"ENVIRONMENTAL IMPACT ASSESSMENT OF STRENGTHENING, CHENNAI PERIPHERAL RING ROAD SECTION V FROM SINGAPERUMAL KOIL AT NH 45 TO MAMALLAPURAM"

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ABSTRACT:

Highway network is one of the important components of transportation system at the national, state and local levels. In order to increase the efficiency of the transportation system, construction of new roads and improvements to existing roads are being undertaken in urban and rural areas. Construction of highways is often coupled with environmental deterioration. It is not only important but essential at planning stage itself to consider environmental impact of the proposed highway works. In the case of major works on existing highway, the impact of these works on the surroundings should be studied and attempts should be made to enhance the environmental quality through improvements. The environmental impact assessment (EIA) is a procedure for bringing out the potential effects of human activities on environmental systems. The EIA has become an integral part of the highway planning and design in many advanced countries. The case for introducing such tool in this country is even stronger, as many new highway projects are being planned and/or implemented at state and central Government levels for the rapid development in the country. It is necessary to ensure that these new/improved highways are not only safer and more efficient but also environmentally acceptable. Highways play a vital role in overall development of the country. Development of highways is generally intended to improve the economic and social welfare of the people. At the same time, it may also create an adverse impact

on the surrounding environment. People and properties in the direct path of road works are affected. The environmental impacts of highway projects include damage to sensitive eco-systems, air and noise pollution, soil erosion, changes to drainage pattern and thereby ground water, interference with wild life movement, loss of productive agricultural lands and resettlement of people. In this present study, the Assessment of Environmental Impacts of strengthening and Chennai Peripheral Ring Road Section V From Singaperumal Koil At Nh 45 To Mamallapuram is being done. For the study, the data about the present air and land environment is collected and studied for the purpose of finding out the possible impacts of the project during the construction and functioning of the Road.

1. INTRODUCTION:

Development of highway projects is generally intended to improve the economic and social welfare of the people. At the same time, it may also create some adverse impact on the surrounding environment. People and properties may be in the direct path of road works are affected. The environmental impact of highway projects include damage to sensitive ecosystems, soil erosion, changes to drainage pattern and thereby ground water, interference with wild life movement, loss of productive Agricultural lands, resettlement of people, disruption of local economic activities, demographic changes and accelerated urbanization. Highway development and operation should, therefore, be planned with careful consideration of the environmental impact. To minimize these adverse effects that may be created by the highway development projects, the techniques of Environmental Impact Assessment (EIA) become necessary.

An environmental impact assessment (EIA) is an assessment of the possible impacts that a proposed project may have on the environment, consisting of the environmental, social and economic aspects. In the case of road projects, World Bank defines EIA as “a rigorous study that involves a thorough documentation of existing conditions, an identification of impacts, and a comparative examination of impacts arising from the road project alternatives”.

Environmental assessment for project roads includes establishing environmental baseline in the study area, conducting organized stakeholder consultation, identify the range of environmental impacts, specify the measures to avoid, minimize, and mitigate negative impacts and maximize positive impacts and integrate possible environmental enhancement measures. The proposed measures will be formulated as environmental management plan with necessary budget and roles for effective implementation. Separate EMPs must be prepared for individual project roads and integrated into project implementation agreements, including construction contract documents.

2. OBJECTIVE OF THE RESEARCH:

2.1 SCOPE OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The objective of the Environmental Assessment is the characterization of the existing status of the environment, to identify the probable adverse and positive impacts on the environment and the community due to the planned project and to delineate various measures to mitigate the adverse impacts and finally to assess the acceptability of overall residual impacts. The EA provides tools for decision-making as well as it also helps in ensuring the sustainable development with the least environmental damage by providing an agreed Environmental Management Plan. To achieve these objectives,

- Characterization of the existing status of the Environment.
- Identification of potential impact of the project as per The Indian Road Congress (IRC 1989).
- Detailed survey and study to minimize the negative impact.
- Selection of the best appropriate method.

The study envisages the preparation of a detailed Environmental Impact Assessment (EIA) for the proposed road project. The scope of environmental assessment includes processes such as

- Environmental screening and scoping,
- Environmental impact assessment and
- Environmental management plans (EMP) for construction and operation phases of the road project.

The EA study also aims to develop a comprehensive environmental management framework for the road project.

2.2 SCOPE OF ENVIRONMENTAL ASSESSMENT

The scope of the Environmental Assessment is the Terms of Reference (ToR) provided by TNRSP and past experience of the consultants on similar projects. The scope has been kept to meet the host country's statutory requirements and the World Bank safeguard policy requirements.

