 nos. are borewells, 1 no. OHT and 4 nos.

Mitigation measures were imposed and carried out:

- Roadside drainage designed for a 25-year return period of rainfall of appropriate duration as suggested in IRC: SP-42.
- A detailed hydrological study was carried to calculate the design discharge.
- Stormwater from all longitudinal and cross drainage works connected to the natural drainage courses.
- Diversions are constructed during the dry season, with adequate drainage facility, and are being cleaned before the onset of monsoon.
- Debris was generated due to the foundation's excavation or the dismantling of the existing structure removed from the watercourse.
- Silt fencing is provided on the mouth of discharge into natural ponds.
- Side drains provided on both sides of the road,



Graph 6 – Statistics on Facilities (Rainwater Harvesting)

The status of the different types of culverts planned and executed as per world bank visit in table 8, and its current status is in table 7.

Photograph 4: water enhancements

During the PPP02 site visit, it was observed that the Bitumen dumping site provided clay lining both at the top and bottom to prevent groundwater contamination.

Photograph 5: Lake enhancement

	Pipe culverts			Box culvert			Slab culvert		
	Scope	Completed	balance	Scope	Completed	balance	Scope	Completed	balance
EPC 01 (SH 116)	55	46	3	80	63	6	3	0	0
EPC 01 (SH 58)									
EPC 02	76	57	2	61	34	6	46	27	2
EPC 03	12	8	1	32	12	5	11	0	2
EPC 04	5	4	1	106	0	50	5	0	0
EPC 05	25	23		6	3	3	2	0	1
EPC 06	39	39		17	16		7	7	
EPC 07									
EPC 08	18	15		19	11	1	6	5	
EPC 09	22	22		17	13	1	10	8	1
EPC 10	57	42	2	22	12	2	32	11	4
PPP 1									
PPP 2	57			40			-		
PPP 3	19			44			19		

Table 8 – World bank inspection data of 2017

Retaining walls, toe walls and breast walls constructed in the various sub projects.

In the road sections, where land was limited for providing cross fall/slope of carriageway after shoulders, RCC breast walls, toe walls and retaining walls have been provided without compromising road safety. Toe Walls for Example:- EPC 01(3460m), EPC 02(105m), EPC 03(490m), EPC 05 (3661.40RM), EPC 06(1231.2RM), EPC 07(1840 RM), EPC 10(455m), PPP 2(1520m) etc., retaining wall for ecample:- EPC 01(738m), EPC 02(205m, EMP

retaining wall: 1330m), EPC 04(289m), EPC 08(2764m), EPC 09(485), EPC 10(1050m), PPP 02(996m), PPP 03(180m) etc,. Well protective wall and R.E wall for example:- PPP 02 (147m), PPP 02 (292m)

Road Side Drains:

In the all the contract packages, covered lined box drains have been provided both sides of roads in habitation areas, while unlined earthen drains have been provided in rural areas. On sides of drains, holes with grit have been provided for entering rain water from carriageway**.** Unlined earthen drains for example:- EPC 01(SH 58: 8545, SH 116: 4200), EPC 06(3172m), EPC 08(33873m), EPC 10(138730m) etc., RCC Cover drains for example: EPC 01(SH 58: 9008, SH 116: 4400), EPC 02(27603m), EPC 03(1600), EPC 04(9900.5), EPC 05(13992m), EPC 06(36150.80m), EPC 07(8398m), EPC 08(620m), EPC 09(18914), PPP 02(47079m), PPP 03(1190m) etc., Lined cover drains for example:- EPC 05(37744m), EPC 07(16571m) etc., Earthen Drains for example:- EPC 03(55294m), EPC 04(61492m).

3.1.5 Road Safety management:

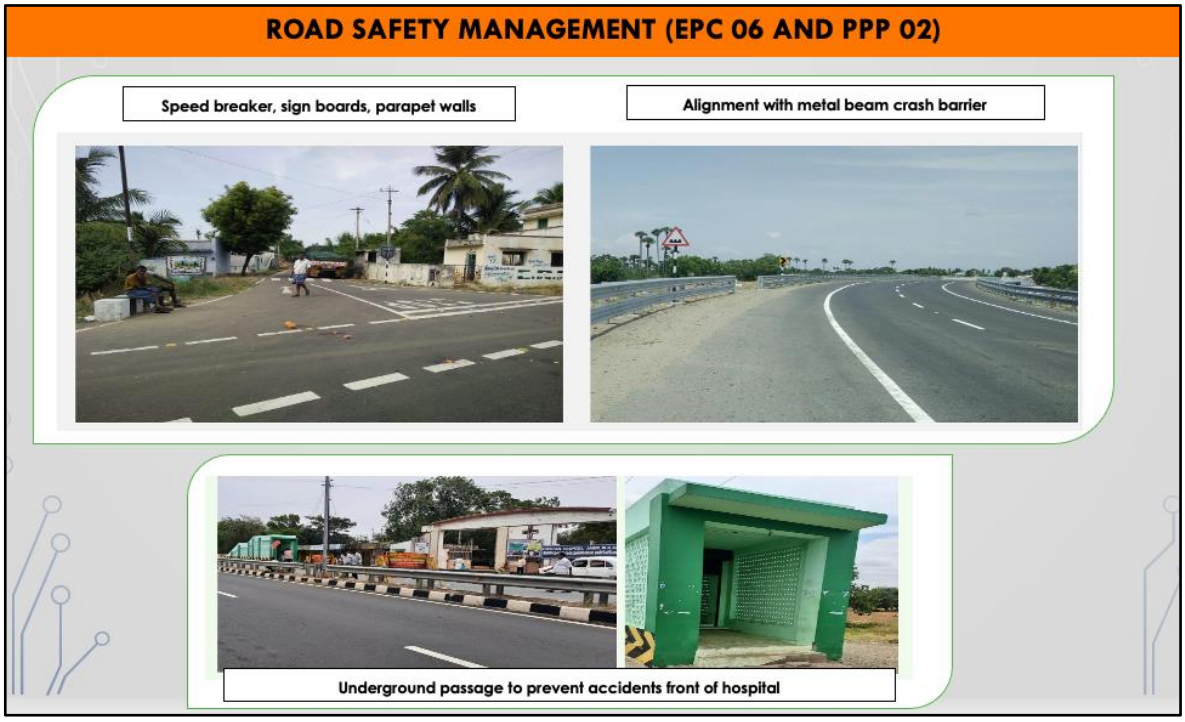
Road Safety Executive Leadership Group (RSLEG), to oversee, guide, and provide leadership to the road safety agenda, has been established with representation from key stakeholder departments, viz., Police, Health, Education, Transport, and Highways. support units such as a Road Safety Management Cell (RSMC) and the implementation units for the district and corridor demonstration projects have also been set up.

Road safety is a critical element of success; several factors help achieve this; some of them considered for review of performance in the TNRSP projects are in both design & construction phase , operation phase & maintenance phase.

Photograph 6 : Road safety (EPC 05)

Design and construction: construction of retaining wall, metal beam crash barrier, signboards, rumble strip, speed humps, pedestrian crossing, delineators, road marking, avoiding S & sharp curves

Operation and maintenance: Road safety audits and recommendations, awareness-raising through village meetings to create road safety programs, community consultation to ascertain village concerns regarding traffic management, traffic management plan for enhancing the convenience to road users/reduction in the travel time etc., Statistical data on road accidents, Mobilization of traffic patrol officers, necessary measures to minimize safety risks In the event of road damages,



Photograph 7 : Road safety (EPC 06 & PPP 02)

Provision of road safety measures like construction of retaining wall, metal beam crash barrier, signboards, rumble strip, speed humps, pedestrian crossing, delineators, road marking avoiding S & sharp curves and the following were evident in most of the roads

- appointment of external consultants for EHS matters, EHS officers onsite
- traffic management plan prepared and is approved by the engineer
- men at work' sign is kept 1km ahead of transition subzone
- a supplementary sign saying diversion 1km ahead provided
- the sign saying road closed on provided
- compulsory turn right/turn left sign provided
- sharp deviation sign placed at the end of advance warning sub-zone
- signage provided in transition sub-work zone
- signage saying keep right/keep left provided
- hazard marker placed where railing for cd structure on diversion starts
- barricades are provided on either side of work sub-zone

- metal crash barriers/plastic crash barriers are provided
- demarcations are provided at bridges/culverts of the construction site
- speed of construction vehicles was controlled during the construction process
- roadway indicators were provided

Speed breaker and pedestrian cross marking provided at the entrance of the crossroad to reduce the speed of the vehicle entering the highway; saplings had been planted along the median to reduce the glare from headlights of vehicles moving in the opposite direction in the adjacent lane/carriageway.

In PPP 02 there is a provision of underground passage to avoid road accidents in front of the hospital, and on the suggestion of safety consultants, ghost island marking (cross marking) is provided at central medial openings to avoid accidents.

Road safety signages: The various road safety signages adopted is compiled in the table 9. Some of the road safety signages adopted are reverse bend, overtaking prohibited, chevron, speed limit 50, ADS , T-junction, speed hump, stop board, informatory board, speed limit 65, bus stop, hazard marker, curve board, place identification, pedestrian crossing, filling station, school ahead, end of dual carriageway, start of dual carriageway, horn prohibited, overtaking prohibited, side road left,

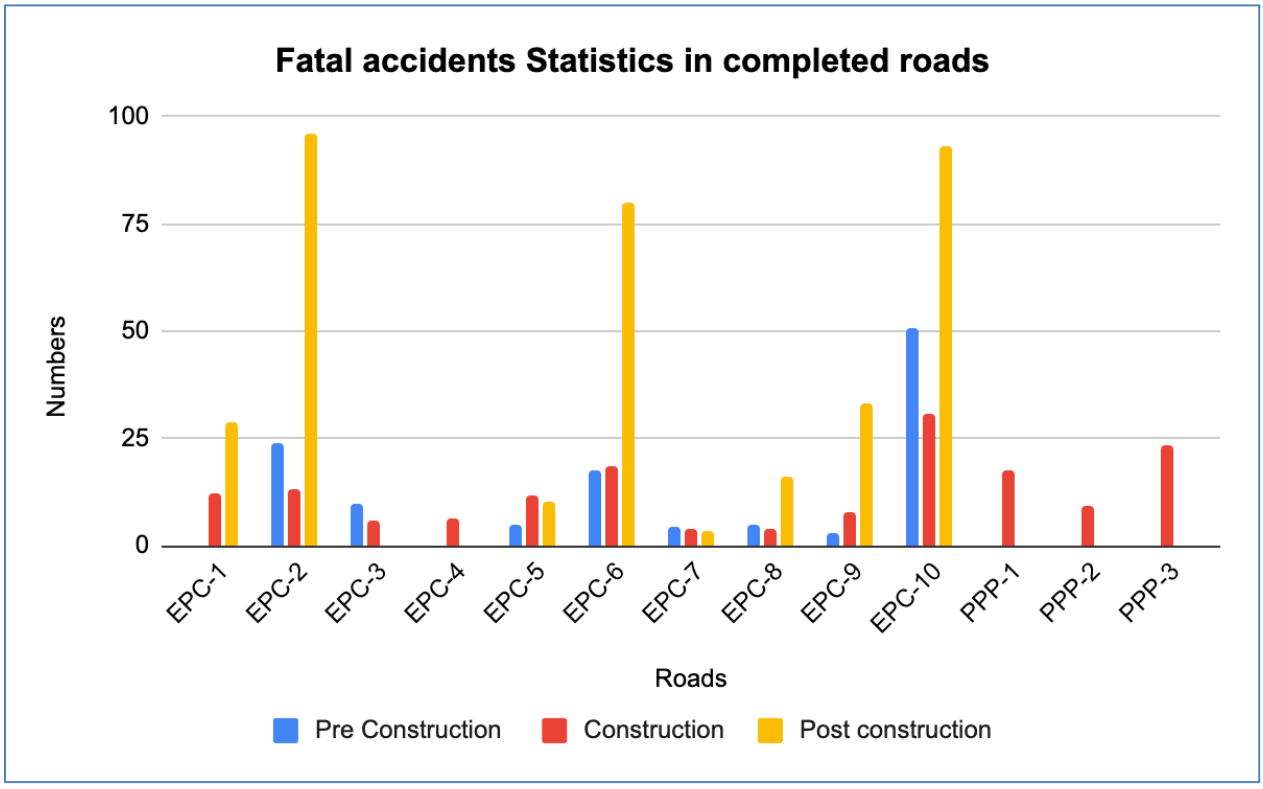
Information about EPC 04, EPC 16 and PPP 03 not available as its ongoing project while PPP 02 information was not reported. Table 9 below gives the glimpse of the statistics of road signages adopted across the roads.

