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ENVIRONMENTAL PROTECTION MEASURES IN PLANNING CONSTRUCTION OPERATION AND MAINTENANCE OF NATIONAL HIGHWAYS IN INDIA

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ABSTRACT
Development of adequate & efficient infrastructure has been recognized as a key to economic development of the country. The national highway is the main component of infrastructure. The developments of national highways are likely to have adverse impacts on environment if these are not planned properly & the required safeguard measures are not built during their construction phase. The development process of highways will be sustainable and able to deliver its benefits to the public if environment considerations and rational utilization of resources are integrated into projects right from the initial stage of planning to construction, operation & maintenance. Environment Impact Assessment in this context is the tool to identify the environment impacts associated with proposed project activity (widening and strengthening of existing 2 lane carriageway) and to help provide the necessary mitigation measures. Significant issues to be addressed in the EIA studies. The sustainable economic development depends on the rational use of environmental resources and minimizing, to the extent possible, adverse environmental impacts through improved project selection and more responsible project planning and design. Under this strategy the development must be environmentally sound in the broadest sense. In highway development, environmental planning is concerned with good blending of improvements of physical, social, and economic parameters. It involves not only the environmental (land, water, and air) but is also concerned with integration to local, regional and national socio-economic development. Careful consideration and assessment of the surrounding environment in road construction and improvement will reduce disruption costs and harmful effects while increasing use and benefits.

INTRODUCTION

The infrastructure developments such as roads and highways play a synergistic role in the socio-economic development of a country. Inadequacy of road infrastructure is realized to be the inhibiting factor for faster development of our economy. Therefore, in the coming ten years the road development programmes in India is likely to proceed at a faster pace. Based on the growth trends and projections for future requirements of roads, the 20 years Road Development Plan (1981-2001) prepared by Indian Road Congress (IRC) worked out a need for 66,000 km long national Highways and 145,000 km long State Highway network by 2001. an Asian development bank (ADB) funded study has established a need for 66,000 km long expressway network by 2015. In addition road construction activities are to expand manifold with the taking up of building of North-south and East-West corridors and the Golden – quadrangle. Consequently, the need for the consideration of environmental aspects in the roads/highways construction operation and maintenance requires due attention. Road development can have wide ranging environmental impacts (Fig. 1) compared to many other developmental projects. This is because roads extend over long distance and by promoting rapid communication they can catalyze dramatic changes in land use patterns. Direct impacts of road projects can often be significantly reduced through the application of environmentally sound construction and operation management practices. In order to achieve this basic conditions to be fulfilled are firstly, a knowledgeable construction and operation management team which is sensitive to environmental issues and secondly, an enabling environmental where government agencies, planners and regulatory authorities encourage sound resource use. Apart from this, knowing at which stage specific types of impacts are likely to occur, and the best time to apply corresponding measures to deal with them, is crucial to the effective limitation of negative impacts of roads/highways.

If future development is to be taken on a sustainable basis, with minimum damage to the existing environmental then apart from technical,economic and financial feasibility of the road projects environmental soundness requires to be emphasized during all stages of planning, design, construction and post-construction management. This paper delves into environmentally sound management procedures need to be addressed at various phases of road/highway

projects in India.

POLICY, GUIDELINES AND LEGAL REQUIREMENT

Environmental Management at Central/National Level

Environmental Management in India took a serious turn after the enactment of Environmental Protection Act 1986, an umbrella act, by the Indian Parliament. A number of rules, regulations and notifications have been passed under the EPA, with the help of which the Government of India regulates the environmental state of the country. One of the important notifications with respect to all developmental projects in India is the EIA notification of 1994, subsequently amended and updated many times up to July, 2004. In addition to the various legislations, there have been guidelines and circulars issued from time to time for various reasons from the respective ministries for streamlining the processes involved. Some of these are the Noise Rules 2000, the Hazardous Chemicals (Handling & Management) Rules etc. There is an increasing awareness on the requirement of stringent laws for achieving the sustainable development objectives of Environmental management.