2.3 ENVIRONMENTAL SCREENING AND SCOPING

The environmental screening exercise of both the project roads was undertaken to facilitate inputs on environmental considerations, apart from social, economic, and traffic & transport considerations. Further, the screening helped in determining the major environmental issues and the scope of work for conducting environmental assessment. As per the recommendations of the

Environmental Screening report, detailed Environmental Assessment has been taken up. The scoping exercise defines geographical boundaries for the project road for impact assessment as well as defining each project influence area to assess the impacts due to project interventions during construction and operation phases.

2.4 ENVIRONMENTAL ASSESSMENT

The EA for the selected project road implementation includes establishing an environmental baseline in the study area, identify the range of environmental impacts, specify the measures to avoid, minimize, and mitigate negative impacts and maximize positive impacts and integrate possible environmental enhancement measures. The proposed measures will be formulated in the form of an environmental management plan (EMP) with necessary budget and institutional roles for its effective implementation. The EMP for project road will be included in project implementation agreements, including construction contract agreement. Basic approach & methodology for conducting an Environmental Assessment and the steps followed, source of secondary data, primary data generated during the EIA study, etc has been presented in the various chapters.

3. LOCATION OF THE PROJECT

Chennai, formerly known as Madras (the official name until 1996), is the capital city of the Indian state of Tamil Nadu. The state's largest city in area and population as well, Chennai is located on the Coromandel Coast of the Bay of Bengal, and is the most prominent cultural, economic and educational centre of South India. According to the 2011 Indian census, Chennai is the sixth-most populous city in the country and forms the fourth-most populous urban agglomeration. The Greater Chennai Corporation is the civic body responsible for the city; it is the oldest city corporation of India, established in 1688—the second oldest in the world after London. The city of Chennai is coterminous with Chennai District, which together with the adjoining suburbs constitutes the Chennai Metropolitan Area, the 36th-largest urban area in the world by population and one of the largest metropolitan economies of India.

Chennai City has got three circumferential roads viz., Inner Ring Road, Chennai Bypass and Outer Ring Road which connects the radial roads. As the city is developing beyond the limits of these circumferential roads, a new circumferential road is required.

The total CPRR project length is 132.871 km which is divided into 5 sections, Our project covers the EIA for section 5 which is as follows,

SECTION 5 starts at km 47/400 of NH-45 in Singaperumalkoil, where the Interchange-cum-

ROB is under construction and ends at Poonjeri Junction in Mamallapuram, for a length of 27.471 km.

4. REVIEW OF LITERATURE:

A review of previous studies was done to set a proper systematic procedure to carry out the objective of this project. Several investigations and studies were carried out worldwide to make the environmental impact assessment process effective and productive. The key-success factors for EIA project management was well studied by Roel Nijsten, Annelies de Ridder, Paul Jongejan, and Jos Arts in 2008, which were identified in a large scale screening of 75 road infrastructure projects in the Netherlands. A comparative study of environmental impact assessment process in two countries such as United States and Thailand was well done by Jhon W Stampe in 2009.He has explained about the difference in their projects and the regulations and aspects that they are following and also the strong and weak points of both countries assessment process. The studies done by B.Ganeshkumar Gobinath, N.Prabhakaran and K.Rajeshkumar in 2010, explains the methods for doing EIA and how to make the process eco-friendly. Different countries differ in their approach to the environment impact assessment.

Environmental Impact Assessment of Extension of National Highway Number one by **Nazifi Umar (June 2014)**, he was a student of Lovely Professional University Punjab, India. It was of 22 km distance from Phagwara to Jalandhar in the state of Punjab. The Methodology of each research emphasized on the sources of information from which the researcher gathers his data and various methods by which he analyses the data for extracting his research findings. The intent of this research paper is to confirm the negative impacts of the project to the immediate environment, to explore the level of public awareness about the degree of impact of the project to their environment, to explore whether the project will harm the natural ecosystem and to make it clear that EIA is needed for the project. θThe main environmental elements that were affected are Vegetation, soil, noise, temperature, dust and drainage. The EIA reduce this affect with the help of afforestation, proper laws, waste management, good drainage system and some environmental ethics. At the end this research project accept and believe in the positive development that the extension of NH1 will bring to the immediate environment through giving efficient transportation network, employment, industrial development, agricultural development and many other benefits. But the protection of the global environment is in the interest of all of us living on this planet.