Road	Road safety signage
EPC 01	1772
EPC 02	Scope 2544, completed 2527
EPC 03	859
EPC 05	416
EPC 06	1087
EPC 07	84
EPC 08	490
EPC 09	428
EPC 10	1700

Table 9 – Statistics on road safety signages

Accident statistics:

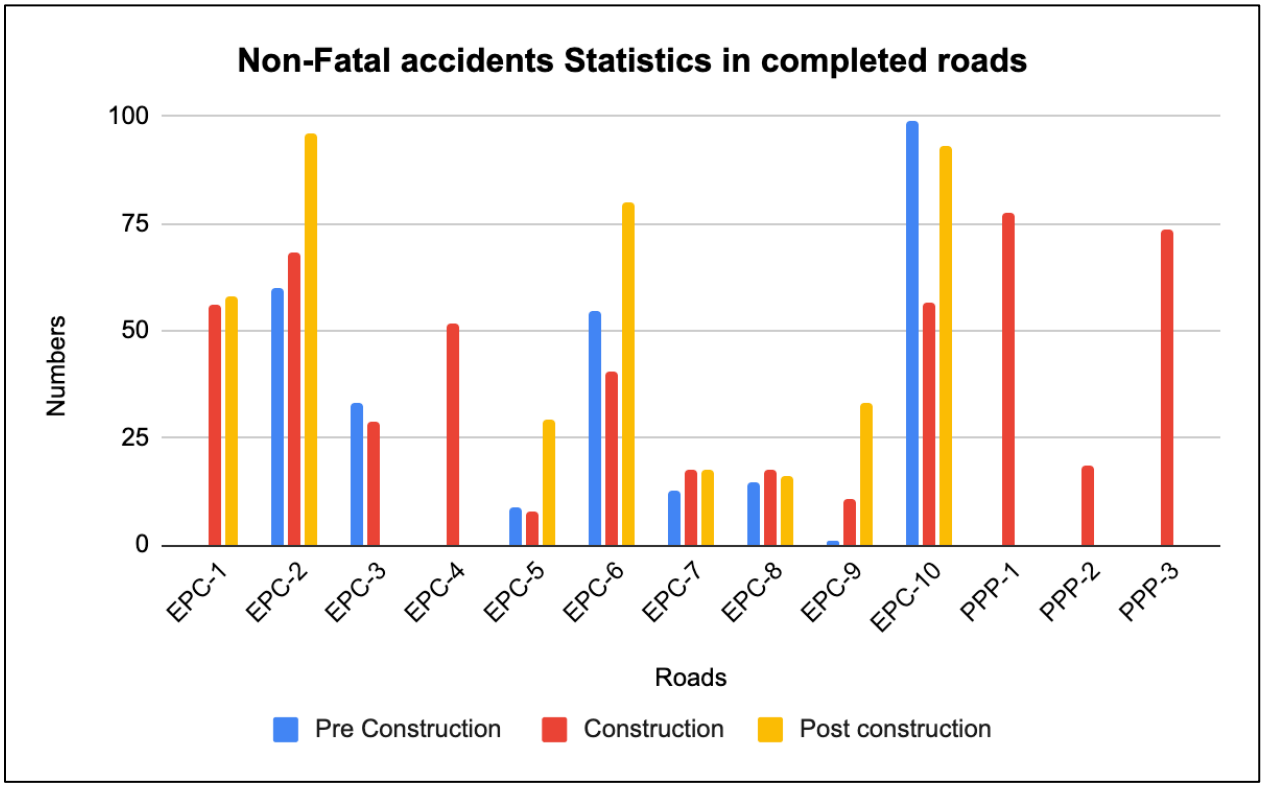
From the analysis of accident data depicted in Table 10 and table 11 , it is found that EPC 10 experienced more number of fatal and non fatal accidents, a total number of 54 and 102 in the year 2013 during pre construction stage which was reduced during construction and post construction. Maximum number of fatal and non fatal accidents of 182 and 694 recorded in the period April 2019 to March 2020. Number of fatal accidents has reduced in the year 2018 and 2019 for the roads EPC 01, EPC 03, EPC 09.



Graph 7 : Statistics on Fatal accidents

Package	Code	Project Period	2013	2014	2015	2016	2017	2018	2019
EPC 01	SH-116 & SH-58	2015-2018			10	15	11	13	29
EPC 02	SH-04	2015-2018	26	22	15	11	13	13	29
EPC 03	SH-09	2015-2019	09	11	9	0	10	6	4
EPC 03	SH-137	2015-2018							
EPC 04	SH-70	Ongoing	09	10	03	04	05	03	11
EPC 05	SH-86	2015-2017	03	07	2	3	30	7	14
EPC 06	SH-79	2015-2018	19	16	13	16	5	40	29
EPC 07	SH-95	2015-2017	06	03	07	03	02	01	06
EPC 08	SH-89	2015-2018	03	07	03	02	4	20	09
EPC 09	SH-44	2015-2018	01	05	11	4	11	6	6
EPC 10	SH-41	2015-2018	54	47	37	26	34	26	26
PPP 1	SH-15	Ongoing			18	29	25	14	03
PPP 2	SH-37	2018-2020			25	29	56	08	11
PPP 3	SH-39	Ongoing						22	25

Table 10 – Statistics on fatal road accidents



Graph 8 : Statics on Non-fatal accidents

Package	Code	Project Period	2013	2014	2015	2016	2017	2018	2019
EPC 01	SH-116 & SH-58	2015-2018			23	58	49	94	58
EPC 02	SH-04	2015-2018	46	74	58	51	97	67	96
EPC 03	SH-09	2015-2019	32	34	23	24	47	26	24
EPC 04	SH-70	Ongoing	59	72	68	52	52	16	42
EPC 05	SH-86	2015-2017	08	10	03	04	16	15	44
EPC 06	SH-79	2015-2018	52	57	64	37	09	52	80
EPC 07	SH-95	2015-2017	14	11	18	27	08	13	22
EPC 08	SH-89	2015-2018	16	13	10	12	05	19	16
EPC 09	SH-44	2015-2018	0	2	1	6	23	13	33
EPC 10	SH-41	2015-2018	102	96	55	49	68	54	93
PPP 1	SH-15	Ongoing			54	76	59	114	84
PPP 2	SH-37	2018-2020			82	140	137	33	04
PPP 3	SH-39	Ongoing						68	79

Table 11 – Statistics on fatal road accidents

EPC 02, EPC 06 and EPC 08 recorded more number of non fatal accidents in the operational stage compared to pre and construction stage. EPC 01, EPC 02, EPC 06, EPC 08 and EPC 09 has recorded highest number of fatal accidents in the operational stage compared to pre and construction stage. It is suggested to conduct root cause analysis of the probable reasons behind the fatal and non-fatal numbers in operational phase.

There is increase in the number of non-fatal accidents in EPC 02, EPC 05 and EPC 06. EPC 05, EPC 07 & PPP 2 is observed to have recorded high number of non-fatal accidents compared to the other roads in pre-construction phase.

It is suggested to conduct root cause analysis of the probable reasons behind the fatal and non-fatal numbers in PPP 02 and other roads also to consider the inputs for design of safe roads in future.

Safety audits were conducted on all roads from EPC 03 to EPC 10 at the DPR stage and Closure phase safety audit reports were made available for review from EPC 01, EPC 02, EPC 05, EPC 06, EPC 07.

Photograph 8: Road safety Management (PPP02)

3.1.6 Noise Mitigation:

The impact of noise during the construction phase is temporary, but during the operation phase, it is considered as a disturbing factor for sensitive zones like educational institutions, hospitals, temples, etc. Considering this, TNRSP made an effort to mitigate noise impact both during construction and operation phases. Diesel generators are provided with acoustic enclosures.

In PPP 02, to avoid noise impact on Allimandel villagers, a bypass road of length 3.18 km was provided from 50 km to 50.318 km.

One of the noise mitigation measures taken by TNRSP is the provision of the compound wall for the operational phase, but the measure's effectiveness is not captured in any of the projects. Hence, monitoring noise levels before and after the compound walls is recommended for further ongoing projects. Below is a list of compound walls established by various projects:

Road Name	Scope (DPR)	Completed (closure report)
EPC 01		22
EPC 02		Nil
EPC 03	7	6
EPC 04	5	
EPC 05	7	9
EPC 06	19	19
EPC 07	6	8
EPC 08		Nil
EPC 09		Nil
EPC 10		Nil

Table 12: Noise mitigation (Compound walls)

3.1.7 Soil & Borrow management:

Borrow pits and quarry management:

Borrow area rehabilitation details were collected from the closure report, and the observations were as follows, For all the road projects, the divisional engineer TNRSP has prepared a borrow area rehabilitation plan covering the details such as the location of borrow area, size of each borrow area, the quantity of earth excavated (cum) and borrow rehabilitation details.

Quarry area rehabilitation:

The divisional engineer TNRSP has prepared a quarry area rehabilitation plan covering the quarry area and its rehabilitation details for all the road projects. Quarry area rehabilitation and borrow area rehabilitation details collected from the closure report are in Annexure IV.

Slope Protection:
Stone pitching and grass turffing have been used to protect the high embankment slopes and erosion prone slopes. Stone pitching was carried out in various roads for example:- EPC 04(4no), EPC 05(3661.40RM), EPC 06(2215 RM), EPC 07(1600), EPC 08(479), EPC 10(583), PPP 2(11094) etc., And turfing was also carried out in various roads for example:- EPC 03(4937m), EPC 05(nil), EPC 06(nil), EPC 07(240RM), EPC 08(1465 RMT), EPC 10(75.36m) etc.,

3.1.8 Waste management During our field visits at the labour camps, the effort was seen in properly handling the liquid and solid waste. The liquid waste was routed through the septic tank at EPC 14, and the canteen waste was collected in the bins for disposal by local authorities.

Photograph 9 : Waste management evidenced during site visit

In EPC 01, it was evidenced from the audit report that the contractor handed overused HDPE drums, used papers, and cardboard at the construction camp to M/s Global Waste Recycler Limited for further processing.

The waste management covering the generation, usage, and disposal based on the available information is given at Annexure III, and table 13 depicts the Bituminous waste generated and reused, and table 14 the construction material consumed. As per the available data from closure report out of 7000 and 9300 cum of generated waste EPC 08 and 09 reused up to 99% for the pavement of crossroads and EPC 10 generated 50295 cum bitumen waste and 100% of it was reused.

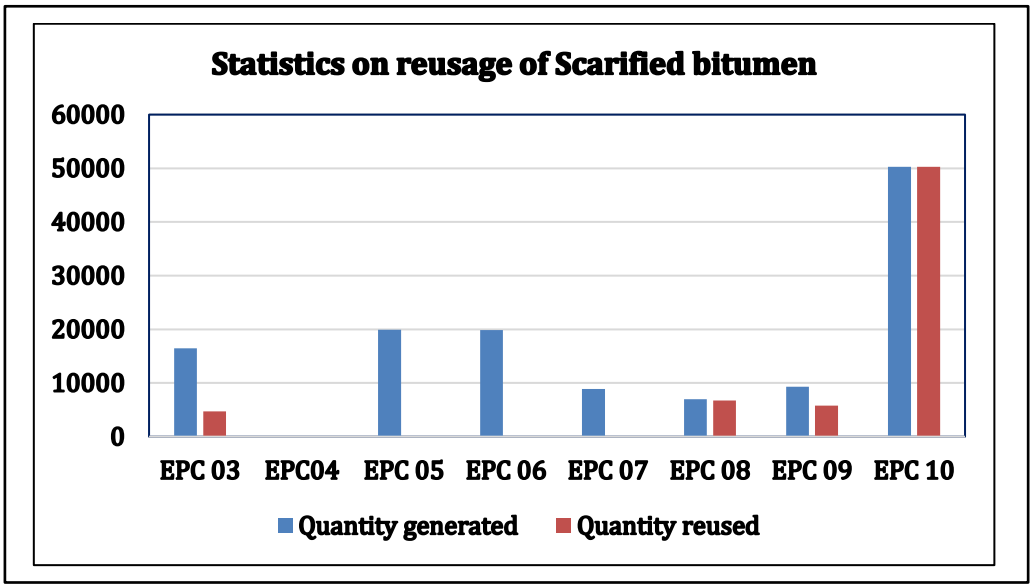
Road	Bituminous waste	
	Generated (cum) (Closure report)	Reused (%) (Closure report)
EPC 01		
EPC 02		
EPC 03	16440	28.58
EPC 04	-	-
EPC 05	19909	Nil
EPC 06	19867.1	-
EPC 07	8890	Nil
EPC 08	7000	99.00
EPC 09	9300	99.62
EPC 10	50295	100.00
PPP 1	-	-
PPP 2		
PPP 3	-	-

Table 13- Data on Bituminous waste generated and reused

Roads	Stone aggregate (cum)	Earth (cum)	Cement (MT)	Steel (MT)	Bitumen (MT)	Diesel (L)
EPC 01	526117	266358	10662.9	1063.39	6821.44	4366.53
EPC 02						
EPC 03	130567.88	160535.59	3295.6	377.75	3309.417	
EPC 05	250041.5	175594	3496.55	850	4255.17	158678
EPC 06	428094	508361	15456	2800	7740	4222000
EPC 07	74195	64104	3362	984	2284	1223942
EPC 08	242284	9348	6206	1019	2736	
EPC 09	267160	23493	5634	960	6448	
EPC 10	176524	31679	13829	1885.86	12827	

Table 14- Data on total construction materials consumed

No information was available for EPC 04, EPC 16 & PPP 02 as its ongoing project. EPC 01, EPC 02 & PPP02 no information were available in closure reports.



Graph 9 – Statistical on Reusage of Scarified Bitumen

It is suggested that the EIA study address further options for more/ optimum utilization of the identified waste especially, bitumen waste, for reuse. In case of any disposal of bitumen waste is planned, the same to be developed in consultation with the State PCB.

Hazardous waste management:

Hazardous waste authorization was taken by the contractor for disposal of used oil generated.

Some examples of them are EPC 06 the authorization was taken by M/s Sheladia Associate Inc and the used oil waste was sent to oil recycler.

EPC 08 and EPC 10 had authorization taken by M/s. LEA Associates South Asia Pvt. Ltd., (TNRSP II/CSCS/SC03/EPC-08-011/082 Dated: 07th November 2015 , M/s. LEA Associates South Asia Pvt. Ltd., (TNRSP II/CSCS/SC03/EPC10-179/791 Dated:12th September'2016

3.1.9 Air Emission & Dust Control

The sources of air pollution differ as per the phases of road construction. Impact on air quality during the construction phase is associated with the movement of construction vehicles, operation of construction plant, crusher, RMC, WMM plant, batching plant, DG, etc., and vehicular emissions during the operation phase. The majority of the projects are seen to take consent under the Air (Prevention & Control of Pollution) Act, 1981, thereby monitoring air quality as per consent requirement. Further, Contractors deployed only PUC-certified vehicles on site.

Dust control is viewed as one of the important factors during the construction phase. To suppress fugitive dust emission, a sprinkling of water is done during excavation and is carried out on several roads; SH 89 and SH 70 are said to have followed dust control with

a sprinkling of water. EPC 04 used 12000 liter /one Trip and 3-4 trips per day of Surface water, EPC 08 - 8 loads, 2000 liters per load so 16,000 lts/day except the rainy season, 3 Loads with 2000 lit/load., it is evidenced from pictures that materials likely to rise dust-covered with tarpaulin during transportation.

3.1.10 Occupational Health and Safety Management

TNRSP identified areas that need to be concentrated regarding OH&S of workers. Environmental and safety consultants and EHS officers were onboard across all roads. From the world bank report information compiled in table 15 it is observed that the Environment and safety officers were nominated from the contractor side in all projects.