The draft Environmental Policy was released in October 2004, which addresses many issues including the present system lacunae in the field of development projects and environmental clearances. After releasing the draft Environmental policy for the country, the Government is in a major drive to improve the implementation aspects and the Environmental clearance process for proposed developmental projects. Meanwhile the Ministry of Environment and Forests, Government of India is finalising the Environmental policy.

The organisations and ministries responsible for the environmental management in India are:

- Ministry of Environment and Forests (MOEF)
- Central Pollution Control Board (CPCB)
- State Pollution Control Board (SPCB)
- Department of Environment and Ecology in different States
- The roles of other institutions like local bodies (Panchayats, Municipalities) are not yet well defined. Therefore these institutions are facing a problem in coordinating the local level activities with the Road projects. However the Ministry and Government of India are continuously trying to streamline the process especially after the EIA notification in 1994.

Applicable GOI - Legal Frame Work

The Table shows the details of the various clearances that will have to be obtained prior to the final Award of Contracting. The bidding and all other related process can proceed till the award of final contract. A summary of applicable GOI policies and regulations:

Table: Summary of Applicable GOI Policies & Regulations1

GOI Policies & Regulations	Year	Objective
Environmental (protection) Act	1986	To protect and improve overall environment
Air (Prevention & Control of Pollution) Act	1981	To control air pollution by controlling emission and air pollutants according to prescribed standards
Water (Prevention and Control of Pollution) Act and Cess Act of 1977	1974	To control water pollution by controlling emission & Water pollutants as per the prescribed standards
Forest (conservation) Act	1980	Protection of forests
The Wildlife (Protection) Act	1972	Protection Wild Life
Ancient Monuments and Archaeological sites & Remains Act	1958	Conservation of Cultural and Historical remains found in India
The Land Acquisition Act	1894 & 1989	Set out rule for acquisition of land by Government.
Noise (Regulation & Control) Rules 2000	2001	Noise pollution regulation and controls
Public liability Insurance Act	1991	Assessment of hazardous materials and accident hazards
Bio- Diversity Act	1972	The disclosure of species survey or collection activities to the National Biodiversity Authority
EIA Notification	2006	Assessment of adverse impacts of proposed projects on the environments.

According to the MOEF-GOI notifications and its amendment of June 13, 2002 no public hearing would be required for the project due to minor impacts. This document in hand is the Environmental Impact assessment report prepared to meet all legitimate contractual requirements for sustainable development. The impact to various natural resources needs to be minimized for maximum benefits due to the implementation of the projects.

[1]An exhaustive list of GOI policies and Regulations provided in Annexure 4 and also in the policy review section

No objection certificate would be required from the State Pollution Control Board under „Air and Water" Act for consent to establish & consent to operate. The requisite fees along with the NOC will have to be submitted to the SPCB by the user agency for getting NOC clearance.

The Environment (protection) Act, 1986

This act provides for the protection and improvement of environment. It extends to the whole of India. The EPA identifies Central and State Government standards set for the quality of the environment; emission or discharge of environmental pollutants; procedures and safeguards for handling hazardous substances; and relevant restricted development areas. The EIA document examines processes, materials and substances with potential to cause environmental pollution. The EA assesses if relevant standards will be breached, and confirms that relevant procedures and safeguards will be followed. Document includes procedures and safeguards for the prevention of accidents, which may cause environmental pollution and remedial measures for such pollution. The EA identifies mechanisms to notify the relevant authority in the event of a discharge of pollution exceeding the standards set.

EIA notification of MOEF Dated 14th September 2006

According to this, latest gazette notification, there are two categories of projects via, category A and category B. Category A will be cleared by the Ministry of Environment and Forest at the central level (Expert Appraisal Committee or EAC constitute by MOEF) and category B project will be cleared by the state level. If there is no State level authority constituted category of project „B" Project treated as Category „A" Project at central level.

The new notification for EIA has been issued by Ministry of Environment and Forests on 14th September 2006 and this notification surpass all other earlier notification of MOEF in this regard. As per the above notification, the Jaipur-Tonk-Deoli Section fall under category "B" Projects listed for Environment Clearance by MOEF. There were no protected areas notified under the Wild Life (Protection) Act, 1972 located within 10 kms from the boundary of the project on both side, the project has been marked as category "B" project. The Environment Clearance for this category "A" projects will be granted by Ministry of Environment and Forests in the Central Government.