Sagar Gawande and Prashant Kadu (2013), studied the Environmental Impact Assessment of six

laning through NH-4 which was going to be constructed from Pune to Satara towards Karnataka state under the (Golden Quadrilateral) Plan V of Road Development. θ Highway capacity was analyzed and it was observed that the present two lane highway was insufficient to handle the current traffic volume so the section requires six laning immediately to accommodate more traffic. This highway construction of six laning from two laning includes both positive and negative impacts on the physical, biological and socio-economic environment. θ Significant socioeconomic benefits to the region were anticipated, including increases in the development of industrial complexes along the corridor, increased tourism, and improved communication. θ A 50% reduction in travel time between the two cities was expected. θ The positive impacts on bio-aesthetes and one beauty about landscaping and beautification of ponds and access roads improved aesthetic consideration. θ Negative socioeconomic impacts include the appropriation of land, the weakening of existing community linkages through relocation, and the suppression of agricultural land. Numerous families would likely have experienced significant reductions in income. θ Survey for this project gives idea about the pollutants from surface water, air, noise is to be studied and from this it was concluded that the SPM was more in that region. The DO content for the total organisms calculated and it was in the limit. Heavy loss of road side trees leading to increase in air and noise pollution etc impacts were identified.

Sumesh Banzal & Santosh K Sar , they are from National Highway Authority of India, Raipur & Study of Centre for Environmental Science & Engineering, Bhilai Institute of Technology, DURG (CG) India. They studied the EIA of four/six-laning of section from km 0.00 to 126.525 (Raipur – Bilaspur) of NH-200 which is going to be constructed through Public Private Partnership on Design, Build, Finance, Operate and Transfer (the"DBFOT") basis. θ Fast and safe connectivity resulting in savings in fuel, travel time and total transportation cost to the society. θ The scope for the environmental impact assessment has been decided based on past experience of consultants of similar projects and Terms of Reference of consultants. The outcome of the environmental screening study carried out by the consultants also helped in finalizing the scope for the EIA study. θ Physical environment includes water resources, water quality, air quality, noise and land environment, Biological environment includes, flora, terrestrial fauna, avifauna, aquatic flora, fauna and plantations. Human environment includes the social environment rehabilitation, employment, agriculture, housing, culture etc. θ Social impact will be covered in detail in the Resettlement Plan being prepared separately. θ The chapter also gives mitigation measures for the adverse impacts.

Kashish Walia, R. K. Aggarwal and S. K. Bhardwaj(2017) ,studied the Environment Impact

Assessment of Highway Expansion in which they review papers of different author, under the Department of Environment Science, YSP University of Horticulture & Forestry, Nauni, Solan (HP) Bharat. θHighway expansion improves the quality of existing roads and enhances the connectivity between prime economic centers. The escalating traffic and need to bolster the economic capability of the area leads to the expansion of highways. θ The accession activity disturbs the ecosystem and induces myriad changes in the surrounding panorama. Also, it affects both abiotic and biotic components, directly and indirectly. Thus, to know and predict the impact on the environment and socio-economic conditions of the residents. θ Environment Impact Assessment of National Highways is imperative. Therefore, this paper reviews the influence of highway expansion on air, water and soil quality and the socio-economic conditions and health status of the natives. θThe discussion infers the view that comprehensive impact of highway expansion has not been carried out elsewhere. This necessitates to carry out impact of highway expansion on air quality, soil quality, water quality, human health and socio-economic condition of populace residing nearby the highway.

Dhyani R, Gulia S, Sharma N, Singh A Air quality impact assessment of a Highway corridor through vehicular pollution modelling. International Journal of Renewable Energy and Environmental Engineering. Vehicular pollution dispersion models have been used world over for regulatory purpose. In India various roads and highways project carry out the air dispersion modeling to predict the future air quality and air quality trends to make an effective air quality management plan along the proposed corridor. The presents study highlights the application of CALINE4 model for air quality management purpose along the road/highway corridor(s). The performance evaluation of CALINE4 model was carried out to assess its predicting capabilities on an urban highway corridor in Delhi.

5. STUDY:

Baseline environment involves collection of data on the existing status of the environment which helps in identification and assessment of impacts due to the proposed road and during various phases of project cycle. The environmental baseline includes investigation of physical, chemical, biological and socioeconomic parameters. This section deals with the description of existing environmental setting in the study area. The baseline data has been compiled for:

• Air Environment
• Noise Environment
• Land Environment

• Water Environment

• Ecological Environment & Socio-Economic Environment

5.1 AIR QUALITY MONITORING

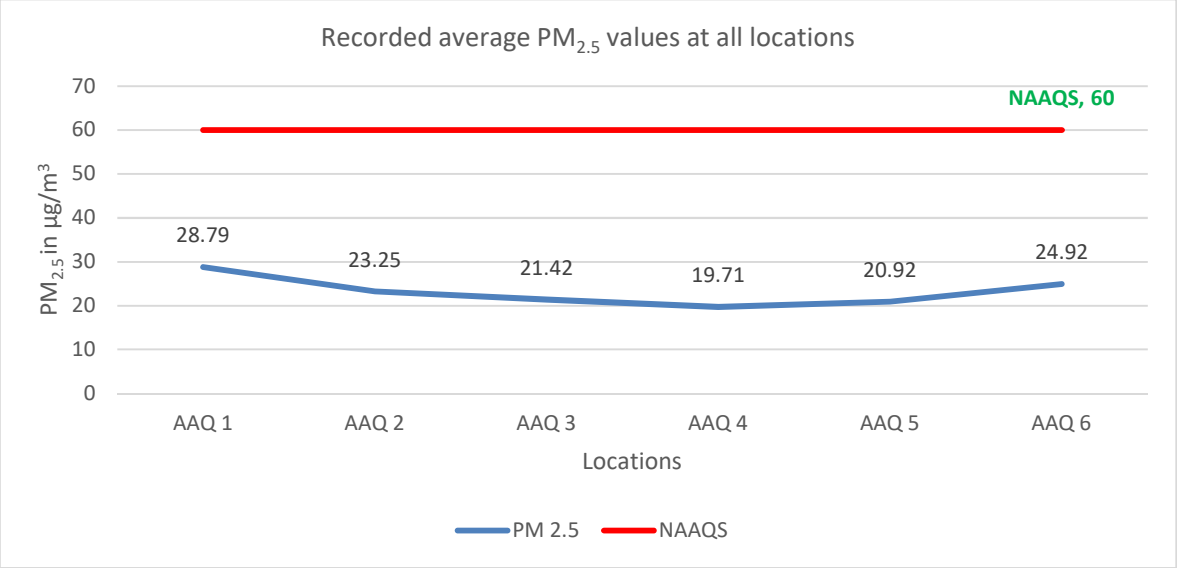
Table 1: Location of Air Sample Collection

Sample Code	Location	Coordinates
AAQ1	SINGAPERUMAL KOIL	12 45'57.16"N, 80 0'19.80"E
AAQ2	KONDAMANGALAM	12 44'49.07"N, 80 2'50.63"E
AAQ3	KARUMBAKKAM	12 42'59.67"N, 80 5'39.89"E
AAQ4	KATTUR	12 40'16.04"N, 80 5'44.81"E
AAQ5	PORANTHAVAKAM	12 38'27.83"N, 80 7'50.00"E
AAQ6	POONJERI JUNCTION	12 36'53.42"N, 80 10'7.14"E