Road	2016 (April)	2016 (Nov)	2017
EPC 01	Yes	Yes	Yes
EPC 02	Yes	Yes	Yes
EPC 03	Yes	Yes	Yes
EPC 04	No	No	Yes
EPC 05	yes	yes	yes
EPC 06	yes	yes	yes
EPC 07	yes	yes	No
EPC 08	yes	yes	yes
EPC 09	yes	yes	yes
EPC 10	No	Yes	Yes
PPP 1	Not started	Not started	Not started
PPP 2	Not started	Not started	Not started
PPP 3	Not started	Not started	Not started

Table 15: Status of Environmental / Safety Officer appointed at site

The guidelines on safety compliance that needed to be adopted at the construction and maintenance phase were planned by the consultants and executed by site EHS officers whom the contractor appointed.

At construction camps: The key points focussed are providing accommodation with necessary facilities such as potable water for drinking and water for bathing, clean toilets, septic tank for proper disposal of liquid waste, solid waste collection and disposal facility, proper lighting and cooking.

During the construction: Usage required PPEs like a helmet, safety shoes, mask, gloves, reflective jacket, and earplugs by the concerned safely.

Facilities in labour camp: During a field visit to the construction camp at EPC 14, site it was observed that the camp is well maintained with the provision of potable drinking water and sanitation facility, canteen, Septic tank, first aid box, demarcated safe assembly point and display of emergency contact number. Similarly, noted in case of PPP 02 - safety manual, conducting frequent safety checks, hazard identification in the

workplace and risk assessment and maintaining monthly safety checklist such as electrical safety, flammable storage area etc were evident.

Construction Camps and Plants Management:

(i) Establishment of Construction Camps and Plants

- The camps sites were minimum of 250 m away from any major settlement or village in downwind direction.
- There was no surface water course or body within of 200 m.
- Sufficiently wide access roads (5.5 m Wide) approach were available for heavy vehicle movements.

(ii) Layout Plan for Construction Camps: The contractors prepared layout plans showing site office, store room, rest room, toilets, material stocking yard, labour accommodations, etc, along with vehicular movement path. Layout plans were approved by the Construction Supervision Consultants

(iii) Display of Signages: Necessary safety, informative and warning signages were displayed at the construction camps for awareness of workers and operators.

(iv) Electrical Safety: At the construction camps and HMP, WMM & RMC plants electrical safety was maintained by implementing the following measures:

- On electrical panels, bone and skull danger signages were displayed. Canopy covers on electrical panels were provided for protection from rains.
- Insulation rubber mats were provided at electrical panels.
- Double earthing was provided at all 440 volts electrical motors and electrical panel and DG sets. Earthing pits were provided as per IS Code and earth resistance was measured regulatory.
- Fire extinguishers were placed near electrical panels.
- Electrical cables were buried under ground.
- CPR Chart was displayed near DG sets.

(v) Guards on Moving Machines: Protection guards over pulleys and belts of motors were provided.

(vi) Collection and Disposal of Hazardous Wastes: Used oil generated from the maintenance of engines of DG sets, construction machines and vehicles, was the only hazardous waste generated at the construction camps. Oil interceptors were provided for collection of used oil and used oil was disposed to TNPCB/CPCB authorized used oil recyclers.

(vii) Housekeeping at Construction Camps and Plants: At the construction camps and HMP, WMM and RMC plants, housekeeping was maintained satisfactory to good.

(viii) Labour Accommodations and Facilities: At the construction camps proper accommodations (with beds) for workers and operators, kitchens, sanitary, etc facilities

were provided and maintained. At all the contract packages, separate toilets and washrooms were provided for male and female workers. For day time working women specially in kitchens, separate rest rooms were also provided.

(ix) LPG for Cooking: Use of wood as fuel was restricted at the construction/labour camps. LPG Cylinders were used for cooking of food.

(x) Availability of Drinking Water: Cool and clean drinking water facilities were provided at the construction camps.

(xi) First Aid Medical Facilities: First aid facilities were available at construction camps and records for the same were maintained by the contractors. Contactors made MOU with local hospitals and doctors for regulator visits the camps and for emergency situations.

(xii) Display of Emergency Number: As part of emergency response plan, important emergency numbers were displayed at the contraction camps.

(xiii) Disposal of Wastes and Waste Water from Camps and Plants: For collection of wastes, dust bins were provided at places. Waste generated were disposed after segregation. Biodegradable wastes were disposed in compost pits. Sewage generated from toilets was disposed though septic tanks followed by soak pits.

3.1.11 Competence, Training, and Awareness:

Skill mapping, Training Plan, Training topics, Training records, Awareness methods adopted, Training materials

- General Awareness on Environment and Safety for Skilled and unskilled labor and Engineers, supervisors, and office for a duration of one day
- Eye care awareness and health camps
- Fire safety training
- Safety awareness and HIV awareness
- CSR activity

The following are some of the programs conducted by the projects:

EPC 01: The contractor conducted an awareness program connected to World Environment Day in 2016 and 2017. Five training programs have been reported in the closure report (1. AIDS awareness camp, 2. Medical camp, 3. OHS, 4. First Aid Camp, 5. Firefighting awareness)

EPC 02: Contractor conducted awareness programs (1. AIDS awareness camp, 2. Medical camp, 3. OHS, 4. First Aid Camp, 5. Firefighting awareness) and check-up program for workers and additional safety training and toolbox talks were provided to workers. Land use management training was proposed in EMP but was not conducted because it was not considered in the current scope.

EPC 03: Conducted three training programs (1. AIDS awareness camp, 2. Medical camp, 3. First aid camp)

EPC 08: Conducted three training programs (1. AIDS awareness camp, 2. Fire safety and 3. Road safety)

PPP 02: Conducted 4 training programs (1. AIDS awareness camp, 2. Medical camp, 3. First aid camp 4. Fire fighting & medical check up)

EPC 14 and EPC 15: During the site visits, observed that training records were maintained and maintained the training information in monthly progress reports. Also, they are doing pep talk during daily toolbox meetings on safety aspects.
It is suggested to incorporate the details on training/awareness conducted in the project closure report.

During the site visit in EPC 14 and EPC 15, training records were seen, and EPC 14, which had started a few months, also maintained the training data conducted in the monthly progress report and spoke of communication on safety matters during the daily toolbox meeting. It is suggested that the project closure report contain information related to training conducted.

Photograph 10: Awareness & Training

3.1.12 Environmental Monitoring

Periodic environmental quality monitoring was scheduled in DPR, and the contractor organized them through a NABL approved laboratory based on the environmental quality monitoring plan provided in the EMP.

Monitoring reports could be verified for some of the projects during the site visits; accessibility for inspecting the monitoring reports has been remote for all projects.
The labs engaged in monitoring were recognized by the MoEFCC /accredited and followed the guidelines and frequency as mentioned in the EMP. Frequency of monitoring and parameters If in line with the plan is to be ascertained.

Following table 16 gives is a glimpse of the Monitoring plan suggested in the EIA , committed in the EMP.

SL No.	Parameters	Pre-Construction	Construction	Operation and Maintenance phase
1	Air Quality near hot mix plants	0 to 3 seasons per year for 2.5 years	3 seasons in a year for 3.5-4 years	One time-based monitoring to 2-3 seasons in a year for 1-3 years
2	Air Quality at Critical Locations	0 to 3 seasons per year for 2.5 years	3 seasons in a year for 3.5-4 years	One time-based monitoring to 2-3 seasons in a year for 1-3 years
3	Noise Level at Equipment Yards	0 to 3 seasons per year for 2.5 years	3 seasons in a year for 3.5-4 years	One time-based monitoring to 2-3 seasons in a year for 1-4 years
4	Noise Levels at Critical Locations	0 to 3 seasons per year for 2.5 years	3 seasons in a year for 3.5-4 years	One time-based monitoring to 2-3 seasons in a year for 1-4 years
5	Water Quality	0 to 4 seasons per year for 1 to 2.5 years	4 seasons in a year for 3.5-4 years	One time-based monitoring to 2-3 seasons in a year for 1-4 years
6	Soil Quality	0 to 4 seasons per year for 1 to 2.5 years	4 seasons in a year for 3.5 years	One time-based monitoring to 2-3 seasons in a year for 1-4 years
7	Soil Quality monitoring during spills	0 to 4 seasons per year for 1 to 2.5 years	0 to 4 seasons in a year for 3.5 years	One time-based monitoring to 2-3 seasons in a year for 1-4 years

Table 16 - Environmental monitoring plan

Photograph 11: Environmental Monitoring (PPP02)

3.1.13 Resource allocation

Cost as envisaged in the EIA / EMP studies, Budget for implementation vs. Actual cost, Human resources such as Environmental Cell / third-party consultants / third party auditors etc were considered, and the resources allocated that could be gathered from the closure report is as follows.

Road	Environmental Budget	Source
EPC 01		
EPC 02		
EPC 03	₹14,015,000.00	DPR
EPC 04	₹31,147,000.00	DPR
EPC 05	₹32,387,372.00	DPR
EPC 06	₹73,301,325.00	DPR
EPC 07	₹25,294,558.00	DPR
EPC 08	₹35,165,940.00	DPR
EPC 09	₹38,985,782.00	DPR
EPC 10	₹74,140,091.00	DPR

Table 17. Resource allocation

Resource allocation under the EMP is done for the following : During construction for oil Interceptor, silt fencing, recharge pit, soak pit, relocation of hand pumps, compensatory plantation, landscaping are considered. For mitigation and enhancement measures for religious/cultural assets for noise-sensitive receptor for surface water bodies and for Monitoring of environmental attributes during the operation phase (air, Noise, Water, Soil quality) & clearing the roads and drains is considered in the maintenance phase.

3.1.14 Grievances (Environment-related):

Committee for addressing grievance: While interacting with EPC 10 officials, DE mentioned the formation of a committee post the project with various stakeholders like the public, NGOs, Forest department, TNRSP etc… to address any issues or grievances of the people. They would meet periodically and the minutes of the meeting were maintained.

Public concern expressed: EPC 02 end stretch at Villupuram there was dumping of waste observed on the roadside the localities also raised concern over hygiene and smell, on checking with TNRSP officials of the road they said by the officials addressed this by writing the letter to municipal corporation and have been doing repeated follow ups.

Court cases:

Case No	Petitioner	Respondent	Subject	Present stage
O.S415/2017	Thiyagarajan	Collector Villupuram DE Kanchipuram SH 04	Against the Construction of Bus shelter in front of his shop in Arcot –Villupuram Road at Km 65/690 (SH 04) (EPC 02)	Counter affidavit filed by TNRSP. Next hearing on 21.10.2021
O.S. 97/2017	Ramalingam Amusavali	Collector Tiruvanamalai DE TNRSP -II Kanchipuram Ilanthirayan Neelavathi	Prayer for removal of encroachment in irrigation channel in Vellary Village (SH – 04) Arcod Arain Road	Counter affidavit filed by TNRSP. Next hearing on 19.11.2021
W.P. 11576/2017	S. Kanagaraj	Collector Tutucorin DE TNRSP Tutucorin	Prayer to prevent flow of sewage water in to his land in Illupurani Village in Kovilpatti Taluk, Following disposal of contempt petition	
WP 2039/18	T. Adihtyan	Secretary to Government (H&MP) Project Director Spl. District Revenue Officer Salem Divisional Engineer Tiruppur	Against the construction of Flyover across Dharapuram Bus stand in strengthening Oddtanchatharam-Dharapuram – Avinasipalayam road SH 37	Case is closed in favour of TNRSP

Table 18: Court Cases

3.1.15 Communications/notices for noncompliance, if any:

The communication system followed at TNRSP was very systematic and followed the organization setup discussed in chapter 1. There was a transparent reporting system to discuss any concerns and report the progress. The periodical meetings like a month

3.1.16 Emergency Preparedness and response:

Environment emergencies such as Pollution due to spillage of oil, other swa waste, and chemicals Emergencies were identified. Emergency preparedness and response manual address these emergencies for the response procedure to be followed. During the site visit it was witnessed that EPC14 considered emergencies that could arise and marked safe assembly point, emergency contact number on site. In the PPP02 toll plaza, a primary health centre is provided, and an ambulance in case of any road accidents was available

3.1.17 Good practices (Field Tour)

TNRSP has taken up good practices to enhance environmental performance along the project corridor by improving greeneries, constructing groundwater recharge pits, soak pits, bridges to avoid alteration in cross drainage flow, pond desiltation. Apart from that, facility enhancement works are also taken up by constructing water taps, overhead tanks, syntax, bus bays.

EPC 01: Additional safety awareness and tool box talks were provided to the workers from the contractor side.

Photograph 12: Good Practices (EPC 05)

EPC 05 has taken up good practices such as providing speed breakers at crossroads entrances, compound walls to mitigate noise, rumble strips, and crash barriers to enhance road safety.

EPC 06 has taken up good practices such as Junction improvement, improvement of greenery along the road. Provision of bus bay and the metal crash barrier.

Photograph 13: Good Practices (EPC 06)

EPC 07

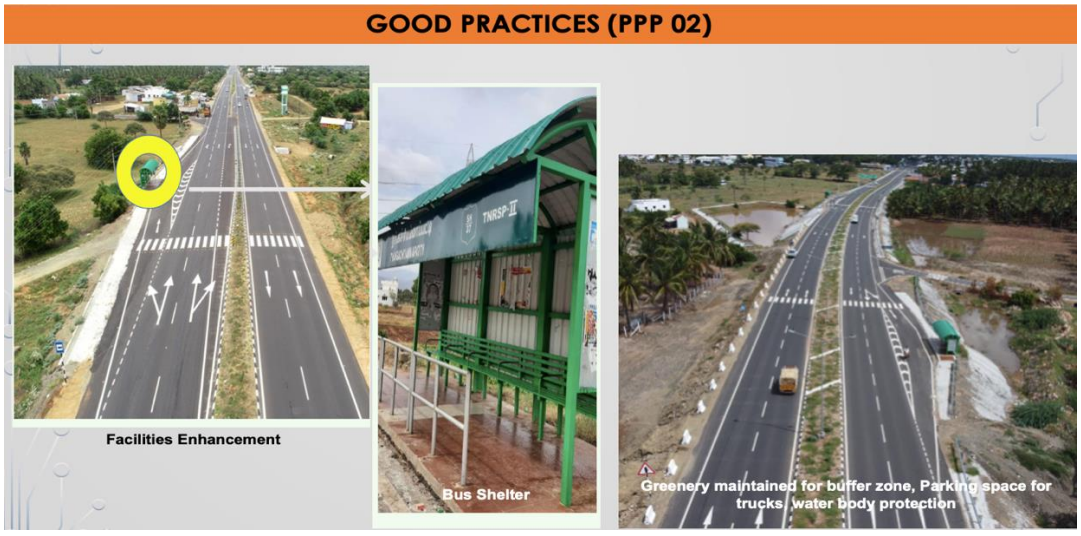
Photograph 14: Good Practices (EPC 07)

EPC 08: Koonthankulam information sanctuary boards are placed at Kms. 0/000 and Kms. 15/000. 2 Sign boards are placed near wild animals crossing.

