Environmental Impact Assessment on Highway

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CERTIFICATE OF ORIGINALITY

The work embodied in this report entitled **"Environmental Impact Assessment on Highway"** has been carried out by **Ashutosh Jha, Sachin, Shubham Chauhan & Yash Kumar** for **"Environmental Management"**. We declare that the work and language included in this project report is free from any kind of plagiarism.

The work submitted is original and has not been submitted earlier to any institute or university for the award of any degree or diploma.

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ABSTRACT

Highway expansion improves the quality of existing roads and enhances the connectivity between prime economic centres. The escalating traffic and need to bolster the economic capability of the area leads to the expansion of highways. Moreover, 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, 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.

INTRODUCTION

India has been experiencing better fiscal growth over the last decade, accompanied by growing hunger for natural resources and rapid proliferation of infrastructure development due to industrialization, urbanization and modernization; which are yardsticks for the degree of heights of development in terms of technology and economy. Road refinement and highway development projects in India have chiefly amplified the quality of existing roads and have strengthened linkage between cardinal economic centres. The spike in India's growth has involved a considerable expansion of infrastructural development projects which provides the vital foundation on which other sectors of the economy can be built. The construction of new highways is the quintessential public sector investment, by which the government attempts to encourage monetary growth in rural as well as in urban areas1 . An effective, smoothly operating transportation infrastructure, as highway network is a prioritized concern for society and is a chief component of transportation system at the National, State and local level, thus, highway projects are generally undertaken to ameliorate the efficient connectivity, financial and social welfare of the personages. From an ecological perspective, development inevitably causes damage to the natural assets of the environment, to a greater or lesser extent . Pollutants emitting from various activities like soil erosion, use of fossil fuels, paint, solvents, cleaners, use of harmful chemicals, construction debris and dirt are added to adjacent water bodies through both direct and indirect discharges which leads to physical, chemical and biological degradation of water quality. The roadside soil and residential area have been polluted seriously due to an increasing flow of motor vehicles along the highway. Whereas, pollution from heavy metals mainly coming from automobiles is considered as a serious environmental issue.Overall EIA offers a systematic process of examination, analysis and assessment of planned activities with a view of ensuring environmentally sound and sustainable development. However, roads influence the abiotic components of terrain including other array of factors such as, the hydrology, the mechanics of sediment and debris transport, water and air chemistry, microclimate and levels of noise, wind, and light adjacent to roadsides. Thus the extent and intensity of the consequences vary with the position of the road relative to patterns of slope, prevailing winds and surrounding land cover. Therefore, review of scientific literature was conducted on the work done regarding Environmental Impact Assessment of National Highways with the purpose of providing an overview of the environmental impacts of transport infrastructure, and to edifice the information according to environmental assessment terminology.

Review and Discussion About Effects of Highway Expansion on Ecosystem

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➔ Air Quality

Air pollution is one of the most often recognized environmental repercussions of roads. Toxic chemicals associated with air borne particulates cause diseases and increased mortality in humans, and indeed, this aspect of transportation has been the focus of intense scrutiny by researchers, regulators and lawmakers for several decades. Air pollution is widely considered to be the dominant environmental result of road related transportation. Air pollutants also enter aquatic systems by adding metals and hydrocarbons to water bodies from atmospheric sources. The available studies are limited for the construction of urban road tunnels and are thus not directly applicable to most urban road schemes . Increased concentrations of ultrafine particles (UFPs, <0.1 mm) are commonly found near roadways and thus substantial reduction in traffic can improve local and regional air quality in high traffic areas and urban areas. Volatile chemicals associated with roads are introduced to the environment from vehicular emissions which includes carbon monoxide (CO), nitrogen oxides, volatile organic compounds, sulphur dioxide (SO_2), particulates from exhaust and road dust, lead (Pb), methane (CH_4) and toxics including benzene, butadiene and formaldehyde. In addition to these primary emissions, secondary pollutants are formed by chemical reactions in the air, mainly ozone, which is produced by combination of nitrogen oxides with volatile organic compounds in the air. So vehicular pollution dispersion models have been used globally for regulatory purposes of pollution from vehicular emissions. In India various roads and highways projects carry out the air dispersion modelling to predict the future air quality and air quality trends to make a potent air quality management plan along the proposed corridor. Dust also provides adsorption surfaces for volatile contaminants that are subsequently deposited either by dry or wet deposition, and causing phytotoxic pollutants to enter plant tissues, hence resulting in respiratory ailments in animals and humans. Grime and other air pollution from demolition and construction also greatly impacts the health and quality of life of people working and residing close to the highway. Inferior air quality also affects the health status of the surrounding people and to prove this many studies have been conducted by various researchers. Reduction in the lung function efficiency of the traffic policemen exposed to vehicular pollution on the highway crossings passing through Jalgaon city was observed. Similarly workers at the construction site are found to be suffering from pulmonary disease. Studies have also reported an increment of mortality due to chronic obstruction due to air pollution.