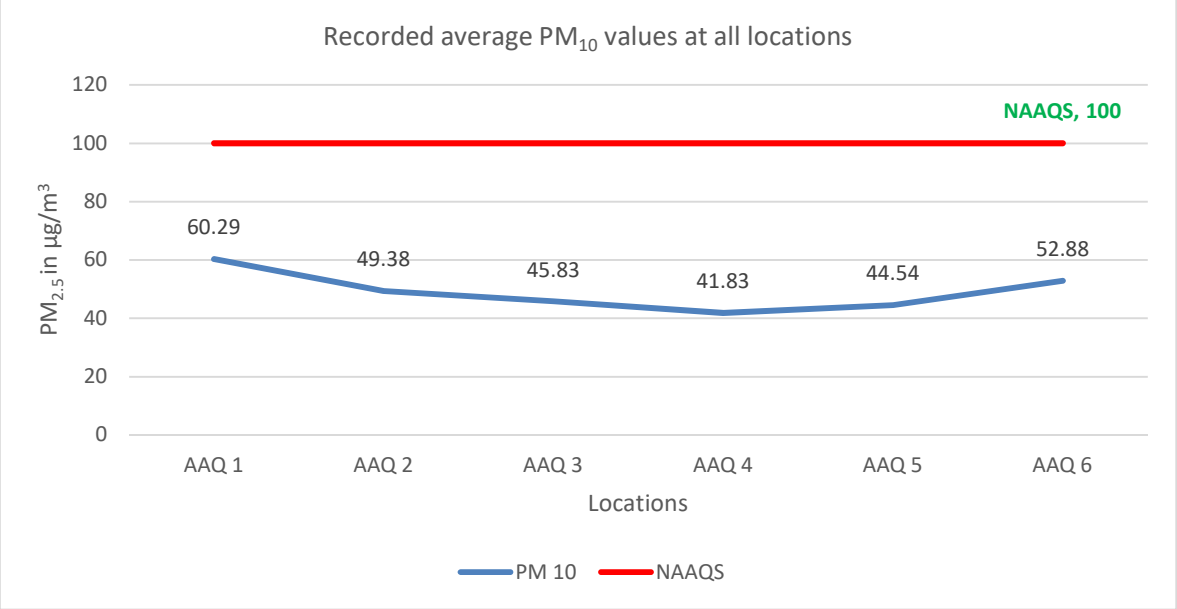
Table 2: Air Sample results

Location	Statistics	PM $_{2.5}$	PM_{10}	SO_2	NO_2	CO	O_3
AAQ1	Minimum	25	52	8.9	16.3	0.29	12.9
	Maximum	33	67	12.2	23.6	0.52	16.9
	Average	28.79	60.29	10.37	19.28	0.42	14.78
	98^{th} percentile	32.54	66.54	11.924	11.924	0.52	16.462
AAQ2	Minimum	20	43	6.8	13.9	0.11	11.4
	Maximum	27	57	8.8	16.9	0.29	13.7
	Average	23.25	49.38	7.74	15.48	0.18	12.57
	98^{th} percentile	26.54	56.08	8.754	16.9	0.2624	13.654
AAQ3	Minimum	19	40	5.1	13.6	-	11.6
	Maximum	24	53	7.9	16.6	-	13.7
	Average	21.42	45.83	6.62	14.93	-	12.48
	98^{th} percentile	23.54	52.08	7.854	16.462	-	13.654
AAQ4	Minimum	17	36	-	12.8	-	10.1
	Maximum	23	48	-	15	-	12.9
	Average	19.71	41.83	-	13.89	-	11.44
	98^{th} percentile	23	47.54	-	15	-	12.716

AAQ5	Minimum	18	38	<5	13.2	-	10.7
	Maximum	24	51	8.5	15.8	-	13.3
	Average	20.92	44.54	-	14.37	-	12.17
	98th percentile	24	51	-	15.708	-	13.208
AAQ6	Minimum	22	46	7.8	15.5	0.21	12.7
	Maximum	28	59	11.8	19.3	0.41	15.3
	Average	24.92	52.88	9.93	17.17	0.32	13.64
	98th percentile	28	59	11.754	19.07	0.41	15.024



Graph 1: Recorded average $PM_{2.5}$ values at all locations



Graph 2: Recorded average PM_{10} values at all locations

5.2 SOIL CHARECTERSTIC

Table 3: Location of Soil Sample Collection

Sample Code	Location	Coordinates
S1	POONJERI JUNCTION	12°37'7.67"N, 80° 9'22.61"E
S2	PORANTHAVAKKAM	12°38'11.22"N, 80° 7'53.17"E
S3	KATTUR	12°40'22.12"N, 80° 5'21.76"E
S4	KARUMBAKKAM	12°43'36.73"N, 80° 5'48.36"E
S5	KONDAMANGALAM	12°44'47.15"N, 80° 3'20.18"E
S6	SENGUNDRAM	12°45'38.66"N

Table 4:Soil Sample analysis result

S. No.	Parameters	S1	S2	S3	S4	S5	S6
1	pH	8.22	7.87	8.36	7.56	7.92	8.28
2	Bulk Density, g/cc	1.27	1.22	1.24	1.37	1.35	1.24
3	Electrical Conductivity, mS/cm	0.174	0.137	0.275	0.114	0.142	0.211
4	Total Nitrogen, kg/ha	127	184	154	146	112	214
5	Available Phosphorous, kg/ha	38.8	47.3	29.3	28.7	33.9	50.9
6	Available Potassium, kg/ha	307	378	274	252	296	410
7	Exchangeable Calcium as Ca,m.eq/100g	17.7	20	19.7	15.7	14.2	21.3
8	Exchangeable Magnesium as Mg, m.eq/100g	5.36	6.14	5.54	4.36	4.97	6.22
9	Exchangeable Sodium as Na, m.eq/100g	1.69	1.33	1.71	1.17	1.02	1.69
10	Organic matter (%)	1.14	1.42	1.32	0.96	1.08	1.32
10	Texture Classification	Clay Loam	Clay	Clay	Loam	Loam	Clay
11	Sand (%)	41.5	30.2	27.5	38.8	41.2	28.7
12	Clay (%)	32.7	53.6	60.6	24.7	25.6	61.3
13	Silt (%)	25.8	16.2	11.9	36.5	33.2	10
14	Sodium Absorption Ratio	1.57	1.16	1.52	1.17	1.04	1.44
15	Copper as Cu	3.71	BDL(< 2)	4.11	BDL(< 2)	BDL(<2)	5.24
16	Zinc as Zn	18.9	22.3	15.3	31	24.1	18.1
17	Manganese as Mn	32.7	36.8	23.1	28.6	37.6	42.8

5.3 WATER QUALITY

Table 5: Location of Water Sample Collection

SampleCode	Location	Coordinates
Sw 1	Twin lotus Lake	12°37'15.63"N, 80° 9'59.48"E
Sw 2	Manampathy Lake	12°39'45.20"N, 80° 6'21.95"E
Sw 3	Nellikuppam Lake	12°43'53.54"N, 80° 4'14.49"E
Sw 4	Kondamangalam	12°45'47.76"N, 80° 0'53.62"E

Table 6: Result summary of Surface Water quality.