EPC 09: 16 solar lightings provided at enhancement sites

Photograph 15: Good Practices (EPC 10)

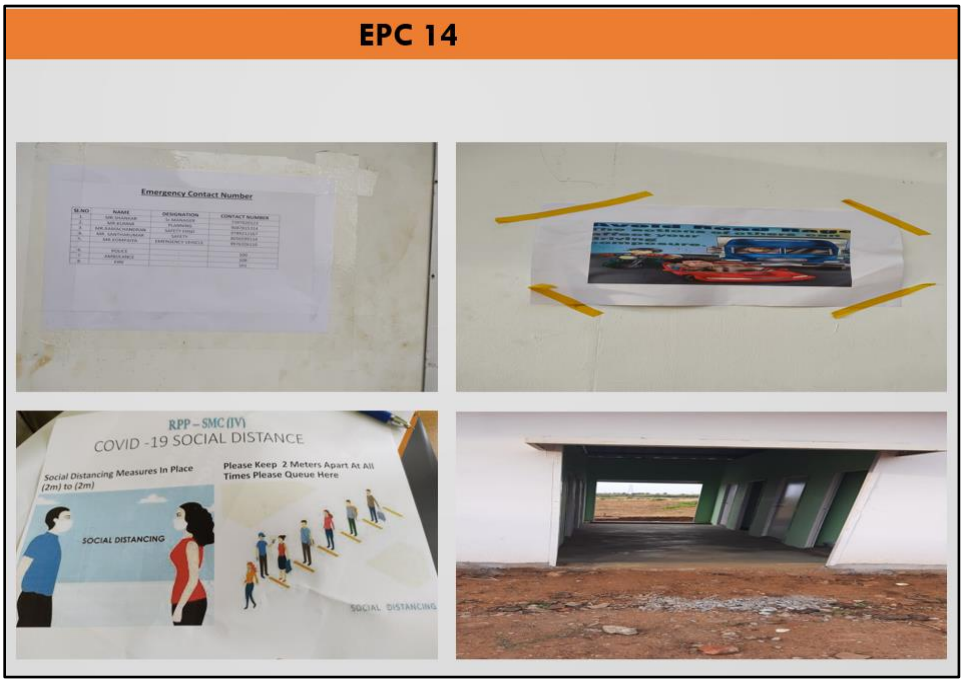
EPC 10 observed to be taken up water enhancement practices like provision of soak pit nearby syntax, stone pitching with dissipation chamber across the slope and, pond desiltation work and 3 solar lights were provided for the enhancement sites.



Photograph 16: Good Practices (PPP02)

PPP 02 used sustainable resource such as solar lighting, natural fencing, terracotta tiles at admin office and primary health center. Further to enhance road safety underground

passage provided nearby hospital and pedestrian crossing signal provided at one intersection.



Photograph 17: Covid precautionary measures (EPC 14)

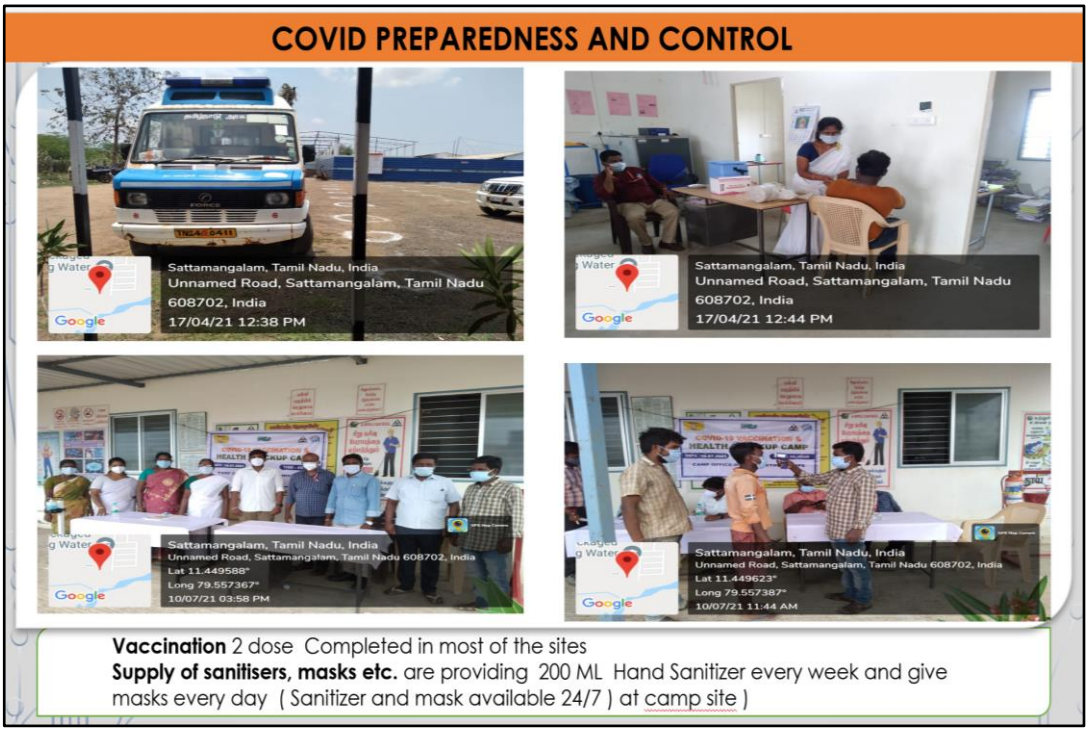
EPC 14 Prioritized occupational health and safety. The display of road safety awareness, social distancing, safe assembly points, and road safety boards was observed during the site visit.

Photograph 18: Good Practices (EPC 15)

EPC 15 is in the construction phase and landed sandbags along the road edge indicate an elevation change. The site office and staff quarters is in construction phase.

3.1.18 Covid precautionary measures

Covid precautionary Measures were taken up and same was shared through photographs by EPC 04, EPC 08, EPC 10 & PPP 2. Other roads were completed before the commencement of Covid19 and only operation maintenance staff are engaged in few numbers. Vaccination 2 doses completed in most of the sites. Some site reported supply of sanitizers 200 ml hand sanitizer every week and masks every day (Sanitizer and mask available 24/7) at the campsite.



Photograph 19: Covid precautionary measures

3.1.19 Performance Evaluation

The evaluation of performance happens at design, construction and post construction stage. The project starts with soil survey, monitoring, review for the suitability of the site and its need and scientific studies is conducted through EIA and required actions are initiated through EMP. The concessionaire details the project specification in accordance with the commitment of EMP in Detailed project report DPR, the implementation of the project by the contractor is monitored by TNRSP environmental unit at project site and by the Project director office. The progress of project execution is monitored monthly , quarterly.

Post project evaluation: Necessary Tests carried out for Highway and Structures before issuing Taking-Over Certificate:

Highways

1. Visual and Physical Inspection report
2. Riding Quality Test.
3. Surface Regularity Test.

Structures

1. Test for Bridges

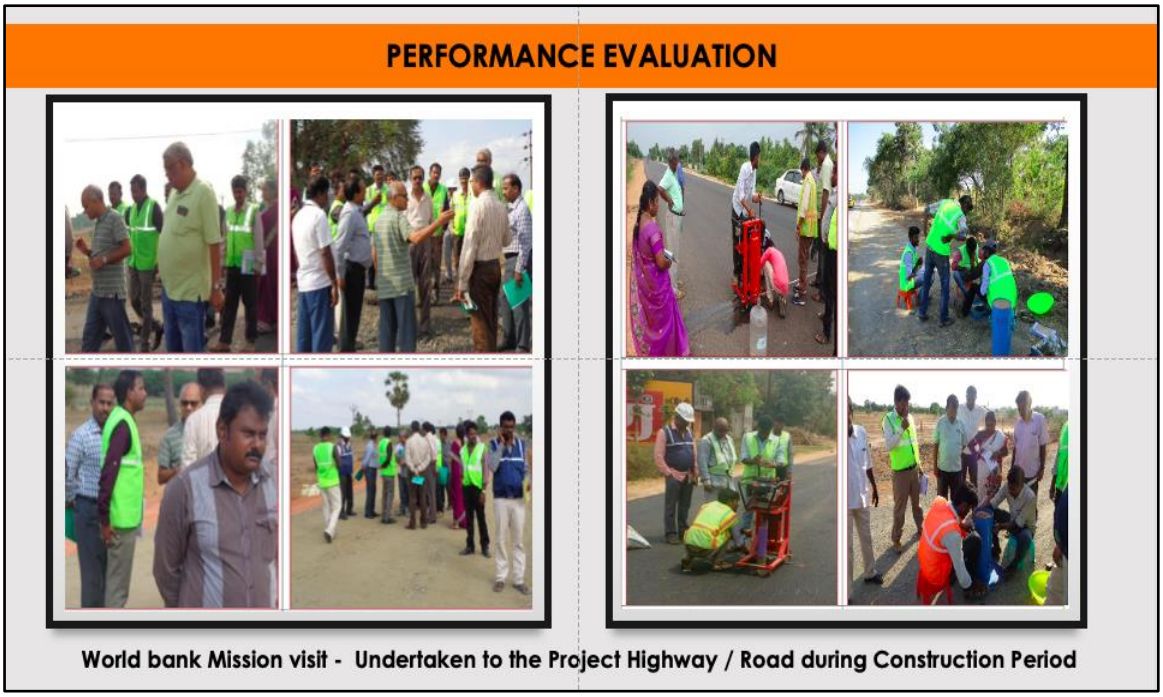
World bank has midterm evaluation of performance conducted on following dates

- First visit of World Bank Mission, on 21.09.2015
- Second visit of World Bank Mission, on 18.04.2016
- Third visit of World Bank Mission, on 01.11.2016
- Fourth visit of World Bank Mission, on 08.06.2017

Findings / remarks / observations of each mission is communicated through aide-memories and report of compliance has been submitted by TNRSP PMC.

The phone call on the status of the road safety component with all stakeholders and WB representative – said to be done monthly.

Remote Monitoring Initiated: During covid virtual meetings, clubbed with a video inspection of the roads was initiated.



Photograph 20: Performance Evaluation efforts

The documented information related EMP across all roads is as depicted in pictures of A Compliance at the Project level as observed by world bank and its action plan communicated by TNRSP are as follows:

A Road Safety Executive Leadership Group (RSLEG) to oversee, guide, and provide leadership to the road safety agenda was recommended – *it has been established with representation from key stakeholder departments, viz., Police, Health, Education, Transport and Highways.*

Support units such as a Road Safety Management Cell (RSMC) had to be set up- TNRSP has set up RSMC also the implementation units for the district and corridor demonstration projects have also been set up. Regular review meetings of RSMC to monitor Road Safety Component - RSMC meeting – post-October 2017, 5 meetings conducted and reviewed the proposals of stakeholders & RSM consultant reports with the support of RSM Working Group (6 meetings conducted). RSM consultant supporting Transport Commissioner for RSMC & RSELG meeting and will be continued till the end of the project

ICERS cell need to organizes review of business process re-engineering and IT process re-engineering – ICERS studies Working Group and Review Committee established for review of reports. meetings are held regularly. Process Re-Engineering: 12 Working Group meetings, 2 Review Committee meetings and 7 monthly review meetings were conducted. IT - ICT Consultancy: 8 Working Group meetings, 5 Review Committee meetings, and 7 monthly review meetings were conducted.

A quick assessment of RADMS by RSM Consultants to identify gaps and primary areas for improvement needs to be done - *Quick assessment of RADMS by RSM Consultants to identify gaps and the primary regions for improvement Consultant has completed management review of RADMS. The report has been shared with all stakeholders. RSMC and RSELG have suggested maintaining the RADMS till the development of the national level Accident Database. Due consultation with the Police, Transport and Developer further course of action will be taken.*

Transport Commissioner to constitute a Road Safety Reference Group – *RSRG established vide G.O.(D) No. 122, Highways and minor Ports (HN2) Department Dt: 11.07.2019. and 1st meeting convened on 12.09.2019. The Transport Department is now working in earnest to formulate a Road Safety Policy. However, all stakeholder departments must formulate and send in their investment proposals to be taken up under this project, some of which could be taken up immediately through approvals by the RSMC, while others with a longer time horizon may need to be vetted by the road safety management consultant firm.*

Vetting of investment proposals from TNRDC and Education departments by RSM Consultants *- TOR for dynamic allocation of ambulances finalized and shared with Bank TNHSP has been requested to complete the work earliest. Training and Capacity Building for Medical officers/ Paramedics on emergency management skills completed - Advance amount Rs.25.00 lakhs released to TNHSP and Hot spot first responder training program for Kancheepuram and Tiruvannamalai District has been completed. Proposal with Time schedule for Emergency management skill training for Doctors & Nurses from Health is in progress.*

Other progress reported by TNRSP include - TOR finalization for an Awareness program in schools in Kanchipuram district and shared with Bank

- *Road Safety Awareness Program in Schools of Kancheepuram District ToR cleared from World Bank and proposals received under CQS method.*
- *Consultant engaged and service commenced on 09.10.2019*

- *M/s Sherwood Technocrats and Consultants Private Limited, Kerala. The consultant submitted the Draft Inception Report on 01.11.2019.*

3.1.20 Continual Improvement

The TNRSP may consider the following suggestions in future projects as a part of continual improvement:

- **Environmental studies:** The EIA consultant shall be insisted to carry out environmental due diligence and state the compliance requirements for the "road project" and for "supported activities" such as stone crusher/quarry mines etc separately and project specific / site specific. It should not be generalized recommendations.
- **Specific compliance requirements:** Due diligence shall be done by the EIA consulting organization duly covering state specific regulations too. For example, the Tamilnadu Pollution Control Board notified certain specific compliance requirements for hot mix plants on 29.07.2016 and which were based on NGT orders.
- **Changes in the regulations:** Due to change in the regulations from time to time, a system to be developed to track the changes in the regulations for compliance and to understand the impact on the project, if any. Generally, the applicability of the environmental permits will be assessed in the project planning stage through EIA study. It is suggested to do the environmental due diligence not only during the planning stage, but also before actual start of the project.
- To study road safety covering the interventions needed from the engineering aspects and also with focus on behavioural aspects with intent to achieve zero accidents. The study shall document the trend in the accidents; do the root cause analysis with suggested corrective action and tracking as a part of post project monitoring – ***Road safety***
- To monitor the noise levels at the sensitive locations before and after project implementation. This will help in understanding the efficiency of the noise barrier. The design and material aspects shall also be covered in the DPR for planning effective barrier. The efficiency of the barriers generally depend on factors such as MoC, thickness, height, location from the source – ***Noise management and comfort to the people***
- In major road projects, the environmental studies to capture the information on the projected fuel savings due to the improvement in the road conditions ***– Fuel conservation for sustainability***
- *In the Environmental studies, to capture how the project is helping in achieving the Sustainability Goals, if any* – ***Towards Sustainability Goals***
- **Green initiatives:** Suggest to include the following during the EIA and DPR stage based on the technical feasibilities:
  - Usage of treated waste water from the Sewerage Treatment Plants for dust suppression. Need to assess the details of the existing operational STPs, availability of the treated waste water and the feasibility for using the same – ***Reduction in the water foot print.***
  - Usage of flyash / fly ash based materials in line with Fly Ash Notification(s) under the provisions of E(P) Act, 1986 for usages such as road construction/ embankments/

construction camps/compound wall/ office buildings / bus shelters etc. Need to assess the existing thermal power plants with in the notified distance from the road project and availability of the fly ask to incorporate in the DPR – **Green initiatives**

- Study on the feasibility and availability of usage of tiles, manufactured from the plastic waste and encourage. Need to assess this aspect too during the EIA study and list out the existing facilities who are manufacturing the tiles from the plastic waste ***– Encouraging circular economy.***
- To study the optimum utilization of the scarified bitumen with an objective of 100% utilization not only in the ongoing project, but to explore usage of the same where ever feasible. In case of any quantity is to be disposed, through land fill, the same shall be planned in consultation with the SPCB – ***Waste management***
- *Mandating the use of energy efficiency lights such as LED and solar system at all the office buildings / toll plazas etc as a minimum requirement* ***– Reduction in the carbon foot print.***

CHAPTER IV SUMMARY & CONCLUSIONS

TNRSP has executed the project with a management framework and organizational setup that enables periodical review and execution. It has also looped in external environmental consultants and other departments like TNCPB and the Forest department to improve the performance of the implementation of the roads.

Greenery: The project has unique achievement on greenery attribute complete project package cutting less than 50% of the planned number of trees to be cut. Planned trees for plantation is maintained 100% overall. Survival rate overall is monitored and is reported as 93.5%. Transplantation has been attempted in a few roads like PPP 02, EPC 14, and EPC 15.

Aesthetics: It is noted that most of the projects executed a considerable number of junction improvement work like grassing on traffic islands, footpath provided with interlocking tiles, plantation of flowering shrubs along the median. Facility enhancement works undertaken such as provision bus bays & bus shelters enhance the view and favours neighbourhood. During the road expansion, relocation of the affected water taps, overhead tanks, borewells, soak pits were evident.

Green use of material: green use of the material to encourage the reuse of scarified bitumen is evident. EPC 03 has attempted to reuse 28% of the bituminous waste, EPC 08, EPC 09 & PEC 10 have reused the bituminous waste 100%. Earthwork is reported to be reused more than 90% in the roads EPC 03, EPC 07, EPC 08 & EPC 10 for pavement of interior roads, approach road, temple pathway and graveyard. During the site visit, we saw PPP 02 used thorny bushes as natural fencing. EPC 02 and PPP 02 had used solar lights provided in the streets.

Water management: water facilities such as new taps provided ranged from a minimum of 23 nos in EPC 10 to a maximum of 164 in EPC 06. Further overhead tank ranges from 1 in EPC 04 to 17 in EPC 03. Additionally, to prevent water pollution, TNRSP has ensured all ancillaries have applied for consent under the Water (Prevention and Control of Pollution) Act and comply with the consent requirement. During the site visit, we observed that culverts and bridges are provided to avoid alteration in cross drainage flow, provision of rainwater harvesting pit at the mouth of the culvert, and excess water directed to the nearby pond through culvert. Pond siltation and protection were also evident.

Road safety management: This is considered an essential factor during the construction and operational phase, and design inputs are evident in DPR. Requirement of warning / cautionary signage at various chainage is noted as per the closure report available metal beam crash barrier installed max length of 11,225 m in EPC 10, number of signboards ranges from 416 in EPC 05 to 2527 in EPC 02, rumble strip provided at 130 locations in EPC 01, pedestrian crossing provided at 24 locations in EPC 07 to 88 locations in EPC 01. As per the accident data analysis, there was a reduction in non-fatal and Fatal accidents at SH 86 after the road establishment. On the other hand, in SH 04, both Fatal and non-fatal accident rates increased after the road establishment and reason cited by officials is negligence of driver while riding on improved road surface.

Noise Mitigation: Construction of compound walls and acoustic enclosed diesel generator were seen as significant noise mitigative measures. It is evidenced from closure report the number of compound walls constructed were EPC 01- 22, EPC 03-6, EPC 5-9, EPC 6-19, EPC 7-08.

Soil & barrow management: EPC 05 and 07 have not mined borrow earth, EPC 08, 09 & 10 used third party overburden quarry, and EPC 06 rehabilitated 06 sites out of 09 mines. Most of the projects are signed with a third-party quarry that has Environmental Clearance.

Waste management: The observed type of waste are scarified bitumen, Excavated earth, earth cutting, demolition waste, and organic waste generated in labour camps. Most of the projects reused bitumen waste 100 percent in the pavement of crossroads, parking lots, graveyards. EPC 03 generated 16440 cum of bituminous waste out of which 4698 cum is reused and out of 108985 earth cutting soil, 100125 reused in bypass and 8860 unsuitable soil disposed at Arumbakkam borrow area.

Air Emission & Dust Control: Air pollution and fugitive dust emission are majorly seen during the construction phase. The sprinkling of water controlled dust emission. EPC 04 used 12000 lts/Trip and 3-4 trips per day, EPC 08 - 8 loads, 2000 litres per load so 16,000 lts/day. evidenced from pictures that materials are likely to rise dust-covered with tarpaulin during transportation.

Occupational Health and Safety Management: as most of the projects have closed we could during the field visit of EPC 14 site observe that the construction camp is well built and maintained with potable drinking water and sanitation facility, first aid box, marking of safe assembly point, and display of emergency contact number. EPC 15 labour camp and site office was under construction. PPP 02 project prioritized demonstrated the safety practices followed through safety manual, conducting frequent safety audits, identifying hazards in the workplace and risk assessment, and maintaining a monthly safety checklist such as electrical safety and flammable storage area. Further to enhance road safety, accident data were analyzed, and critical accident zones were identified to provide appropriate warning signs.

Competence, Awareness and Training: Various training conducted across project sites includes AIDS awareness camp, Medical camp, OHS, first aid camp, Firefighting awareness. As there is no evidence of training completed in most project closure reports, it is suggested that the project closure report contains information related to training conducted.

Environmental Monitoring: The monitoring frequency planned for some projects varied and was carried out through a NABL approved Laboratory.

Resource Allocation: TNRSP allocated a budget for environmental improvement of all the projects following the commitments made in the EMP. It ranged from INR14,015,000 in EPC03 to 74,140,091 in EPC 10

Grievances: To address the environmental grievance, a committee was formed with various stakeholders, and they conduct meetings once in a month along with maintenance of minutes of the meeting as informed by EPC 10 TNRSP officials. In the EPC 02 end stretch at

Villupuram, a concern was raised about dumping waste on the roadside. TNRSP has written to municipal authorities to take action on the same.

Communication: The system of communication was well established and was systematically planned through monthly and quarterly reviews.

Emergency Preparedness and Response: This involves identifying emergencies on-site and preparing an emergency plan and response manual. It is evidenced that PPP02 placed Emergencies on sites such as Electrical shock, fire in flammable storage, etc., and developed an emergency manual, further in toll plaza, primary health centre provided along with ambulance in case of any road accidents. During the site visit, we saw in EPC14 emergencies that can arise and marked safe assembly point, emergency contact number on site is displayed.

Performance Monitoring: TNRSP has included a safety audit at the DPR stage and at the closure of the project. The safety audit at the DPR stage was said to be conducted and the safety audit report was available for EPC 01, EPC 02, EPC 05, EPC 07 EPC 10 and PPP 02.
As per the information available, an Environmental audit was conducted for EPC 01, EPC 02 and PPP 02 and safety audit was conducted for EPC 01, EPC 02, EPC 05, EPC 07 EPC 10 and PPP 02, letter stating road safety audit was conducted for EPC 08 was also shared. These audits have brought a great visibility of ground execution on environmental and safety safeguards and the compliance aspects,. It is suggested to consider doing these audits for all projects in the future.

Observation on EIA studies:

The EIA Study should be project-specific and site-specific for achieving the intended objectives of the EIA process. Sometimes, its observed to be carried out generically. For instance, in the EIA Report 2014 (page 1.2) of EPC 01, it was stated that the project attracts the provisions of the Environment (Protection) Act, 1996. This is a very generic recommendation. It will be helpful if the report explicitly states acts and notification with sections, norms, code of practice applicable, and compliance to be planned. In future projects, the consulting organizations assigned shall be insisted on doing the environmental due diligence with clear-cut recommendations on the applicability for the project under consideration. The following may be insisted to cover in the EIA:

- What are the appropriate clearances, consents, or NOC for the project duly quoting the specific sections of the act/notifications/circular
- What are the mandatory monitoring requirements/post-project submissions?
- What are the national/state/local regulations/restrictions applicable to the project understudy

The above information is to be stated separately for the ROAD project and other associated projects such as stone crusher/ hot mix plant/ quarry mines etc.
There is some inconsistency in the EIA Report 2014. For example, on page 1.3 it was stated that - "as per the condition described, the proposed road is categorized as B and does not require environmental clearance". When it was classified as a Category B project, it automatically attracted the EIA Notification 2006. In this case, it does not fall into the category B project and hence does not require environmental clearance.

Similarly, the report states that the project attracts the "Public Liability Insurance Act 1991" provisions. But the road project or associated projects does not attract the requirements of the said act.

The report does not mention the applicability of certain specific notifications such as Fly Ash Utilization Notification under the provisions of the E(P) Act, 1996.

Observations on Environmental and Safety audits conducted:
The safety audit is said to be practice to be done at the start of the project to ascertain the safety controls required to be incorporated in the DPR and also the same is conducted at the end of the project. The agencies who conducted the safety audits followed different templates. Some of the safety reports received is given in the annexure. In case of safety audit reports pertaining to EPC 01 and EPC 02, it was seen to verify the implementation of the committed facilities in the DPR. EPC 05 report covers few the photos of the signages and safety safe guards provided at some locations where some improvement is needed. but, the scope and methodology is not clear.

As a part of the continual improvement process, it is recommended for defining the objective, scope and template for conducting the safety audit. The template could be focused for covering the information that needs to be covered at the beginning of the project (design stage) and at the end of the project (completion stage). The initial safety report to cover the design aspects too and to capture the root cause analysis of the past accidents and mitigation recommended. The criteria for the auditors who would be engaged for conducting the safety audit may also be defined,

Suggestions:

Considering the frequent changes in the regulations, it is suggested to carry out environmental due diligence for legal compliance at the project formulation stage and at the starting of the project. Orientation program on legal compliance may be considered to all the concerned officials at the project planning stage. Considering the number of accidents, further studies may be considered in future projects focusing on engineering aspects and how to address the behavioural aspects of the road users; and further integrate Traffic Division of Police Department, an essential stakeholder for ensuring the road safety aspects from the planning stage onwards.

Potential improvements in Noise Mitigation: Since the effectiveness of the provision of compound walls is not captured, monitoring noise levels before and after the establishment of compound walls for further ongoing projects is recommended.

Potential improvements in waste management: Litter bins were planned in the EIA / EMP; however, bus bays didn't have such a provision for waste collection.

Potential improvements in Road safety management: Investigation of Road fatal and non-fatal accidents is suggested to understand the inputs that should be taken in future projects right at the design stage.

Potential improvement in Environmental monitoring: Monitoring frequency scheduled for each project has been different, the data of monitoring was not easily verifiable as the compliance to the plan is reported by few roads in the monthly or quarterly progress reports.

Grievances handling: It is suggested that environmental grievances are also recorded like social, and grievance officers may attend towards resolving the grievances.

TNPCB official associated with the project, when interviewed for perception and feedback, suggested that the Highways department may plan for an environmental cell to enrich the environmental safeguards understanding in the project.

Environmental and safety audits: It is recommended to be conducted in all road projects at the beginning and at end of the project in a template predefined by TNRSP covering the scope, objective and details as needed at the stage of the project phase.

Sustainability: Potential exists to review the future projects from a Sustainability angle, where opportunities for the use of green material, review the project from ESG framework and connectivity to Sustainable development goals and review the project from a life cycle perspective.

