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Environmental Impact Assessment of State Highway 299 passing through Amravati city

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ABSTRACT

Environmental degradation is the disintegration of the earth or deterioration of the environment through consumption of assets like air, water and soil. Environmental degradation is one of the primary causes of diseases, health issues and long-term livelihood impact for world. The increase in public concern regarding the "quality of life" has intensified the need for rational identification, measurement and evaluation of environmental impacts. In order to achieve the desired harmony between the road and its surroundings, it becomes necessary to study the environmental effects at the planning stage itself. At present, in the course of planning and designing a road project the main aspects taken into account are those of economy and traffic flow. As a result of this limited approach, many environmental problems such as noise, air, water, soil pollution, aesthetic deterioration, excessive use of cement concrete and ecological disturbances that gets created are overlooked.

This paper aims to analyse the pollution caused due to the use of cement concrete in road construction project of state highway 299 passing through Amravati city. The construction of State highway will add access to markets, jobs, education and health services, and reduced transport costs for both freight and passengers, reduce fuel consumption and exhaust emissions from the vehicle plying on the road. However, there might be negative impacts on environment due to the construction of state highway. This paper discusses the positive and negative impact on physical and chemical parameters of environment such as air, noise, soil and water drainage due to the use of various materials and machines are identified and discussed.

Keywords: - *Degradation, natural resources, ecological disturbance.*

1.0 INTRODUCTION

1.1 General

Road projects are generally undertaken to improve the economic and social welfare of those using the road or served by it. Increased road capacity and improved pavements can reduce travel times and lower the costs of vehicle

use. Benefits include increased access to markets, jobs, education and health services, and reduced transport costs for both freight and passengers, reduce fuel consumption and exhaust emissions from the vehicle plying on the road.

Improvement of the road project will have significant positive impact, but they may simultaneously also bring significant negative impacts on nearby communities and the natural environment if proper precaution will not be taken during design and implementation stage of the project. People and properties may be in the direct path of road works and affected in a major way. People may also be indirectly affected by the project, through the disruption of livelihood, loss of accustomed travel paths and community linkages, dumping of excavated materials, increases in noise levels and pollution. Roads bring people and people bring development. Roads are agents of change, which can bring both benefits and damage to the existing balance between the people and their environment.

Roads have a variety of effects on the environment. This applies to everything from the initial building through the ongoing maintenance, upgrades, and use. Roads that obstruct drainage or allow run-off to become concentrated or contaminated can have a significant negative impact on the environment. Vehicles on the road can contribute to ambient noise and lower air quality, which can have a negative impact on people's health. All road development proposals must go through a consultation procedure with other government agencies to determine potential environmental and community consequences. A formal assessment may be required under the Northern Territory's Environmental Assessment Act, depending on the project's scale and possible impact.

With the increasing pace of all round developmental activities in India, the intensity of traffic on Indian roads in general and particularly on highways has increased many folds thus rendering inadequate the existing roads capacity to contain this increased volume of traffic. To cope up with this challenge the public works department of government of Maharashtra started development of various state highways for augmenting their capacity adequately for safe and efficient movement of traffic.

1.2 Need for environmental assessment in road construction projects

Whether it's in the areas of trade, employment, education, or health care, connectivity and growth of highways are inextricably intertwined. Road connectivity is a critical component of development. Development as a means of ensuring poverty reduction facilitating access to marketing centres for small businesses agricultural products at a lower cost of shipping as a result, higher price realisation occurs, resulting in an increase in revenue, income in the countryside. The roads make it easier to go about. Increased employment, education, and health care opportunities, boost economic activity, and enhance things in general as a result, a greater standard of living is achieved.

The Office of Environmental and Heritage, which administers the Environmental Assessment Act, requires an environmental clearance for projects with little environmental impact, such as road widening or duplication. Under the Act, routine repair does not normally need an environmental evaluation. Roads have an environmental impact that extends beyond their construction and upkeep. Traffic noise, reduced air quality, dust pollution, contamination of natural water supplies, landscape damage, and soil erosion are among problems that can be caused by motor vehicles on roadways. In the majority of situations, the environmental issues linked with motorways strangle the road infrastructure. The most common problems are:

1. Air pollution
2. Noise pollution
3. Disposal of excavated material
4. Excessive use of cement concrete
5. Soil fertility
6. Deforestation
7. Water logging

1.3 Project description

Amravati camp short road SH 299 is major road connecting Walgaon road to Camp area. The road having 5Km length and 9m width of each lane. Project road connects Panchwati chauk to Rajput dhaba junction on Rahatgaon

Lalkhedi Amravati mini bypass.The road serves the flow of traffic coming to city from Walgaon, Paratwada, Achalpur, Daryapur road.It also has many prominent educational institutes such as government engineering college, government polytechnic college, government Vidarbha mahavidyalaya, Dr. P. D. polytechnic college, Dr. Panjabrao Deshmukh medical college to name a few.The construction of cement concrete road is in progress. There is no work of underground sewerage system is sanctioned on this stretch and in future it may be laid through other parallel road.