The Environmental Impact Assessment Notification 1994/July 2004

This is the Ministry of Environment & Forests Notification on Environmental Impact Assessment of Development Projects. The Notification is triggered if the project is listed in schedule 1 of the Notification (includes 'Highway Projects' and 'Tarred Roads in Himalayan and/or Forest Area') or if the project occurs in a restricted area. Such projects require environmental clearance from the Central Government in accordance with the procedures specified in the notification. If environmental clearance is required, public hearing is to be conducted in each affected district, in which the Project construction activities will be carried out. If environmental clearance is required, then the application requirements for MOEF are provided in Section 3.4.

Public Liability Insurance Act, 1991
The purpose of this act is to provide for public insurance liability for the purpose or providing immediate relief to the persons affected by accident occurring while handling any hazardous substances. The EA confirms that appropriate insurance policy will be taken out. EA identifies hazardous materials associated with the project. The EA document identifies the major accident hazards. Document describes steps to prevent accident hazards and to limit their consequences to the environment. The EA indicates commitment to provide information, training and equipment to ensure workers safety. EA describes mechanisms to notify the concerned authority in the event a major accident occurs.

Forest (Conservation) Act 1980 as amended
Under this law the PWD must obtain administrative approval from the Forest Department to clear over 20 hectares of designated forestland and in 1986 when the MOEF enacted the Environmental Protection Act, the entire linear stretches of road side plantations along the State highways were declared as protected forests. According to this although the land is under the control of State Government, due to its protected Status, approval of Central, Regional or State Government for using the land for widening and rehabilitation must be obtained.
At the State level, Government was empowered to declare reserves and protected forest and was also given the authority to acquire land for extension and preservation of forests. In December 1996, a Supreme Court judgment further defined the types of forests to be protected.
Depending on the size of the tract to be cleared, clearances are required from the following levels of Government. If the forest exceeds 20 hectares then prior permission of Central Government is required. If the forest is between 5 to

20 hectares the regional Office of Chief conservator is empowered; if the forest is below or equal to five hectares

the State Government may give permission; and, If the construction area is more than 40 % forest, permission to undertake any work is required from the Central Government, irrespective of the size of the area.
The strip and linear plantations are very significant for a development project like road widening and improvement. Applicability of Forest conservation act to Roadside Strip-Plantations: The February 18, 1998 MOEF circular on linear plantations on roadsides, Canal and railway lines modified the applicability of provisions of Forest (Conservation) Act, 1980 to linear plantations. The new modification recognizes that the spirit behind the Forest (Conservation) Act was conservation of „natural forests" and not „strip plantations". In the case of the "notified to be protected" roadside plantations, the clearance may be given by the concerned regional office of the MOEF, irrespective of the area of plantation lost. While issuing the approval, in place of normal provisions for compensatory afforestation, the regional offices will stipulate a condition that for every tree removed at least two trees should be planted. If the concerned Regional office does not issue the decision within thirty days of the receipt of fully completed application, the project proponent may proceed with widening/expansion under intimation to the State Forest Department, and the MOEF.

Wildlife (Protection) Act of 1972

This Act has allowed the Government to establish a number of National Parks and Sanctuaries over the past 25 years. This Act prohibits an activity within National Park and Sanctuary areas. The EA identifies National Park and Sanctuary areas within the project study area. The EA confirms that permission from the Chief Wildlife Warden will be sought for: Undertaking activity in a National Park or Sanctuary area; and labourers and contractors entering a National Park or Sanctuary area. Document identifies the extent of habitat destruction, including number of trees removed. The EA document describes mitigation measures to minimize habitat destruction

Biological Diversity Act, 2000

This Bill prevents persons undertaking biodiversity related activities without approval from the National Biodiversity Authority. It extends to the whole of India, and approval is required from the National Biodiversity Authority. There are particular restrictions if the Project involves the participation of non-Indian persons. The EA assesses if any biological resource is required for the Project (plants, animals and micro organisms or parts thereof). EA assesses if bio-survey or bio-utilisation is needed for the Project (surveyor collection of species, etc for any purpose). EA document outlines measure to avoid or minimize effects on biodiversity.