S. No	Parameter	Unit	Results			
			SW 1	SW 2	SW 3	SW 4
1	Temperature	ºC	26.6	27.5	28.4	29
2	Colour	Hazen	25	10	10	35
3	Odour	-	No Odour Observed	No Odour Observed	No Odour Observed	No Odour Observed
4	pH at 25°C	-	8.05	7.85	7.95	8.23
5	Electrical Conductivity	µS/cm	654	492	612	982
6	Turbidity	NTU	11.6	4.7	2.7	13.3
7	Total Dissolved Solids	mg/l	345	266	339	552
8	Total Hardness as CaCO3	mg/l	120	110	146	240
9	Total Alkalinity as CaCO3	mg/l	102	92	124	188
10	Chloride as Cl	mg/l	115	85	97	156
11	Sulphate as SO4	mg/l	28	14	30	58
12	Fluoride as F	mg/l	0.18	0.16	0.16	0.33
13	Nitrate as NO3	mg/l	8	5	9	21
14	Ammonia as NH3	mg/l	0.52	0.23	0.37	1.98
15	Phosphate as PO4	mg/l	0.68	0.34	0.52	1.13
16	Sodium as Na	mg/l	78	60	72	110
17	Potassium as K	mg/l	4.2	2.7	4.3	5.2
18	Calcium as Ca	mg/l	33	25	31	52
19	Magnesium as Mg	mg/l	9.1	11.5	12.7	26.7
20	Iron as Fe	mg/l	0.44	0.25	0.19	0.58
21	Manganese as Mn	mg/l	0.14	0.08	0.10	0.13
22	Anionic Surfactants as MBAS	mg/l	BDL (<0.025)	BDL (<0.025)	BDL (<0.025)	BDL (<0.025)
23	Total Suspended Solids	mg/l	10	6	7	18

24	Dissolved Oxygen as O2	mg/l	5.3	5.5	5.7	4.5
25	Chemical Oxygen Demand	mg/l	30	18	16	38
26	Bio-Chemical Oxygen Demand @ 27°C for 3 days	mg/l	3.2	2	2	6.3

Table 7: Ground Water Quality Monitoring Locations

Sample Code	Location	Coordinates
GW1	POONJERI	12°37'27.16"N, 80° 9'10.48"E
GW2	MANAPATHY	12°43'8.10"N, 80° 4'58.38"E
GW3	NELLIKUPPAM	12°40'54.60"N, 80° 6'3.21"E
GW4	KONDAMANGALAM	12°44'37.33"N, 80° 2'49.97"E

Table 8: Result summary of Ground Water Quality Analysis Performed

S. No.	Parameter	Unit	Results			
			GW3	GW4	GW3	GW4
1	Colour	Hazen	<1	1	<1	1
2	Odour	-	No Odour Observed	No Odour Observed	No Odour Observed	No Odour Observed
3	Turbidity	NTU	0.5	BDL(<0.5)	0.5	BDL(<0.5)
4	pH at 25 °C	-	7.33	7.55	7.33	7.55
5	Conductivity at 25 °C	µS/cm	1116	1445	1116	1445
6	Total dissolved solids	mg/l	635	837	635	837
7	Total Suspended Solids	mg/l	<2	<2	<2	<2
8	Total Alkalinity as CaCO3	mg /l	270	330	270	330
9	Total Hardness as CaCO3	mg/l	316	460	316	460
10	Calcium as Ca	mg/l	86	108	86	108
11	Magnesium as Mg	mg/l	24.5	46	24.5	46
12	Chloride as Cl-	mg/l	166	207	166	207
13	Sulphate as SO4	mg/l	82	112	82	112
14	Nitrate as NO3	mg/l	3	11	3	11
15	Iron as Fe	mg/l	0.11	0.23	0.11	0.23
16	Manganese as Mn	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)