2.0 METHODOLOGY

2.1 Air Pollution

Rapid expansion in the road transportation sector may result in increasing emissions of automobile exhaust, lowering ambient air quality. Automotive vehicles generate a variety of pollutants, depending on the type and quality of the gasoline they consume. Pollutants released by automobiles may include fugitive fuel emissions; thus, the source and level of these emissions are dependent on the type of vehicle as well as its maintenance, among other factors.

Table 1. Key pollutants and their effects on human health (Colin and Michael, 2005; Amer, 2007)

Name of pollutant	Effects on human health
Heavy metals	Exposure will lead to irreversible brain damage and also lead to premature deaths.
Nitrogen dioxides	Linked to a wide range of respiratory problems; sore throat and cough.
Particulate matter	Acute exposure will lead to death, decreased lung function, pulmonary inflammation and increased respiratory symptoms, Chronic exposure will increase mortality.
Carbon monoxide	Have great effect on the oxygen delivery to the body's tissues and organs, and may cause death.

In order to evaluate the resultant air quality around proposed road alignment, it is necessary to determine the existing air quality in terms of Sulphur–di–Oxide (SO2), Oxides of Nitrogen (NOX) and Respirable suspended particulate matter (RSPM). Accordingly, these parameters were monitored at the Ambient Air Quality (AAQ) monitoring station located at computer science engineering building of government college of engineering, Amravati.

2.2 Noise pollution

Road noise quality depends on many factors such as traffic density, type and condition of the vehicles plying on the road, acceleration / deceleration / gear changes/level of congestion and smoothness of road surface. Ambient noise standards were established as per the CPCB/MOEF Gazette Notification dated 26th December 1989.

Table 2. Ambient noise standards as per CPCB

Category of area	Limits in dB	
	Day time	Night time
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Sensitive Zone	50	40

Noise level monitored by using sound level meter. To have an idea of the present background noise level of the project site, a detailed measurement of noise level was carried out covering residential, commercial and industrial areas at hourly intervals for twelve hours during the monitoring period. Precision integrated sound level meter (type 2221 of Bruel & Kjaer of Denmark) was used for measurement of noise level for the study. The noise measurements were carried out for 12 hours and readings were measured by operating the instrument for 10- 15 minutes in each hour at one-hour intervals in which Leq (A) have been measured.

2.3 Impact on soil

Erosion of top-soil can be considered a moderate, direct and long-term negative impact resulting from the construction of existing road of SH299. The potential for soil erosion is pervasive during the construction stage, especially in realignment and earth work on the existing alignment. The soil organic carbon test is performed on samples collected from construction site by Walkley-Black method. Potassium dichromate solution in concentrated sulphuric acid oxidizes oxidizable organic carbon in the soil. The organic carbon can then be calculated by back-titrating with ammonium ferrous sulphate utilizing diphenylamine as an indicator and measuring the residual unreduced dichromate.

2.4 Impact on water drainage

During the construction period, some amount of drainage alteration and downstream erosion/siltation is anticipated. Some of these alterations may be because of construction of temporary traffic detours/diversion. Changes in the drainage pattern due to the raising of the road profile is also an important issue for the shopkeepers along roadside. During construction phase, the project activities are unlikely to create localized flood related issues. Nevertheless, various construction activities could temporarily worsen the flooding problem due to improper drainage conditions on account of the contractor's poor engineering practices and negligence. If the high intensity rainfall continues for many days a number of sections along the project road could develop flooding situation.

2.5 Use of cement concrete in construction activity

A major component of concrete is cement, which has its own environmental and social impacts and contributes largely to those of concrete. The cement industry is one of the main producers of carbon dioxide, a potent greenhouse gas. Concrete causes damage to the most fertile layer of the earth, the topsoil. The presence of some substances in concrete, including useful and unwanted additives, can cause health concerns due to toxicity and (usually naturally occurring) radioactivity. Furthermore, the production of concrete requires large amounts of water, and global production accounts for almost a tenth of worldwide industrial water use. This amounts to 1.7 percent of total global water withdrawal. A study that appeared in *Nature Sustainability* in 2018 predicts that concrete production will in the future increase pressure on water resources in regions susceptible to drought conditions. In 2050, 75% of the water demand for concrete production will likely occur in regions that are expected to experience water stress. The amount of cement used is calculated from detailed project estimate report from PWD department Amravati.