April 10, 1997 MOEF Gazette Notification on EIA for Road Improvement Projects

According to this notification, road improvement projects are generally exempt from the environmental clearance. This exemption is for "Highway Projects except projects relating to improvement work including widening and strengthening of roads with marginal land acquisition along the existing alignments provided it does not pass through ecologically sensitive areas such as National Parks, Sanctuaries, Tiger reserve, Reserve forests". Accordingly, an EIA addressing specific actions and circumstances within the corridor must be prepared, and approvals received. After the Project receives Forestry Department and SPCB „No Objection Certificate" (NOC), the MOEF application will proceed to MOEF for review and action. The MOEF establishes a review committee and the committee may attach conditions to the NOC. In this case the proposed Project road passes near the reserve forest areas but does not have any direct impact on them.

October 15, 1999, MOEF Circular on Marginal Land Acquisition And Bypasses

According to the provision of EIA Notification of January 27, 1994 and as amended on April 10, 1997, environment clearance is required for highway projects except projects relating to improvement work including widening and strengthening of roads with marginal land acquisition along the existing alignments provided they do not pass through ecologically sensitive areas such as national parks, sanctuaries, tiger reserves, reserve forests etc. It is clarified that marginal land acquisition means land acquisition not exceeding a total width of 20 metres on either side of the existing alignment put together. Further, it is also clarified that bypasses would be treated as stand-alone projects and would require environmental clearance, only if the costs of the projects exceed Rs. 100 crores each.

Noise (Regulation and Control) Rules, 2000

As a result of considering the deleterious and psychological effects of the noise pollution on the human well-being, MOEF has drawn up the above rules, which have come to force with effect from February 14, 2000. According to the provisions of the rules notified, a person might make a complaint to the designated „Authority" in the event that

the actual noise levels exceed the ambient noise standards by 10dB(A) or more as compared to the prescribed

standards. The designated authority will take action against the violator in accordance with the provisions of these rules or other law in force.

The EA identifies all 'industrial', 'commercial', 'residential' and 'silent' zones within the project study area. EA assesses if the levels of noise generated by the project in any area exceeded the ambient air quality standards in respect of noise as specified in the Schedule of the Rules. The EA describes noise pollution control measures to achieve compliance with the ambient air quality standards in respect of noise. The EA document considers if a loud speaker or public address system is needed for Project.

The Air (Prevention and Control of Pollution) Act, 1981

This Act provides for the prevention, control and abatement of air pollution. It is triggered by air polluting activity in an air pollution control area or when emissions of any air pollutant into the atmosphere exceed the standards set by the Central and State Boards. The EA identifies air pollution control areas. The document identifies all air polluting activities and sources associated with the project. EA confirms that consent will be required for air pollution control area. The Environmental report describes mechanisms requested for the operation of industrial equipment to notify the State Board of an unforeseen release of air pollutants exceeding the standards. Remedial measures proposed to mitigate air pollution in air pollution control areas are described.

CLEARANCES REQUIRED PRIOR TO CONSTRUCTION

Tree felling permissions are required from the concerned forest department. No specific applications forms are available for this process, but applications should reach the respective DFOs. This follows a joint verification (according to species) for girth, size and classifications. The entire EA process will be carried out in tandem with the design stage with appropriate mitigation measures.

FOLLOW - UP ENVIRONMENTAL CLEARANCES FOR ROAD / HIGHWAY PROJECT

Clearances Required	Time frame	Status	Remarks
Preparation of BOQ for EMP items	After or during the preparation of EMP document.	Will be prepared as planned.	During DPR stage
PCB Clearance[2]	This will be filed after the preparation of a draft EIA report.	After August 2005	„Consent to establish" under air & water Act
Forestry Clearances	Not required according to the present design alignment	No forest area is required for widening of the road. Hence, no forest clearance would be required.	In case, forest land required at any future stage forest clearance application to be submitted to the forest department.
Permission for tree cutting	After an initial assessment by consultant, an application on plainpaper must be submitted to the concerned DFO	Will start after the Environmental Impact Assessment.	Joint survey (NHAI & Forest Department) will be required for final approval from the Forest department

The clearances required for the project include the following

- Forest Clearance if forestland is required at any future stage. (At present no forest land acquisition has been considered for the project)
- PCB clearance/ NOC for „consent to establish" under Air Act and Water Act.
- MORTH /IRC Standards and specifications - The design of the project road will be according to the IRC standards and specifications.