Annexure 1- Artefacts Collected

Package	Code	EIA	EMP	DPR	Project closure report	K Schedule
EPC-1	SH -116	Present	Present	Present	Present	Present
	SH-58	Present	Present	Present	Present	Present
EPC-2	SH-04	Present	Present		Present	
EPC-3	SH-09	Present	Present	Present	Present	Present
	SH-137	-	-	Present		
EPC-4	SH-70	Present	Present	Present	On-going Project	On-going Project Not Available
EPC-5	SH-86	Present	Present	Present	Present	Not available
EPC-6	SH-79	Present	Present	Present	Present	Not available
EPC-7	SH-95	Present	Present	Present	Present	
EPC-8	SH-89	Present	Present	Present	Present	Present
EPC-9	SH-44	Present	Present	Present	Present	Not Available
EPC-10	SH-41	Present	Present	Present	Present	Present
PPP-1	SH-15	Present	Present	Present	On-going Project	Present
PPP-2	SH-37	Present	Present	Present		Present
PPP-3	SH-39	EIA not applicable	Present	Present	On-going Project	On-going Project Not Available

Annexure 2- Compilation of Compliance Across Ancillaries

Statutary Clearance	EPC-1		EPC-2	EPC-3		EPC-4	EPC-5
	SH-116	SH-58	SH-04	SH-09	SH-137	SH-70	SH-86
Environmental Clearance	No	No	No	No		No	No
Public Hearing	No	No		No		No	No
Air & water consent for the Road	Yes	Yes	Yes	No		No	No
Forest Clearance	No	Yes -forest clearance is required for SH 58 at Thirukaukundram bypass.	Not Applicable	No			No
CRZ				No		No	No
Archeological				No		No	No
Air & water consent for the ancillaries	Quarry operation (for new quarry), Consent to Establish for HMP, WMM, RMC, CRUSHER, QUARRY, Consent to operate HMP, wmm, RMC, Crusher, Quarry	Quarry operation (for new quarry), Consent to Establish for HMP, WMM, RMC, CRUSHER, QUARRY, Consent to operate HMP, wmm, RMC, Crusher, Quarry	Explosive License from Chief Controller of Explosives,	Consent to Establish' and 'Consent to Operate' for construction camps and associated facilities (HMP, WMM Plant, crushers, Concrete Batching Plant etc.).		Consent to Establish' and 'Consent to Operate' for construction camps and associated facilities (HMP, WMM Plant, crushers, Concrete Batching Plant etc.).	Consent to Establish' and 'Consent to Operate' for construction camps and associated facilities (HMP, WMM Plant, crushers, Concrete Batching Plant etc.).
Environmental Clearance under EIA Notification 2006 as amended for Quarry	SEIAA-TN/F.No.2385/EC/1(a)/1223/2014, 23.04.2014		Not Applicable	SEIAA-I N / F.No.824/2073 / Ec / 7\a)/ 160, 27.03.2013			SEIAA-TN/F.No.4345/SEAC Meeting/2015 dated 16.10.2015
Environmental Clearance under EIA notification 2006 as amended for Borrow Area	SEIAA-TN/F.No.2385/EC/1(a)/1223/2014, 23.04.2014		KNRCL/CSC/EPC02/2016/08/211 dated 18.08.2016	SEIAA TN/F.No.3515/Ecl1(a)/26a7 /2017 , 05.07.2011			The contractor purchased soil from private agency
Forest clearance		F.No.4/TNB023/2018/C HN-1130, dated 18.07.2018	Not Applicable	Not Applicable			Not Applicable
Consent to Establish under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Hot Mix Plant	DEE/TNPCB/MMN/F2400/RS/W/2014, dated 02.12.2014 DEE/TNPCB/MMN/F2400/RS/W/2014, dated 02.12.2014 - Environmental audit report conducted at end of the project mentioned the hot mix plant was taken from third party who had consent to operate as mentioned in HMP CTO below			Not Applicable			Consent Order NO: 150122036386 dated 21.09.2015 under the Air Act 1981; Consent Order No:150122036386 dated 21.09.2015 under the water Act, 1974 :
Consent to Establish under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for WMM Plant	F.0262MMN/GS/DEE/TNPCB/MMN/A/2016, dated 04.03.2016 - Closure report gives this ref however the acivity is carried by party specified in CTO		Audit report conducted at end of the project mentions the RMC of third party being used - M/s JSR Infra developers and they have valid CFE dated F0238/VPM/OS/DEE/TNPCB/VPM/A/ 2016 dated 2.04.2016 & F0238/VPM/OS/DEE/TNPCB/VPM/W/ 2016 dated 2.04.2016				Consent Order NO: 150122036386 dated 21.09.2015 under the Air Act 1981; Consent Order No:150122036386 dated 21.09.2015 under the water Act, 1974 :
Consent to Establish under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Raw Mix Concrete RMC Plant	F.0510MMN/GS/DEE/TNPCB/MMN/A/2016, 04.03.2016 - Closure report gives this ref however the acivity is carried by party specified in CTO			F.O329CUD/GS/DEE/TNPcB/CUD/W2016, dated 72.O2.20L6			Consent Order NO: 150812034574 dated 14.09.2015 under the Air Act 1981; Consent Order NO: 150812034574 dated 14.09.2015 under the Water Act 1974
Consent to Establish under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Crusher	F.TVM0721/W/2014, date 25.08.2014			Not Applicable			Consent Order NO: 150812034574 dated 14.09.2015 under the water Act, 1974: Consent Order No:150812034574 dated 14.09.2015 under the Air Act, 1974

Statutary Clearance	EPC-1		EPC-2	EPC-3		EPC-4	EPC-5
	SH-116	SH-58	SH-04	SH-09	SH-137	SH-70	SH-86
Consent to operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Hot mix plant (HMP)	F.0441MMN/RS/DEE/TNPCB/MMN/A/ 2016, 05.03.2016		Closure report mentioned - KNRCL/CSC/EPC02/2015/09/20 dated 16.09.2015 However the Audit report conducted at end of the project mentions the HMP of third party being used - M/s JSR Infra developers and they have valid CFE dated F 0235/VPM/RS/DEE/TNPCB/VPM/A/ 2015 & F0235/VPM/RS/DEE/TNPCB/VPM/W/ 2015 7.9.2015, and 17.4.2017	F.O533CUD/OS /DEE/TNP CB/cuD/A/2017, dated 27.04.2071			Consent Order No:170819368924 dated 02.06.2017 under the water act , 1974 valid upto 31.03.2019: Consent Order No:170819368924 dated 02.06.2017 under the Air act , 1981
Consent to operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Wet Mix Mechadem (WMM)	were third party having CTO - SRC Projects Pvt. Ltd. Water Consent - F.0029TVM/OS/DEE/TNCB/TVM/W/2016 date 19.05.2017 Air consent - No. F.0029 TVM/GS/TEE/TNCB/TVM/A/2017 date 19.05.2017	were third party having CTO - M/s GKC Vaibhav JV Water Consent - F.0262MMN/GS/DEE/TNPCB/MMN/w/ 2016, dated 04.03.2015 Air Consent - F.0262MMN/GS/DEE/TNPCB/MMN/A/ 2016, dated 04.03.2016	KNRCL/CSC/EPC02/2015/09/20 dated 16.09.2015 However the Audit report conducted at end of the project mentions the WMM of third party being used - M/s JSR Infra developers and they have valid CF0 dated F0029/TVM/GS/DEE/TNPCB/TVM/A/ 2015 dated 29.04.2015 & F0029/TVM/GS/DEE/TNPCB/TVM/A/ 2015 dated 29.04.2015	F.O394CUD/GS /DEE/TNP CB/C0D/A/2O07, dated 29.05.2077			Consent Order No:170819368924 dated 02.06.2017 under the water act , 1974 valid upto 31.03.2019: Consent Order No:170819368924 dated 02.06.2017 under the Air act , 1981"
Consent to operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Raw Mix Concrete (RMC)	M/s JSR Infra Developers Pvt. Ltd. No . F 0267 TVM/GS/DEE/TNCB/TVM/A/2016 date 22.04.2016 Water act - No. 0260 TVM/GS/TEE/TNCB/TVM/W/2016 date 22.04.2016	M/s JSR Infra Developers Pvt. Ltd. Air consent - F.0510MMN/GS/DEE/TNPCB/MMN/A/2016 , 04.03.2016 Water consent F.0510MMN/GS/DEE/TNPCB/MMN/W/2016, 04.03.2016	Closure report mentioned KNRCL/CSC/EPC02/2015/09/20 dated 16.09.2015, However the Audit report conducted at end of the project mentions the RMC of third party being used - M/s JSR Infra developers and they have valid CFE dated F 0236/VPM/GS/DEE/TNPCB/VPM/A/ 2016 dated 27.03.2016 & F 0236/VPM/GS/DEE/TNPCB/VPM/W/ 2016 dated 27.03.2016 & they obtained valid CFO on 27.3.2016	F,O329CUD/GS /DEE/TNP CB/CUo/A/2016, dated 06.10.2016			Consent Order No:160815047157 dated 01.04.2016 under the water act , 1974 ; Consent Order No:160815047157dated 01.04.2016 under the Air act , 1981
Consent to operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended- Crusher	Project closure report mentions - F.0312TVM/RS/DEE/TNPCB/TVM/W/ 2016, dated 13.05.2016 However Environemntal audit report mentions Srinivasa Blue Metal Air consent - F 0202 MMN/RS/DEE/TNPCB/MMN/A/2016 4.3.2016 Water consent - F 0202 MMN/RS/DEE/TNPCB/MMN/W/2016 4.3.2016	Project closure report mentions - F.0312TVM/RS/DEE/TNPCB/TVM/W/ 2016, dated 13.05.2016 However Environemntal audit report mentions Srinivasa Blue Metal Air consent - F 0202 MMN/RS/DEE/TNPCB/MMN/A/2016 4.3.2016 Water consent - F 0202 MMN/RS/DEE/TNPCB/MMN/W/2016 4.3.2016	Consent Order No. 1501219518 40 dated 07.09.2015 - No New Stone Crusher is nominated existing stone crusher M/S JSR Infra developes Pvt. Ltd. is finalised by contractor with renewed consent as per audit report as he went in to maintenance 4 new crusheres were identified who had valid consents.	F.0357/VPM/OS /DEE/TN PCBNPM/A/2O |7 dated 20.07.2017			Consent Order No:160826003176 dated 27.07.2016 under the water act , 1974 ; Consent Order No:160826003176 dated 27.07.2016 under the Air act , 1981
Consent to Operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Quarry	F.0202MMN/RS/DEE/TNPCB/MMN/A/ 2016, dated 04.03.2016		B/G&M/192/2009 dated 27.06.2019	F.049OVPM/RS/ DEE/TNP CB|VPM/W /2077 , dated 23.05.2017			Consent to Order No: 00179 dated 28.12.2015 under the Water Act,1974; Consent to order No: 00189 dated 28.12.2005 under the Air Act, 1981

Statutary clearance	EPC-6 SH-79	EPC-7 SH-95	EPC-8 SH-89	EPC-9 SH-44	EPC-10 SH-41	PPP-1 SH-15	PPP-2 SH-37	PPP-3 SH-39
Environmental Clearance	No	No	no	No	No			
Public Hearing	No	No	no	No	No			
Air & water consent for the Road	No	No	no	No	No			
Forest Clearance	No	No		No	No			
CRZ	No	No	No The project road does not fall under Coastal Regulation Zone (CRZ). In order to avoid the applicability of CRZ Notification, the end point of SH-89 has been considered up to Km 35.200 (intersection with SH-176, TTK Road), which is about 1km away from high tidal point of Sea.	No	No			
Archeological	No	No	No	No	No			
Air & water consent for the ancillaries	Consent to Establish' and 'Consent to Operate' for construction camps and associated facilities (HMP, WMM Plant, crushers, Concrete Batching Plant etc.).	Consent to Establish' and 'Consent to Operate' for construction camps and associated facilities (HMP, WMM Plant, crushers, Concrete Batching Plant etc.).	CTE For establishment of construction camp, construction plant, crusher, batching plant etc., CTO For operating construction plant, crusher, batching plant etc.		CTE For establishment of construction camp, construction plant, crusher, batching plant etc., CTO For operating construction plant, crusher, batching plant etc.			
Environmental Clearance under EIA Notification 2006 as amended for Quarry	SEIAA-TN/F.NO.1282/EC/(a)591/2013 Dated:18/07/2013	SEIAA-TN/F.No.5165/1(a)?EC.No:3204/2016 dated 06.07.2016	1) EC Nos. 2981-2016 dated 19-02-2016(Mine plan approval) 2) DC approval: R, C No. 81964- 23/08/2011 for SF NO 1115/1 and 1116/1 of kottaikarungulum,kumbikulum village, Radhapuram Taluk 3)E/HQ/TN22/375(E76143)					
Environmental Clearance under EIA notification 2006 as amended for Borrow Area	The Contractor purchased soil from private agency	The contractor purchased soil from private agency	SEIAA TNF No. 4804/1a EC nos. 2981-2016 dated 10-02-2016					
Forest clearance	Not Applicable	Not Applicable	Not applicable		Not Applicable			
Consent to Establish under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Hot Mix Plant	Consent Order NO: 1501122172472 dated 20.10.2015 under the Air Act 1981; Consent Order No:1501122172472 dated 20.10.2015 under the water Act, 1974 :	Consent Order NO: 1501121438807 dated 12.08.2015 under the Air Act 1981; Consent Order No: 1501111438807 dated 12.08.2015 under the water Act, 1974 :	Consent Order No: 1501112529974 dated 15-10-2015 under the Air Act 1981 Consent Order No: 1501112529974 dated 15-10-2015 under the Water Act 1974	1601243467 79 dated 12.02.2016 1601138774 29 dated 12.02.2016 (one more consent not visible)	Obtained CO No. 1501216881 46 dated 11.09.2015			
Consent to Establish under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for WMM Plant	Consent Order NO: 1501221724 72dated 20.10.2015 under the Air Act 1981; Consent Order No:1501121724 72 dated 20.10.2015 under the water Act, 1974 :	Consent Order NO: 1501214388 07 dated 12.08.2015 under the Air Act 1981; Consent Order NO: 1501214388 07 dated 12.08.2015 under the water Act, 1974 :	1501125368 87; Dated 15-10-2015 under the Air Act 1981 1501125368 87; Dated 15-10-2015 under the Water Act 1974	1601138774 29 dated 12.02.2016 1708186486 34 dated 5.04.2017 1601243467 79 dated 12.02.2016 1708286488 08 dated 5.04.2017	Obtained CO No 1501217766 79 dated 26.08.2015			
Consent to Establish under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Raw Mix Concrete RMC Plant	Consent Order No: 1501217096 66 dated 24.08.2015 under the Air Act 1981; Consent Order No: 1501217096 66 dated 24.08.2015 under the Water Act 1974; Consent Order No: 1501117096 66 dated 24.08.2015 under the Air Act 1981; Consent Order No: 1511117120 38 dated 24.08.2015 under the Water Act 1974;	"Consent Order NO: 1501214388 07 dated 12.08.2015 under the Air Act 1981; Consent Order NO: 1501214388 07 dated 12.08.2015 under the water Act, 1974 : "						