2.6 Environmental pollution due to material consumption

During road construction, management of excavated materials has become one of the major hindrances. Construction projects and roads often lead to production of a large quantity of excavated soil (both clean and contaminated). Most of the excavated soil ends up in landfills, uncontrollable sites or in other inappropriate areas. These kinds of practices cause negative impact on 6 nature which include air pollution, water pollution, underground water pollution, risks in public health and many others. The use of water in such a large amount for construction and curing purpose is also an important issue to be taken into account. The materials required for construction of state highway 299 is calculated from detailed estimate report of PWD department Amravati.

2.7 Biological environment

Roadside trees are valued for their natural beauty and because they provide shade, moderate temperature fluctuation, control evaporation, block air movement, catch rain and channel rain wash, and control local humidity. Trees absorb gaseous pollutants and reduce airborne particulates. Studies of environmental psychology suggest that the presence of trees influences driver behaviour and also stimulates both urban and suburban retail business. As a result, roadside trees are widely valued by the general public, and support is often expressed in public forums.

The proposed up-gradation of the project road doesn't involve forest areas. Hence, anticipated impact on Forest area is not envisaged. Existing road side vegetation and trees were recorded during the field survey. Some of the indigenous of trees are likely to be cut down due to the upgradation. During the construction activities, dust will be emitted and deposited on the leaves of vegetation/crops along the project roads. Dust deposition on the leaves will affect

the photosynthesis process and subsequently hamper the growth of the plants. Some of the trees are likely to be cut down due to the upgradation.

2.8 Public consultation

As a part of the project preparation and to ensure that the community support is obtained and the project supports the felt needs of the people; public consultations were carried out as an integral component. Consultations involve soliciting people's views on proposed actions and engaging them in a dialogue. Consultations were done using various tools including, interviews with government officials, questionnaire-based information with stakeholders etc. The public consultation carried out during the Environment impact Assessment stages of the project has been summarized.

3.0 RESULTS

3.1 Air Pollution

Air quality noted along the construction site in the month of April 2022 given in below table:

Table 3. Ambient air quality monitoring results

Description	SO_2 $\mu g/m^3$	NOx $\mu g/m^3$	RSPM $\mu g/m^3$
1.	14	15	62
Standards	80.00	80.00	100.00
Min	8.00	10.00	47.00
Avg	11.59	12.88	56.88
Max	14	15	62

3.2 Noise pollution

The noise measurements were carried out for 12 hours and readings were measured by operating the instrument for 10- 15 minutes in each hour at one-hour intervals in which Leq (A) have been measured. along the construction site is given below: -

Table 4. Ambient noise quality monitoring results

TIME	AMBIENT NOISE LEVEL (dB)
10:00 -11:00	74.50
11:00 -12:00	69.25
12:00 -13:00	72.20
13:00 -14:00	68.20
14:00 -15:00	69.80
15:00 -16:00	62.90
16:00 -17:00	64.50
17:00 -18:00	68.85
18:00 -19:00	78.23
19:00 -20:00	81.26
20:00 -21:00	84.20
21:00 -22:00	82.35

3.3 Impact on soil

In this project, contamination of the soil may take place, from the following activities at the construction zones and other auxiliary facilities required for the construction. Details of the activities from which the contamination can occur are presented below:

- Scarified bitumen wastes
- Debris generation
- Maintenance of the machinery and operation of the diesel generator sets on site
- Oil spill from the operation of the construction machineries, maintenance and diesel storage and diesel generator sets

The soil organic carbon test can be performed on the soil sample collected from construction site and found to be 0.63%.

It means that the organic content in soil is moderate

3.4 Environmental pollution due to material consumption

Following calculation were performed on material usage –

- Excavated material for road construction = 37760 metric tonnes.
- Material required for Earth work = 18720 metric tonnes.
- Material required for granular subbase = 8775 metric tonnes.
- Stone aggregates required = 18880 metric tonnes.
- Excavated material after Milling of asphalt surface = 86120 kg
- Cement bags required for road construction = 187000 bags of 50 kg.
- Sand required = 26180 metric tonnes.
- Aggregates required = 44880 metric tonnes.
- Water required = 5610000 l
- Water required daily for curing = 40000 l