Clearances required during Construction

During construction stage the Contractor will be required to obtain a number of permissions, consents and clearances from various bodies. Details of these are provided in the Table 3.3.

TABLE 3.3: CLEARANCES & APPROVALS AT PRE-CONSTRUCTION & CONSTRUCTION STAGE

Sl. No	Contractors activity for which the clearances area applicable	Statute under which clearances required	Statutory Authority
1	Hot mix plants ,Crushers and Batching plants	The Air(Prevention and control) Act 1981 and the noise pollution Rules 2000	SPCB,

2	Storage handling and transport of Hazardous materials	Hazardous waste management handling rule and manufacture storage	SPCB,
3	Location and layout of workers camp, equipment, storage yards.	EP act 1986 and Environmental Management Plan	SPCB,
4	Quarries	EP Act 1986 and Environmental Management Plan	SPCB & State Mining Dept
5	Discharge from labour camp	Water (Prevention and control of Pollution) Act, 1974	SPCB
6	Disposal of bituminous and scarified waste material	Hazardous Waste management Rules	SPCB

The implementation of the environmental law is actually a challenge and can be effective only if all the agencies work together towards sustainable development.

1. ROAD/HIGHWAY PROJECT ACTIVITIES & THEIR IMPACTS

Development of road and highways often bring significant economic and social benefits on one hand, and on the other, they can have substantial negative impacts on communities and natural environment. The impacts, mostly temporary, caused by the construction of roads mainly concern the population in the immediate surroundings of the construction works and can often be mitigated effectively at project level. The most direct impact caused by the road infrastructure project is land take (landloss). This may have serious consequences for property and communities in town and for semi natural resources in rural areas and can be in conflict with other economic land use functions, such as forestry and agriculture. The largest proportion of environmental impact is caused by the use of road/highway, i.e. passenger & freight traffic. A new road project or the extension of infrastructure generally affects the overall transport system both traffic flow and model split.
The main project activities associated with road/highways and their likely impacts on the environment are as follows:

Project Activities Potential Impacts

Pre-construction Activities

- Site Surveys & Investigations Inducement of uncertainties regarding the future Inducement of land speculation Inducement of squatter influx Destruction of vegetation/cultural heritage
- Land acquisition & resettlement Displacement of population from housing Resource pressure in resettlement areas Loss of & displacement from agricultural land Unplanned development on unsuitable sites
- Displacement of public buildings/facilities Loss of cultural heritage

Construction Activities

- Site clearance of sensitive or rare habitat Loss of trees Noise, vibration and dust nuisance from building demolition Interference with services Increase in erosion/sediment deposition
- Construction camp establishment Friction between workers and local population & operation Increased pressure on local services Water pollution from sanitary and other wastes Depletion of rare/endangered species by trapping Etc. Reduction in land quality on abandonment
- Quarry establishment & operation Loss of and displacement from productive land Disturbance of wildlife and loss of habitat Generation of noise & dust nuisance Generation of blasting vibration Visual alteration in landscape quality Increase in erosion/sediment deposition Increase in slope instability
- Borrow pit establishment & Loss of productive land, Loss of sensitive habitat/vegetative cover, Waterborne disease risks on abandonment Visual alteration in landscape quality Increase in slope instability/erosion
- Establishment & Operation of Loss of productive land Spoil disposal areas Loss of sensitive habitat/vegetative cover Increase in erosion/sediment deposition Increase in slope instability Generation of dust nuisance Visual alteration in landscape quality Pollution arising from special spoils
- Mobilization of heavy plant and Overloading of road structures & damage to Machinery pavement Inducement of traffic congestion & road safety Hazards Haulage of materials Damage to road pavement & structures Inducement of traffic congestion & Road safety Hazard Increase in noise and air pollution Increase in dust nuisance Increased soiling of roads and road safety hazard
- Construction of earthworks Increased land instability Increased erosion/sediment deposition Interference with aquifers Interference with natural drainage patterns Interference with services/infrastructure Visual