➔ Soil Quality

Roads serve as a major link among communities through which food and other important commodities are transported. It is an essential amenity that plays a major role in enhancing social and economic activities. However, road construction has also resulted in heavy environmental pollution especially on soil. It is clear from various reports that roadside soils may be contaminated from various anthropogenic activities such as industrial processes, energy production, vehicle exhaust, waste disposal as well as coal and fuel combustion. Soil plays an important role in assessing the potential environmental impacts of automobile emissions as soil along roadsides is being contaminated with emissions from various vehicles in the form of metal and several researchers have indicated the need for a better understanding of heavy metal pollution of roadside soils. Heavy metals reported to cause potential hazards are Cd, Cr, Pb, Zn, Fe and Cu. Public motor roads affect the natural environment to a large extent because automobiles act as line sources of heavy metal pollutants. Emissions from heavy duty and commuter vehicles on the roads were reported to contain lead (Pb), cadmium (Cd), zinc (Zn), nickel (Ni), and Copper (Cu) which are present in fuel as anti-knocking agents and these leads to contamination of air and soil. Nokware investigated the effect of automotive emissions of Cd, Cu, Cr, Ni, Pb and Zn on soil, vegetation and crops along the highway with high traffic density where decrease in concentrations of the metals with distance was found and higher accumulations of the metals on vegetation and soil samples near to the highway than from sites at a greater distance was also noted. Minute concern has been given to the likelihood of pollution by other heavy metals beside lead which can originate from automobiles, tyre wear and motor oils. Lagerwerff reported that the Cd content of three lubricating oils ranges from 0.20 to 0.26 ppm and that of three diesel oils from 0.07 to 0.10 ppm.Nonetheless, the level of contamination could lead to the leaching of these metals to adjacent farmlands and potable water sources, which would eventually find their way into the food chain. Also, constant exposures to the vehicular emissions could lead to the bioaccumulation of these metals in plants and humans until it reaches the critical maximum level of toxicity. The study provided ample information in assessment of the current status of soils adjacent to the highway and brought to the awareness of the residents imminent dangers from roadside activities.

➔ Water Quality

The roadway infrastructure causes measurable impacts on the morphology of stream and river channels which in turn disturbs the biota. Motorways escalate the energy of stream systems, causing channel erosion and scouring on one hand; and on the other hand, cut banks of lanes near streams which cause sedimentation. It has been noted that both highway and road construction projects and operational roads impose a remarkable threat on the water quality. Based on data from long-term observation of the reservoir in Taiwan, verifies the difference in water quality before and after the highway construction. The large-scale land development project harmed the water quality of the reservoir and caused prolonged degradation in its quality. Impact of highway construction projects on natural water bodies in Sri Lanka showed that both highway and link road construction activities foist a notable threat on the quality of water. The pH of water was identified as a chief factor to monitor the water quality of different water bodies adjacent to the construction sites. Severe river pollution has occurred in some cases during road construction, also it has been observed that discharges arising from road construction can be serious enough to warrant implementation of control measures. Similarly, loss of top soil near the construction site was observed mainly due to the acquisition of agricultural land and to construction dumps which also increased the levels of SPM in water. The maintenance activities associated with the roadways and the chemical spills along roads are an important source of chemical pollutants along roadsides. Some chemicals affect only the areas nearest to the road itself, while other chemicals are transported via water to greater distances from the road61. Toxic contaminants from roads enter the water bodies imperatively via stormwater runoff. The contaminants in run-off differ greatly in size and magnitude, and include various hydrated ions and suspended matter. A particularly detailed study on the effects of motorway run-off on freshwater ecosystems has also been undertaken by Maltby et . Roads act both as a source and sink for water run-off from road surface and for accumulation of water on roads. Roads can act as barriers to water flowing downhill, but can also rush the removal of water. Road networks interact with stream networks, increasing the stream drainage density, the overall peak flow in the stream drainage, and the incidence of debris flows in the drainage basin. Roads extend the drainage network of the stream network when drainage swales along roads directly connecting to stream networks. Faster moving water enters the stream channels increasing the energy of the stream system, eroding channel banks, scouring the channel and increasing the likelihood of flooding downstream.