3.5 Biological environment

Table 5 Vegetation observed along the project area

Sr. No.	Local Name - Plant	Scientific Name	Family
1	Teak	Tectona grandis	Lamiaceae
2	Khair	Senegalia catechu	Fabaceae (or Leguminosae)
3	Peepal	Ficus religiosa	Moraceae, the fig or mulberry
4	Neem	Azadirachta indica	Meliaceae
5	Sal	Shorea robusta	Dipterocarpaceae
6	Palash	Butea monosperma	Fabaceae
7	Anjan	Hardwickia binata Roxb.	Detarioideae
8	Baheda	Terminalia bellirica	Combretaceae
10	Char-Mar Ridge	Parthenocissus quinquefolia	-
11	Ain	Plantago	Plantains
12	Tarvad	Senna auriculata	Caesalpinioideae
13	Agave	Agave americana	Asparagaceae
14	Zizipus jujuba	Ziziphus mauritiana	Rhamnaceae
15	Banyan	Ficus benghalensis	Moraceae
16	Vidya	Thuja	Cupressaceae
17	Ashoka	Saraca asoca	Fabaceae
18	Babool	Acacia nilotica	Fabaceae
19	Bel	Aegle marmelos	Rutaceae
20	Jamun	Syzygium cuminis	Myrtaceae

3.6 Public consultation

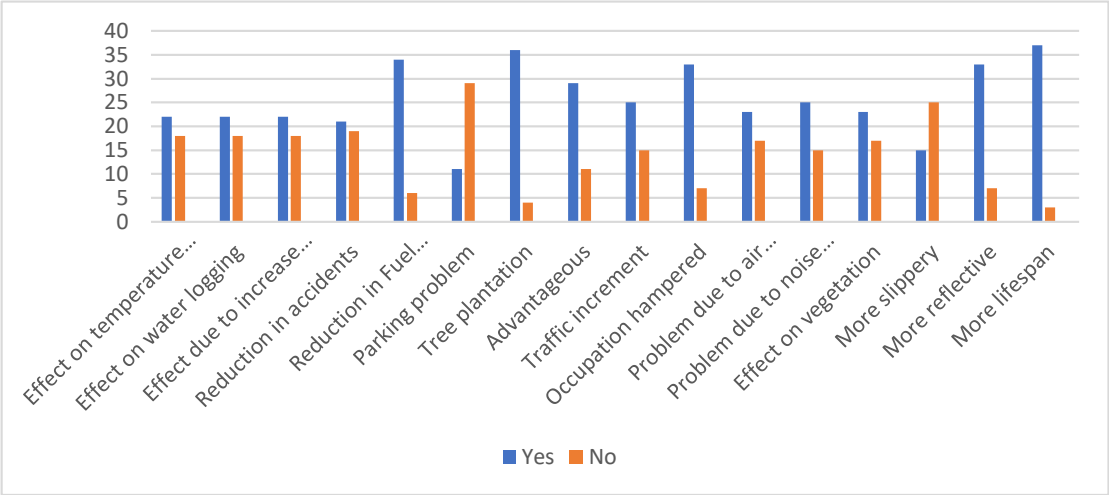

Fig 1 Bar chart of public consultation responses

4.0 CONCLUSIONS

The RSPM levels are observed to be lower than the NAAQS level of 100µg/m3. The RSPM in the study area is contributed mainly by vehicular emissions, re-suspended dust from paved roads and open areas as well as from nearby industrial activities. The highest levels of SO2 were found to be within the prescribed NAAQ standards. The maximum limit was observed is 14 µg/m^3. The main source of SO2 emission is from industrial and vehicular sources. The highest level of NOx was found is 15 µg/m^3. The main source of NOx emission is from industrial and vehicular traffic. The highest levels of NOx were found to be within the prescribed NAAQ standards.

Noise sensitive receptors have been identified along the project road. The noise sensitive receptors include school, hospitals, colleges, etc. The results of ambient noise monitoring have been compared with MOEF norms. The result shows that measured values of noise are higher than prescribed norms and proper mitigation measures are necessary.

Erosion of top-soil can be considered a moderate, direct and long-term negative impact resulting from the construction of existing road of SH299. Starting with clearing and grubbing, vegetation will be stripped away, exposing raw soil. Earth works and embankment will also prone to erosion during rains. The major source of debris generation is scarifying of bitumen and removal of existing road for upgradation. The excavation of quarries and borrow pits used for obtaining aggregate materials and soil for road construction can cause direct, and indirect long-term major adverse impacts on the environment. One of the long-term residual adverse impacts of borrow pits not reclaimed, is the spread of mosquitos. Mosquitoes breeding and multiplying in stagnant water that collects in these pits can affect human health.

There will be temporary impact on terrestrial ecology, as trees will be cut. There are no endangered species or rare species of vegetation in the project area. There is no major loss of vegetation hence adverse impact in terms of availability of nesting sites for the bird doesn't arise.

During road construction allied activities like quarrying and crushing operations, traffic diversions, etc., may cause disruption of social and economic life of the local population of the nearby areas. Dust and noise generated during construction may cause nuisance to the nearby communities. Other problems perceived during construction period is inconvenience to the local people as well as the highway passengers due to traffic jams and congestion, loss of access and other road accident risks, as a result of diversion of traffic and construction work on road.

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