alteration in landscape quality

- Construction of structures Inducement of traffic congestion/road safety Hazards Disturbance of sediments/reduction in water Quality Noise & vibration nuisance from driven piling
- Basic course/surfacing Air pollution from asphalt plants
- Operation Increase in noise nuisance
- Increase in air pollution from spillages/surface run-off Severance of communities Disturbance to fauna by noise/severance of access Loss of trees resulting from increased access
- Increase in congestion connecting roads Traffic diversion leading to loss of business Increased access threatening traditional communities
- Pressure on resources form unplanned ribbon development Increased road safety hazards
- Maintenance Interference with traffic flow Increase in road safety hazards.

ENVIRONMENTAL MANAGEMENT CONSIDERATIONS

As discussed above, road projects activities have profound impact on the environment and consequently, a need for environmental management.
Environmental management includes protection/mitigation/enhancement measures as well as monitoring. A well designed environmental management plan should address environmental issues related to all the phases of the project, from pre-construction right through to decommissioning. Therefore, to be effective, mitigation measures have to be considered at various tiers of infrastructure planning and have to address both the infrastructure design and traffic that will use it. In practice, mitigation at project level consists mostly of adapting the technical design and the materials of the infrastructure so that disturbance is avoided or minimized. Measures to be taken to address environmental issues at various phases of road project are as follows:

A. Design Phase:

Alignment: The alignment should be selected from various alternatives so as to minimize the land occupation, air pollution, and noise impact on residences, to avoid unfavorable geological conditions and cultural relics.

Interference on People: Underpasses, Overpasses & Cattlecrossing should be designed so as meet the needs of the local residents, vehicles & cattles.

Soil Erosion: In slopes and suitable places along the roadside, bush grass should be planted, and retaining wall, water intercepting ditches, and masonry rubbles should be built to prevent soil erosion. Temporary and permanent drainage systems are designed to minimize the soil erosion and the impact on irrigation canals. The affected ponds should be re-excavated (relocated) affected pond (irrigation pond).

Dust/Air Pollution: Earth borrowing sites, waste disposal sites, and asphalt mixing sites are to be identified to concern with the environmental issues like dust & gaseous emission and similar residences
Water Pollution: Sewage disposal facilities should be designed at the service areas of highway to treat the sewage before entering into public water sources.
Noise: Measures such as sound barriers, building and heightening fencing walls, should be identified and incorporated into the design and tendering documents.

Flood: Bridges and culverts have to be well designed for the purpose of the flood discharge.

B Construction Phase

Dust/Air Pollution

- Water should be sprayed during construction phase, in the lime and earth mixing sites, asphalt mixing site, and temporary roads. In filling sub-grade, water spraying is needed to solidify the material. After the impacting, water spraying should be regular to prevent dust.
- Coal ash is to be used it should contain 30% water content or more to prevent the ash from dispersing, In warehouses and piling yards, especially, The coat ashes should be covered, except where they should be used immediately.
- Vehicles delivering materials should be covered to reduce spills.
- Residences should be 500m from downward wind direction of asphalt mixing sites.
- Mixing equipment should be well sealed, and vibrating equipment should be equipped with dust-remove device. Operators should pay attention to their health.

Soil Erosion / Water Pollution

- In slopes and other suitable places along the roadside, trees and grass should be planted. On sections with high filling and deep cutting, their slopes should be covered by stone walls and planted with grass, etc. If existing irrigation and drainage system ponds are damaged, they should be rebuilt or recovered by suitable methods.
- Limestone and coal ash should be stacked together, fenced by bricks or earth wall, and kept away from water.
- In sections along the river, earth and stone will be properly disposed of so as not to block rivers, resulting in adverse impact on water quality.
- In building permanent drainage system, temporary canals and culverts should be built for the sake of irrigating drainage.
- All necessary measures should be taken to prevent earthworks and stone works form impeding the rivers and water canals or existing irrigation and drainage system.
- All justifiable measures should be taken to prevent the waste water produced in construction from entering into rivers and irrigation system.