➔ Socio-economic Impacts

Development of transport facilities, like road infrastructure, play a vital role in the socio-economic and cultural development of any region through dynamic externalities that such development often generates. It can be a cardinal element of both direct and indirect interventions for poverty reduction and improvement of socio-economic conditions of rural population which has been persistently marginalized from the benefits of aggregate economic growth. The literature linking transportation to economic variables is rich in scope and scale analysts. Researchers have sought to link transportation improvements with economic growth and development and have shown significant and positive correlations between highway transportation infrastructure and economic activity. However, there has been little assessment of the socio-economic impact of an infrastructural project like construction or widening of a highway. It is however, now being realised that the socio-economic impact analysis with a thrust on distributional issues like poverty reduction, should be made to see how important is the role of a transport infrastructural project in bringing about the distributional justice. The developing economies like that of rural India, a large public investment project on road infrastructure development, apart from its broader general equilibrium, affects the national economy and may help in ameliorating rural poverty and improving the socio-economic well-being of the people living in its proximity. Studies assert that transportation infrastructure is important in generating local economic development. The reduction in physical isolation through widespread transport networks is quintessential to raise a chief portion of the populace above the threshold of poverty. The residents in Toli and Bhawani towns of Dailekh district have been exposed to new and dynamic flow of opportunities that enhanced their livelihood due to better access to education, medical facilities and markets through roads. Positive changes in the environmental situation of the households and institutions located along the Thika highway in Kenya have been observed, especially in reference to increased investment opportunities and greater markets, but influenced mainly vegetation and wildlife, negatively. A unique link between transportation and economic development has been shown by many researchers. New manufacturing locations are systematically influenced by the provision of highway infrastructure. The development of new motorways affects the spatial allocation of new manufacturing establishments but some evidence also indicates that negative effects may occur in terms of displacement.

➔ Landscape Change and Habitat Fragmentation

It is considered by many authors that fragmentation of habitats by roads may be the imperative ecological effects of road expansion. Though studies on ecosystem fragmentation are increasing day by day, there are still very few reports which inspect the effects of fragmentation by roads. Thus, there is a wider space for research on effects of roads, habitat loss and how to overcome those effects. Many direct ecological effects on adjacent aquatic and terrestrial ecosystems have been observed during development of a road network structure but they also have far reaching, cumulative effects on landscapes which have been less well-studied. The loss of habitat, reduced habitat quality by fragmentation and the loss of connectivity through the transformation of existing land covers to roads and road-induced land use and land cover change are some major effects to landscapes due to the road network. In rural areas, mainly in developing countries, the presence of roads has been strongly correlated with processes of land cover change by facilitating deforestation. Habitat fragmentation is believed to have the greatest long-term impact on nature and the effect of road construction varies and depends on the type of road, the stage of economic development in the region. In the Amazon regional climate change, and the amount of forest fragmentation and deforestation, directly related to the construction of roads85. The basic principles of land use, transportation, network theory and ecology, comprises of ecological road network theory and provides a framework to interpret the ecological effects of road networks. Thus further, analysis of the effects of a road network on ecosystems suggests that they extend over large areas of the landscape, saturate a landscape and create isolated patches of habitat. In a study in the Rocky Mountains, Reed assessed the extent of forest fragmentation caused by roads and by deforestation. They found that motorways did contribute more to forest fragmentation than depletion of the forests. Trees may prevent land slips on to roads. In a study of woodlands in Ohio, Kupfer88 looked at patterns and determinants of edge vegetation and concluded that microclimate influences edge succession. Williams89 working on forest edges in tropical wet forests of Panama found changes in microclimate penetrating 15 m into the forests and these microclimatic changes can affect areas at great distances from the roads and change the vegetation composition. The microclimatic changes produced by even narrow roads affect the leaf litter and vegetation composition, soil macroinvertebrates, interior dwelling forest birds, herptiles, mammals and overall species richness.

CONCLUSION

Roads infrastructure affects both biotic and the abiotic components of the ecosystem by changing the dynamics of populations of plants and animals, altering flows of materials in the landscape, introducing exotic elements, and changing levels of available resources, such as water, light and nutrients. Thus, the above discussion infers the view that comprehensive impact of highway expansion has not been carried out elsewhere. This necessitate 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

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