17	Fluoride as F	mg/l	0.29	0.41	0.29	0.41
18	Sodium as Na	mg/l	102	74	118	144
19	Potassium as K	mg/l	2.4	1.3	2.1	3.6

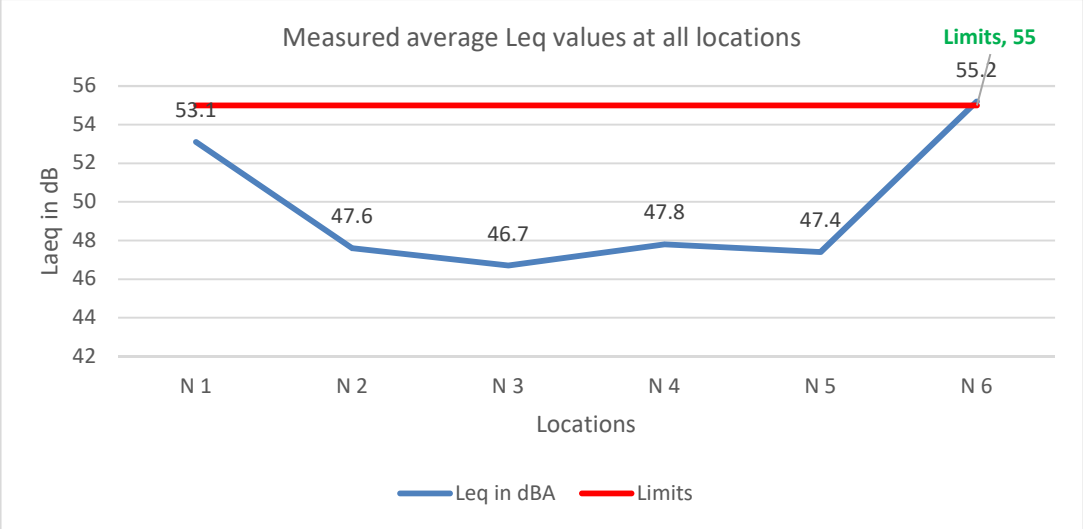
5.4 NOISE QUALITY

Table 9: Noise Quality Monitoring Locations

Sample Code	Location	Coordinates
N1	POONJERI JUNCTION	12°36'57.44"N, 80° 9'58.71"E
N2	PORANTHAVAKKAM	12°38'33.39"N, 80° 7'43.66"E
N3	KATTUR	12°40'38.81"N, 80° 5'51.37"E
N4	KARUMBAKKAM	12°43'20.20"N, 80° 5'33.70"E
N5	KONDAMANGALAM	12°44'57.15"N, 80° 2'21.93"E
N6	SENGUNDRAM	12°45'48.97"N, 80° 0'38.97"E

Table 10: Summary of Noise Quality Results

Location Code	Sample Location	Lday [dB(A)]	Lnight [dB(A)]	Leq [dB(A)]
N1	Poonjeri junction	54.7	44.6	53.1
N2	Poranthavakkam	48.9	41.9	47.6
N3	Kattur	47.8	43	46.7
N4	Karumbakkam	49.1	42.8	47.8
N5	Kondamangalam	48.7	42.4	47.4
N6	Sengundram	56.8	45.5	55.2



Graph 3: Measured average Leq values at all locations

6. CONCLUSION

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

Air Environment

Motor vehicles have emerged as one of the major sources of air pollution especially in urban areas. As the proposed road is aimed at enhancing the efficiency of road transport system, the number of vehicles plying on this road will be increased overtime. Summary of potential impact and mitigation measures proposed is mentioned below.

Meteorological Factors and Climate Construction Phase

Felling of trees, laying of pavement and other construction activity may cause temporary impact on microclimate of the project influence area. No other significant impacts are envisaged in climatic parameters.

Operation Phase

The objective of the present project is only to widen and strengthen the existing road. Hence, no changes in climatic conditions are anticipated. If any minor impacts do exist due to the proposed project, it will be mitigated by compensatory and additional afforestation and avenue plantation.

Ambient Air Quality

Construction Phase

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

a) Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered to reduce spills on existing roads

b) Water will be sprayed on earthworks, temporary haulage and detour roads on a regular basis. During and after compaction of the sub-grade, water will be sprayed at regular intervals to prevent dust generation.

c) The hot mix plant will be fitted with dust extraction units. d) It shall be ensured that the dust emissions from the crusher and vibrating screen from the stone quarries do not exceed the standards.

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

a) An adequate cyclone/scrubber to control emissions from the stack of hot mix plants will be provided in the event of the emissions exceeding the SPCB norms.

b) To ensure the efficiency of the mitigation measures suggested, air quality monitoring shall be carried out at least once every season during the period for which the plant is in operation.

c) All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the SPCB norms. A vehicle management schedule prepared by the contractor and approved by the Engineer shall be adhered to.

Operation Phase

Development of landscape along the road can reduce concentration of pollutants. It is, therefore, recommended that the area available on both sides of the road be used to develop a green belt with dense canopy to minimize the air quality impacts in the downwind regions. Such development will also improve the general aesthetics in the region. The periodic monitoring of the ambient air quality at pre-designated locations will be conducted to ensure further improvement /modification in the design methodology.