Construction Camp

- Sufficient measures should be taken in the construction camps, i.e. provision of garbage tanks and sanitation facilities. Waste in septic tanks will be cleared periodically.
- Drinking water should meet National Standard
- Garbage should be collected in a tank and disposed of periodically.
- Special attention should be paid to the sanitary condition of camps.
- Noise
- Noise standard should be strictly enforced to protect construction workers from damage. Workers in vicinity of strong noise should wear earplugs and helmets and their working time should be limited.
- In construction sites within 150m where, there are residences, noisy construction should be stopped from 22:00-6:00.
- Maintenance of machinery and vehicles should be enhanced to keep their noise at a minimum.

Conservation of Eco-resources

- To preserve the forest, earth borrowing, pilling and building temporary camps should be prohibited in forest lands.
- Arable lands should not be used as earth borrowing whenever possible. If needed, the top soil (30 cm) should be kept and refilled after construction is over to minimize the impact on ecosystem and agriculture.
- Construction workers should be told to protect natural resources and wild animals. Hunting is prohibited.
- Construction vehicles should run at temporary accesses to avoid damaging arable lands and cattle-raising lands.

Accidental Risks

- To ensure safe construction in the temporary accesses during construction, lighting devices and safety signal device should be installed. Meanwhile, traffic rules and regulations should be actively enforced in these temporary accesses.
- During construction effective safety and warning measures should be taken to reduce accidents. The blasting time, signal, and guarding should be regulated. The people and vehicles within blasting area should be removed in time.
- Prior to blasting, thorough inspection should be conducted.
- Safety lookout should be built to prevent people and vehicles from passing after blasting. Blasting should not be carried out during rush hours so as not to cause traffic jams and injuries.
- The management and use of blasting materials should be in strict conformity with the safety requirements for public security.

Cultural Relics

- If valuable or invaluable articles such as fabrics, coins, artifacts, structures, or other geographic or archeological relics are discovered, the local related department should be notified immediately. The excavation should be stopped until authorized department identifies articles.
- Archaeologists should supervise the excavation to avoid any damage to the relics.
- Communication and Transportation
- Local materials should be used as much as possible so as to avoid long distance transportation, especially.

that of earth and stone.

- If there are traffic jams during construction, measures should be taken to move the jam with the coordination of transportation and public security department.
- Temporary access should be built at the inter-change of the highway and other roads.
- A transportation plan of materials should be formulated to avoid delivery of them at peak hours, especially on existing roads.

C. Operation Phase

Accident of Hazardous Materials

- Regional or municipal transportation bureaus should set up respective transportation coordination unit for hazardous substances.
- For delivery of hazardous substances, certificates issued by transportation department permit license, driving license, and guarding license may be made mandatory, vehicles delivering hazardous substances should be printed with unified signs.
- Public security, transportation and fire-fighting departments should designate a special route for these vehicles. These vehicles can only harbored at designated parking lots.
- In case of spill of hazardous materials, report to the relevant departments should be made at once and deal with it in accordance with the emergency plan.

Vehicle Management

- If the noise of vehicle is excessive, the vehicle is not to be permitted to run on this highway until the problem is solved. Exhaust inspection and maintenance should be enhanced.
- Public should be educated about the regulations on air pollution and noise of vehicles.
- Bulk cargo such as coal, cement, sand, etc, easily spilled or polluted over the highway, should be inspected and regulated.

Noise

- According to monitoring results, at places with excessive noise, sound barriers or other measures should be adopted.

Maintenance of Drainage System

The drainage system should be periodically cleared so as to ensure water flow

Others

The New Building is to be prohibited within 50m of the road. No new schools and hospitals should allowed within 100m from the roadsides.