Statutary clearance	EPC-6	EPC-7	EPC-8	EPC-9	EPC-10	PPP-1	PPP-2	PPP-3
	SH-79	SH-95	SH-89	SH-44	SH-41	SH-15	SH-37	SH-39
Consent to Establish under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Crusher	Consent Order NO: 150122172472 dated 20.10.2015 under the water Act, 1974: Consent Order NO: 150122172472 dated 20.10.2015 under the Air Act, 1974	Consent Order NO: 0250 dated 23.04.2007 under the water Act, 1974: Consent Order NO: 0250 dated 23.04.2007 under the Air Act, 1974	Consent order No:268 and 269 dated 26.08.2013	CTO 1508115817 80 dated 24.08.2015				
Consent to Establish under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Quarry	Consent Order NO: 407W dated 27.12.2013 under the water Act, 1974: Consent Order NO: 407A dated 27.12.2013 under the Air Act, 1974	"Consent Order NO: 1608251985 93 dated 22.04.2016 under the Air Act 1981; Consent Order NO: 1608251985 93 dated 22.04.2016 under the water Act, 1974 valid up to 31.03.2018: "	EC Nos 2981-2016 Dated 19-02-2016	CTO 1508257771 3 dated 11.05.2015 CTO 3371720 dated 11.12.2015 CTO 1604155954 17 dated 24.06.2015	M/s Ashwath blue metals 1805216870 659 17.09.2018 Nachiyar Blue Metals TNCP 1708210585 810 dated 16-10-2017 KK Blue Metals 1708210125 938 dated 27.11.2017			
Consent to operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Hot mix plant (HMP)	Consent Order NO: 1708190343 52 dated 13.09.2017 under the water Act, 1974: Consent Order NO: 1708290343 52 dated 13.09.2017 under the Air Act, 1974	"Consent Order NO: 1608251985 93 dated 22.04.2016 under the Air Act 1981; Consent Order NO: 1608251985 93 dated 22.04.2016 under the water Act, 1974	1604157975 93 Dated 17-08-2016 under the Air Act 1981 1604157975 93 Dated 17-08-2016 under the Water Act 1974	1605163076 90 dated 21.10.2016 1708286486 97 dated 5.04.2017	1808213846 957 dated 30.05.2018			
Consent to operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Wet Mix Mechadem (WMM)	Consent Order NO: 1708190343 52 dated 13.09.2017 under the water Act, 1974: Consent Order NO: 1708290343 52 dated 13.09.2017 under the Air Act, 1981		1708192610 71 dated 11.07.2018 under the Air Act 1981 1708192610 71 dated 11.07.2018 under the Water Act 1974	1604157090 93 dated 27.06.2016 1708286486 34 dated 5.04.2017 1604151924 57 dated 27.06.2016 1708286488 08 dated 05.04.2017	Obtained CTO No 1608249063 35 dated 05.04.2016			
Consent to operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Raw Mix Concrete (RMC)	Consent Order NO: 1608250477 67 dated 17.04.2016 under the water Act, 1974: Consent Order NO: 1608250477 67 dated 17.04.2016 under the Air Act, 1981 Consent Order NO: 1608250479 13 dated 26.04.2016 under the water Act, 1974: Consent Order NO: 1608250479 13 dated 26.04.2016 under the Air Act, 1981	"Consent Order NO: 1608251985 93 dated 22.04.2016 under the Air Act 1981; Consent Order NO: 1608251985 93 dated 22.04.2016 under the water Act, 1974						
Consent to operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended- Crusher	Consent Order NO: 1708190343 52 dated 13.09.2017 under the water Act, 1974: Consent Order NO: 1708290343 52 dated 13.09.2017 under the Air Act, 1981	"Consent Order NO: 1608260883 70 dated 24.11.2016 under the Air Act 1981; Consent Order NO: 1608260883 70 dated 24.11.2016 under the water Act, 1974	1508115551 89 dated 20..08.2015 under the Air Act 1981 1508115551 89 dated 20..08.2015under the Water Act 1974	CTO 1508257771 3 dated 11.05.2015 CTO 3371720 dated 11.12.2015 CTO 1604155954 17 dated 24.06.2015				
Consent to Operate under Water (Prevention and Control of Pollution) Act, 1974 as amended, the Air (Prevention and Control of Pollution) Act, 1981 as amended for Quarry	Consent Order NO: 1708190343 51 dated 18.09.2017 under the water Act, 1974: Consent Order NO: 1708190343 51 dated 18.09.2017 under the Air Act, 1981	"Consent Order NO: 1608260883 70 dated 24.11.2016 under the Air Act 1981; Consent Order NO: 1608260883 70 dated 24.11.2016 under the water Act, 1974	EC Nos 2981-2016 Dated 19.02.2016	CTO 1508257771 3 dated 11.05.2015 CTO 3371720 dated 11.12.2015 CTO 1604155954 17 dated 24.06.2015	M/s Ashwath blue metals 1805216870 659 17.09.2018 Nachiyar Blue Metals TNCP 1708210585 810 dated 16-10-2017 KK Blue Metals 1708210125 938 dated 27.11.2017			

Annexure 3- Quarry and Borrow Area Rehabilitation

Road	Sl No	Type of Debris	Quantity Generated (cum)	Quantity Reused (cum)	Details of Approved Disposal Locations & Quantity Disposed (cum)
	1	Scarified Bitumen	16440	4698 1. Ch 52+150 RHS - Village Road- 225Cum 2. Ch 54+800 LHS- Vinayaga School Interior Roads - 135 Cum 3. Ch 54+800 LHS- Vinayaga School Vehicle Parking - 900 Cum 4. Thollamur Debris Pit 468 cum 5. Thollamur Access QUarry to Crusher Road-	M/s Vignesh Blue Metals, Thollumur, 11742 Cum, disposed at this location
	2	Excavated Earth	22289	22289 Cum- Back filling in culvers & retaining wall, Access Road Filling at Ch 49+600 RHS, Ch 62+183(BHS)	
	3	Earth Cutting	108985	100125 CUm reused in bypass	Arumbakkam Borrow Area, 8860 Cum unsuitable Soil disposed at this location
EPC 03	4	Demolition Wastes	208.97		
	1	Scarified Bitumen	19909	NIL	Disposed at approved disposal site at N pudupatti village about 19909 cum
	2	Excavated Earth			
	3	Earth Cutting	300699	175594 cum used for higheay work	Disposed at approved disposal site: 125105 cum
EPC 05	4	Demolition Wastes		Lump sum Quantity	Disposed at approved disposal site
	1	Scarified Bitumen	19867.1		
	2	Excavated Earth	253634.963	53435.025	
	3	Earth Cutting			
EPC 06	4	Demolition Wastes			
	1	Scarified Bitumen	8890 cum	NIL	Disposed at approved disposal site at pottanam village about
	2	Excavated Earth		50604 cum used for HIghwat work and 4956 cum top soil used for landscaping work	
	3	Earth Cutting	55560		There is nothing for disposal
EPC 07	4	Demolition Wastes		Lump sum quantity	Disposed at approved disposal site at pottanam village
	1	Scarified Bitumen Layer	7000	6750	Approved sites redeloped
	2	Dismantled Sub base/ base course layers (Earthwork)	270000	160000	Re-use at Project Road
	3	Builings	546	500	Approved sites
	4	Excavated Earth	160000	160000	Soil, Gravel during excavation were reused for filling
	5	Hill/Earth Cutting			
EPC 08	6	Others(Specify)			
	1	Scarified Bitumen Layer	9300	5800	Reused at approved locations NPC for dump sites enclosed in closire KM 23+500 LHS; Km 26+600 LHS, 54+100 LHS, 55+600 RHS
	2	Dismantled Sub base/ base course layers (Earthwork)	1167	120	Private Land Development
	3	Builings	124269	62134	
	4	Oil Drums	20		Shifted to alternate site
EPC 09	5	Iron Rods MT	6		Shifted to alternate site
	1	Scarified Bitumen Layer	50295	50295	Used at approac road, Temple, graveyard, vehicle parking yard, access road to cillages, houses, ramp for Plants. Requisition from land owners for re-used material recorded
	2	base course layers (Earthwork)			
	3	Builings	1280	1280	Landfill and levelliing at campsite
	4	Excavated Earth	51631	51631	
	5	Hill/Earth Cutting	54150	54150	
EPC 10	6	Top soil stored and reused			

Annexure 4- Quarry and Borrow Area Rehabilitation

Package Code	Location	Size if each borrow area	Quantuty of earth excavated (cum)	Borrow area Rehabiltation detail
EPC 01				
EPC 02				
EPC 03	Arumbakkam	400x200X0.90	72000	
	Semmedu	200x200x0.75	30000	
EPC 04				
EPC 05	65+400 RHS	NA	Nil	The borrow area identified and approved was not used and so no rehabilitation work carried out
	19500 RHS	Approved	5106	
	68200 RHS	NA		
	34200 RHS	Approved	10764	
	11050 LHS	Approved		
	59050 RHS	Approved	12000	
	59050 RHS	NA		
	0000 LHS	NA		
	54750 LHS	Approved		
EPC 06	55890 LHS	Approved		
EPC 07	8 + 690 RHS - 4 Km from MCV	NA	NIL	The Borrow area identified and approved was not used and so on rehabilitation work is carried out
EPC 08	BMC Gravel Approved L SEIAA TNF No.4801/1a	EC Nos.2981-2016 Dated 19-02-2016	81,189 Cum	Third party overburden quarry used, redevelopment is quarries EMP not contractor rehabilitation. EMP is implemented by Quarry Owner as per Mine Plan approval
	11 Ponds, identified as BA submitted to DC by SMC	Survey No and Area provided by letter No,.010; Dated 27-08-2015	Permissions not granted by DC. PIU has permitted use of overburden quarry(BMC)	Not approved by the DC office. A minor minerals clause caused the delay
	BA 02: Kasavankundru at km 44+120 RHS, CSC approval 167-23-12-2015 (7km). Gravel only		30000 Cu.m	Third party EC valid quarry. Procurement of material is by MOU. QUality approved by CSC Letter No.167
	BA-040Moorthynaickanpettai; at km 22+520 LHS: CSC approval ltr No. 166/23-12-2015 (10km). Gravel Only		50000 CU.m	Third party EC valid quarry. Procurement of material is by MOU. QUality approved by CSC Letter No.166
	BA 07 Chettikurichi KM 38+750 RHS; CSC approval by letter NO. 845-22-09-2016(26km) Gravel Only		50000 Cu.m	Third party EC valid quarry. Procurement of material is by MOU. QUality approved by CSC Letter No.845
EPC 09	46+720 RHS; CSC approval by letter No.1474-22-4-2017	< 5 Hectare	30000 Cu.m	Third party EC valid quarry. Procurement of material is by MOU. QUality approved by CSC Letter No.1474
	M/s K.K Blue Metal at km 57+650	<5 Hectare	7533 Cum	Third party EC Valid Borrow areas; THe refevelopment clause is applicable to Owner of the quarry and license. MOU procurement closure for third party EC valid Quarry is submitted by letter No. SPK-KMS/EPC-10/LASA/2018/408; Dated 20-12-2018 for EPC 10
	M/s M.P.R Blue Metal at 65+650 at kanarpatti Village	<5 Hectare	28294 Cum	
EPC 10	M/s Muttu Blue Metals(Sakunthala Quarry)	SEIAA-TN/F No.5154/1(a) EC No.3358/2016 S.F	88151 Cum	

Quarries Rehabilitation

Package code	Location	Size of each quarry	Quantuty of earth excavated (cum)	Quarry area Rehabiltation detail
EPC 01				
EPC 02				
EPC 03	outsourced			Purchased from third party
EPC 04				
EPC 05	located at M Pudupatti village Namakkal	3 Acres	NIL	Since Production of Quarry is going on, no Re-habitation work is carried out
EPC 06	Located at Akkalamapatti Village Tiruchengode, Namakkal	14.68 Acres	NIL The Contractor	Since Production of Quarry is going on, no Re-habitation work is carried out
EPC 07	250 KM away from 13 + 385 located at Pottanam village, Senthamangalam, Namakkal	30 Acres	The Contractor purchased Soil from Private agency	Since Production of Quarry is going on, no Re-habitation work is carried out
EPC 08	BMC; 1047, 1115/1, 1116/1	4.7 Ha	MOU for borrowing established from BMC, EC Valid quarry	Third party quarry, rehabilitation is quarry owners EMP
EPC 09	Gomathi Quarry	< 5 Ha.	267170 cum	EC valid third party quarries. CSC has approved material source by QME and Lab
	Ashwath Quarry	< 5 Ha.		
	KVT Quarry	< 5 Ha.		
	Vishnu Suriya	< 5 Ha.		
EPC 10	M/s. Dhanalakshmi Blue MEtals at Km 17+000; Lead 22.00km to campsite	<5 Hectare	26854	MOU for procurement of aggregates for construction period established and closed. The redevelopment clause is applicable only to EC holder under third party clauses. MOU procurement closure for third party EC valid quarry is submitted by letter No. SPK-KMC/EPC-10/LASA/2018/408; Dated 20-12-2018 for EPC 10
	17+000 Lead is 22.00 Km to campsite	<5 Hectare	23635	
	17+000 lead is 22.00 Km to campsite	<5 Hectare	24172	
	M/S Ashwath Blue Metals at Km 58+600, Lead is 11KM	<5 Hectare	24420	
	M/s K.K Blue Metals at Km 57+650	Hectare	26284	
	M/s. Nachiyar Blue Metal at Km 75+600; Lead is 3 km	<5 Hectare	28376	
	M/s Venkateshwara Blue Metals at Km 78+000 ; Lead is 48 km	<5 Hectare	304965	
	crusher at km 75+000 Lead is 33Km	<5 Hectare	278677	
	M/s Rajkumar Blue Metal at Km 37+000; Lead is 14km	<5 Hectare	43886	

Annexure V - TNRSP road project
End term environmental evaluation report
photo information of EMP