Noise Environment

Construction Phase

Noise and vibration during construction is a significant impact especially around settlements and inhabited areas. The following mitigation measures need to be worked out by the contractor for the noise impacts associated with the various construction activities:

a) Noise standards will be strictly enforced for all vehicles, plants, equipment, and construction machinery to avoid and minimize excessive noise and vibration and ensure environmental safety of workers. All construction equipment used for an 8-hour shift will conform to a standard of less than 90 dB (A).

b) To avoid and minimize excessive vibration and deformations, it is recommended to use alternative methods of drilling.

c) Machinery and vehicles will be maintained regularly, with particular attention to silencers and mufflers, to keep construction noise levels to minimum. Workers in the vicinity of high noise levels must wear earplugs, helmets and be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A) per 8-hour shift.

d) Construction camps shall not be located 1000 m from settlement areas. No hot mix, batching and aggregate crushing plants shall be located within 1000 m of sensitive land uses as schools, hospitals etc.

e) The main noise producing sources such as the concrete mixers, generators, grader etc. should be provided with noise shields around them. The noise shields can be any physical barriers, which is effective in adequate attenuation of noise levels. A 3 m high enclosure made up of brick and mud with internal plastering of a non-reflecting surface will be very effective in this regard.

f) For protection of construction workers, earplugs should be provided to those working very close to the noise generating machinery.

g) To avoid significant impacts on human health, it is being recommended to avoid construction work at certain sections during night times and ensure that only minimum required machinery is deployed on the site. At construction sites within 150 m of human settlements, noisy construction should be stopped during nights

h) Noise level monitoring should be conducted as per Environmental Monitoring Plan given in EMP.

Operation Phase

Mitigation of the noise effects during the operation of the project can be effected by the following options:

a) Development of greenbelt with high canopy along the project road for attenuation of noise.

b) Noise barriers: The impacts due to high noise levels will be critical at various urban locations and due to the larger number of receptors and their continuous exposure to high noise levels from the traffic.

c) Noise monitoring should be conducted as per Environmental Monitoring Plan.

Water Environment

Water Resources

Necessary measures will be taken not to dispose the slurry in to the water bodies by providing barrier with sand bags constructed around the piling location and the slurry can be stored in it so that the clear supernatant will flow out and the sludge will be settled at bottom. The sludge can be removed periodically and disposed at sites identified for debris disposal. The contractor will arrange

for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected. Wastage of water during the construction will be minimized. While working across or close to perennial water bodies, the Contractor will not impede or block any flow of water. If for any bridgework, containment of flow is required, the Contractor will seek Approval of the Engineer. Construction over and close to any non-perennial streams shall be carried out in the dry season. Construction over irrigation canals will be undertaken with permission with the Department of Irrigation. Care should be taken to minimize any disruption to the flows and to ensure that a high quality of water is maintained. The Contractor may use the natural sources of water subject to the provision that any claim arising out of conflicts with other users of the said natural sources will be his responsibility.

Water Quality

• The Contractor will take all precautionary measures to prevent the waste water generated during construction from entering into streams, water bodies.

• Oil interceptor will be provided at plant site and truck parking.

• All wastes arising from the project will be disposed of, as per SPCB norms, so as not to block the flow of water in the channels. The wastes will be collected, stored and transported to the approved disposal sites.

• Construction work close to the streams or water bodies will be avoided during monsoon.

• Construction laborers camps will be located at least 1000m away from the nearest habitation.

• Construction of temporary or permanent devices to prevent water pollution due to increased siltation and turbidity shall be ensured.

• It will be ensured that no sanitary wastes from the labour camps are discharged into the nearby watercourses. Wastewater arising from domestic use in labour camps will be sent to septic tank and soak pit.

• The location of all fuel storage and vehicle cleaning area will be at least 300 m from the nearest drain/ water body. In addition, the maintenance and repairs of vehicles will be carried out in a manner such that contamination of water bodies and drainage channels can be avoided.

• The slopes of embankments leading to water bodies will be modified and rechanneled to prevent entry of contaminants into the water body.

• During the construction stage periodical water sampling and laboratory analysis shall be implemented to examine possible pollution of surface and underground flows.

The main aim of assessment of environmental impacts is to influence developmental activities and decision-making, by providing sound information on environmental impacts and the means for preventing or reducing those impacts. Thus, it is necessary to know the adverse effect of any project

to the environment. By carrying out EIA we can minimize the adverse effect on human beings, plants, animals as well as environment. The data's collected about the present air environment and land environment help us to predict the possible changes during the construction and operation stages of the road. The impact during these stages can be controlled by following certain mitigation measures that will be given at the end of the project study.

Based on the environmental impact assessment, the proposed CPRR alignment at Section 5 do not have any major impact on the environmental as well as social aspects. The anticipated impacts are found to be common for construction of any highways/ road projects. The modelling study performed for the air quality and noise levels also predicts the same. The proposed CPRR shall have traffic safety measures for safeguarding the road users. Climate risk adaptation measures like providing adequate culverts, bridges and use of anticorrosive materials shall extend the life of the proposed structures and the pavement from flooding or other natural disasters.

The given EMP will be implemented by the Contractor for which the EMP has been included in the Bid Document to make it mandatory for implementation. For the loss of land and structures, adequate compensation has been worked out and given in the RAP. The suggested enhancement measures including the compensatory afforestation, deepening of water bodies shall add positive environmental benefits.

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