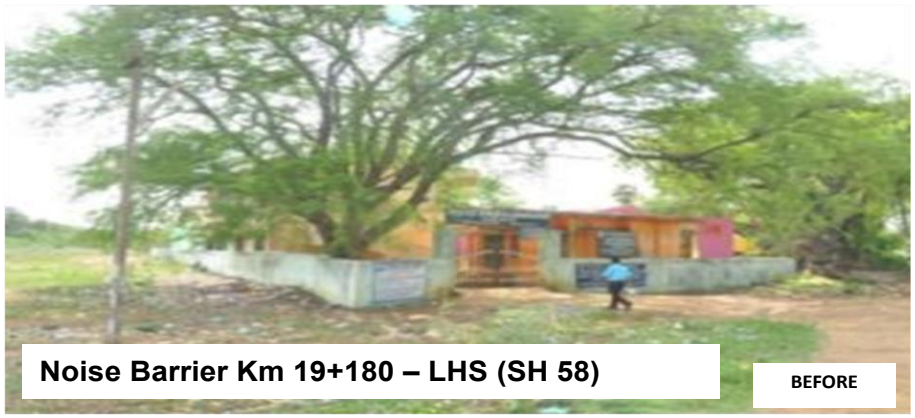
EPC 01: Upgrading Kanchipuram - Vandavasi Road (SH 116) km 14/300 - km 36/700 and Upgrading Sadras – Chengalpattu - Kanchipuram - Arakkonam - Thiruthani Road (SH 58) Km 0/000 to Km 26/811

Bus Shelter (EPC 01)

Hazard Marker on the Completed Road (EPC 01)

Plantation Along the Completed Road (EPC 01)

EPC 01



Noise Barrier Km 19+180 – LHS (SH 58)

BEFORE

BEFORE DESILTING

Km 2+700 De-silting of Pond SH 58

AFTER

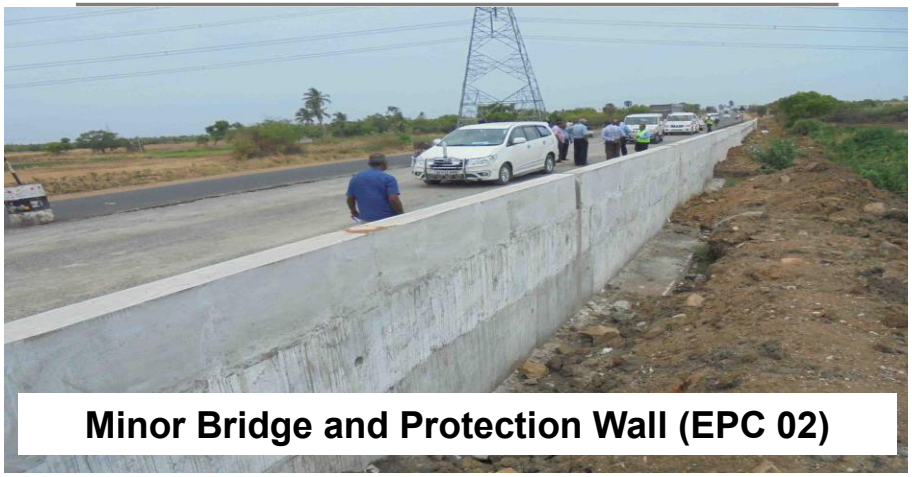
AFTER DESILTING

EPC 02

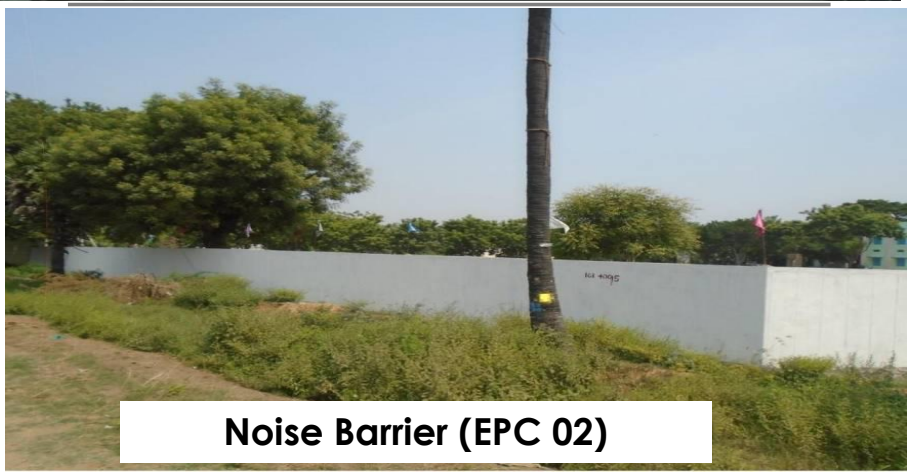
EPC 02: Up-grading of Arcot - Villupuram Road (SH-04) Km 29+000 to Km 110+165 and Km 113+325 to Km 114+600

Retaining Wall along the Road

Road Marking (EPC 02)



Minor Bridge and Protection Wall (EPC 02)



Noise Barrier (EPC 02)

EPC 05: Upgrading of Tiruchengode to Paramathy Road (SH 86) Km 54/800 to 81/000, Contract:TNRSP-II/EPC-05,

Road Marking, Railing and Bus Shelter

Roadside Plantation

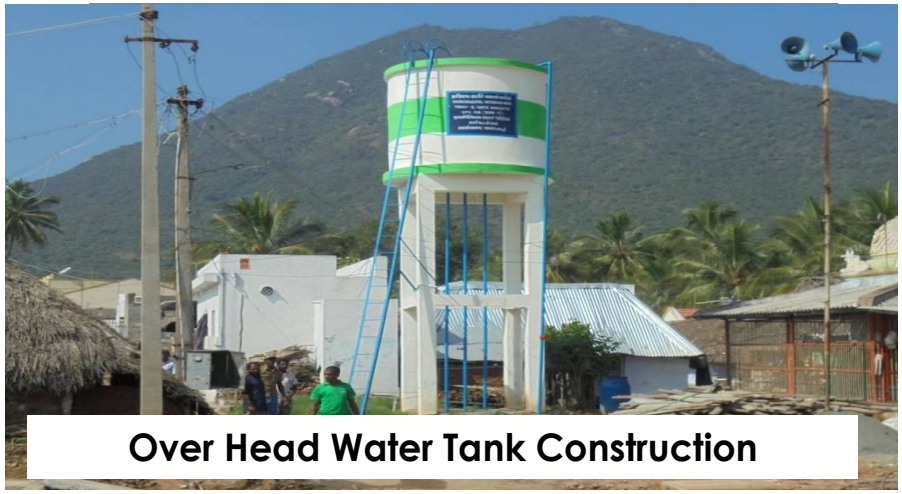
Roadside Open Lined Drain

Overhead Water Tank Constructed

EPC 06: Up-grading of Malliyakarai – Rasipuram – Trichengode Road (SH-79), (Km 0/00 to Km 30/600 & Km 51/400 to Km 71/300)

Roadside rain

Rainwater Recharging Structure



Over Head Water Tank Construction

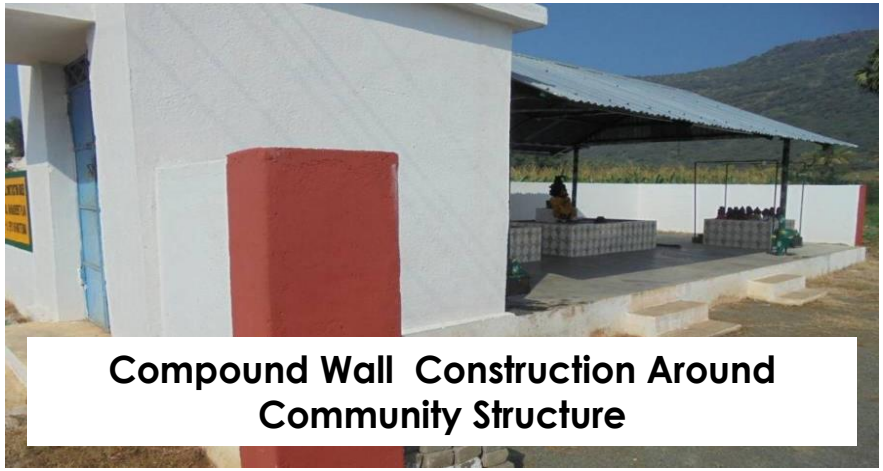
Slope Protection and Tree Saving

EPC 06

Culvert Protection Under Construction

Bus Shelter and Road Marking

Compound Wall Construction Around Community Structure



Compound Wall Construction Around Community Structure

EPC 09: Up-grading of Paruvakudi – Kovilpatti – Ettayapuram- Vilathikulam-Vembar Road (SH-44) Km 22/500 to Km 38/750 to Km 41.300 to Km 56.700

Road Marking and Zebra Crossing

Plantation along the Road

Bus Shelter

Plantation along the Road

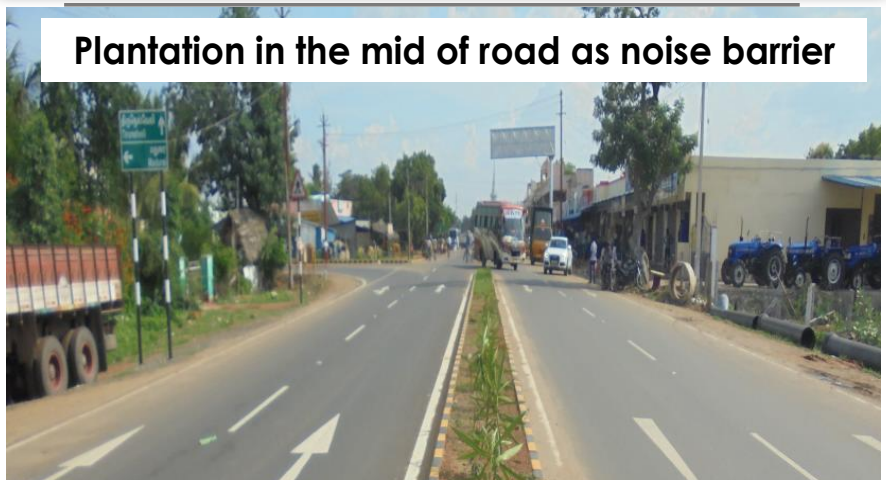
EPC 10: Up-grading of Rajapalayam – Sankarankoil- Tirunelveli Road (SH-41) Km 1/800 to Km 28/800 and Km 33.800 to Km 82.800

Work Zone Safety Along Road

Pond protection for public use

Project Information Board at the Starting Point

Plantation in the mid of road as noise barrier



EPC 08

EPC-08: Upgrading Nanguneri Bharatavaram Ovari Road (SH-89) upto ECR junction Km.0/000 to Km. 35/200

Road Marking and Road Safety Signage

Blinkers effectiveness in night

Grass Turffing for Slope Stabilization

Junction Improvement and Road Marking

Construction Camps and Plants Management

Plantation at Camp Site

Construction Camp

House Keeping Hot Mix Plant

DG Set with Proper Stack Height and Earth Pit

Construction Camps and Plants Management

Camp Site Safety display

Safety Guard

Safety Measures

Emergency information display

Construction Camps and Plants Management

Accommodation facilities

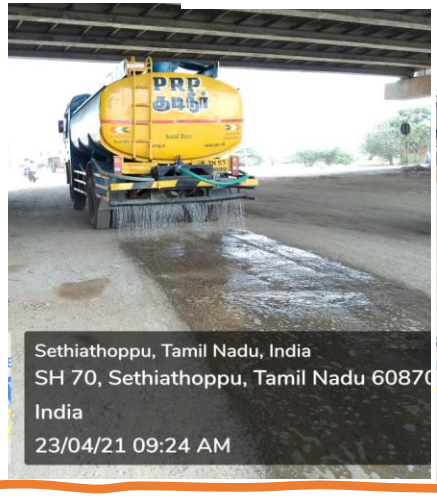
Cooking facilities

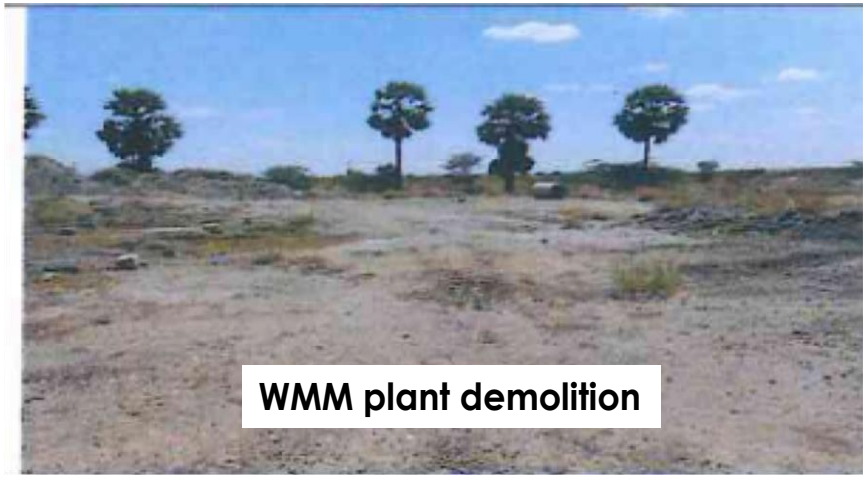
RO Plant for drinking water

Septic tank

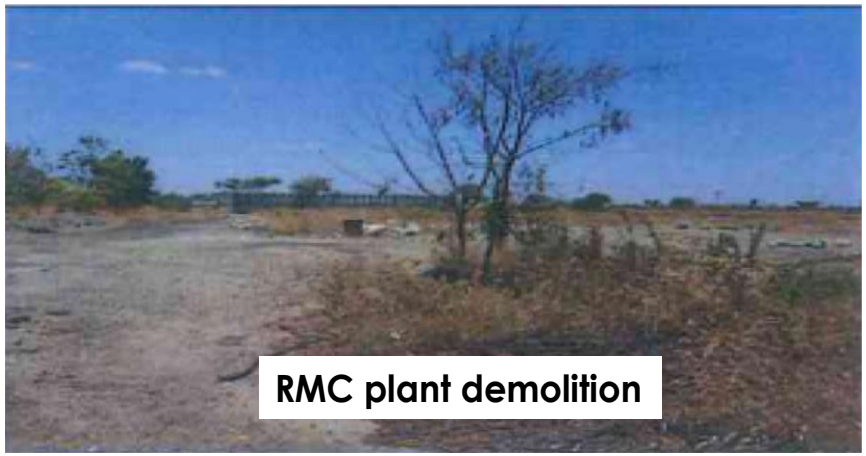
Dust Suppression and demolition of site

Dust suppression measure





WMM plant demolition



RMC plant demolition

Monitoring Activities

Ambient Air Quality Monitoring

Ground Water Sampling

Noise Level Monitoring

Soil Monitoring