D. Maintenance & Rehabilitation

Biophysical Environment:

The protection can be assisted by regular drain clearing, upkeep of vegetation on slopes and exposed surfaces, maintenance of flow speed reduction devices in drains, removal of waste materials arising from road works, and avoiding the use of herbicides and other toxic or polluting substances.

Community and Social Environment:

Impacts can be mitigated through well designed traffic management plans, the use of quiet equipment, operating during daily periods of high ambient noise, focusing attention on improvements in the quality of signs, guardrails, footpaths, and other features which contribute to safety and local accessibility

For environmentally sound road construction and management, the key questions to be addressed are – what are the major road activities that can have potentially serious impacts, and what are the action that can be planned to prevent/initiate these impacts, placing environmental clauses in contract documents can be another essential step in environmentally sound road project management. Training road crews in environmental management, ensuring management support for environmental policies and action plans, involving experts in traffic management & safety, road side vegetation & environment, to ensure that work practices meet environmental objectives; these are some of the measures which will help in integrating the objectives of environmental management with the requirements of economic growth and social development.

NEED FOR ENVIRONMENTAL IMPACT ASSESSMENT

A sustainable approach to road development requires substantial change in attitude towards the environment as it relates to the preparation and management of road projects. It involves three basic steps – firstly, the identification of full range of impacts on natural and social environment, second, quantification of these impacts.
The techniques for this analysis are often substantially different from those used in road engineering and often less well developed. In the third step, procedures need to be established for avoiding, mitigating and compensating for these impacts. These should include provision for consulting affected communities, and follow up with implementation plans and training. The process which systematically deals with these elements is called Environmental Impact Assessment (EIA).
Thus Environmental Impact Assessment (EIA) forms an integral part of the road planning process. It is defined as a technique for ensuring that the likely significant effect of a new infrastructural development are fully understood and taken account of, before the proposed project is allowed to proceed. EIA is an important tool for integrating the objectives of environmental management with the requirements of economic growth and social development. EIA serves as a valuable tool for eliminating or mitigating the undesirable effects of contemplated actions on the environment by appropriate modification in the planning, designing construction and operational phases. EIA present a clear and concise picture of the benefits and cost in terms of natural and cultural assets as well as social values associated with alternate courses of action. It is indeed the most invaluable, interdisciplinary and objective decision making tool with respect to alternate routes for development, process technologies and project sites.
From an engineering and road planning perspective, project development cycle includes preliminary and feasibility studies, preliminary design, detailed design and construction followed by operation and maintenance of the completed project. Depending on the nature of the project, consultation with various government agencies or the public, or both, may an important component in several of the early stages of this cycle. The process of environmental assessment of road projects also consists of a number of steps- screening, and scooping of the studies required, environmental studies, mitigation plans etc., as discussed above. Here also consultation with various government agencies, the public, or both depending on the nature of the project may be needed at several points. In order to integrate environmental studies into planning, design and further analysis, it is important to synchronize environmental impact assessment process with the project development cycle.

Institutional Initiatives

Restructuring and strengthening of National Highways Authority of India (NHAI), which is the implementing agency for the National Highways programme. Institutional mechanisms have been established to address bottlenecks arising from delays in environmental clearance, land acquisition etc. A special focus is being provided for traffic management and safety related issues through the proposed Directorate of Safety and Traffic Management. It is expected that the sum total of these initiatives should be able to deliver an efficient and safe highway network across the country.

In order to specify the policy and regulatory framework on a fair and transparent basis, a Model Concession Agreement (MCA) for PPPs in national highways has been mandated. It is expected that this common framework, based on international best practices, will significantly increase the pace of project award as well as ensure an optimal balance of risk and reward among all project participants.

CONCLUSIONS

Introduction of an environmental perspective into the planning, design and implementation of road project in India is relatively new, as it is only since January 1994 that environmental Impact Assessment has become mandatory for major projects. Environmental impact assessment should not be a one time process; it should be made an ongoing process incorporating environmental considerations into road planning, implementation and management. The knowledge about short-term, medium and long-term effects of roads/highways on the environment must be enhanced. Environment and social issues need to be addressed as integral parts of project planning and implementation rather than an isolated studies and future vision should focus on achieving long-term environmental, social & economic sustainability.

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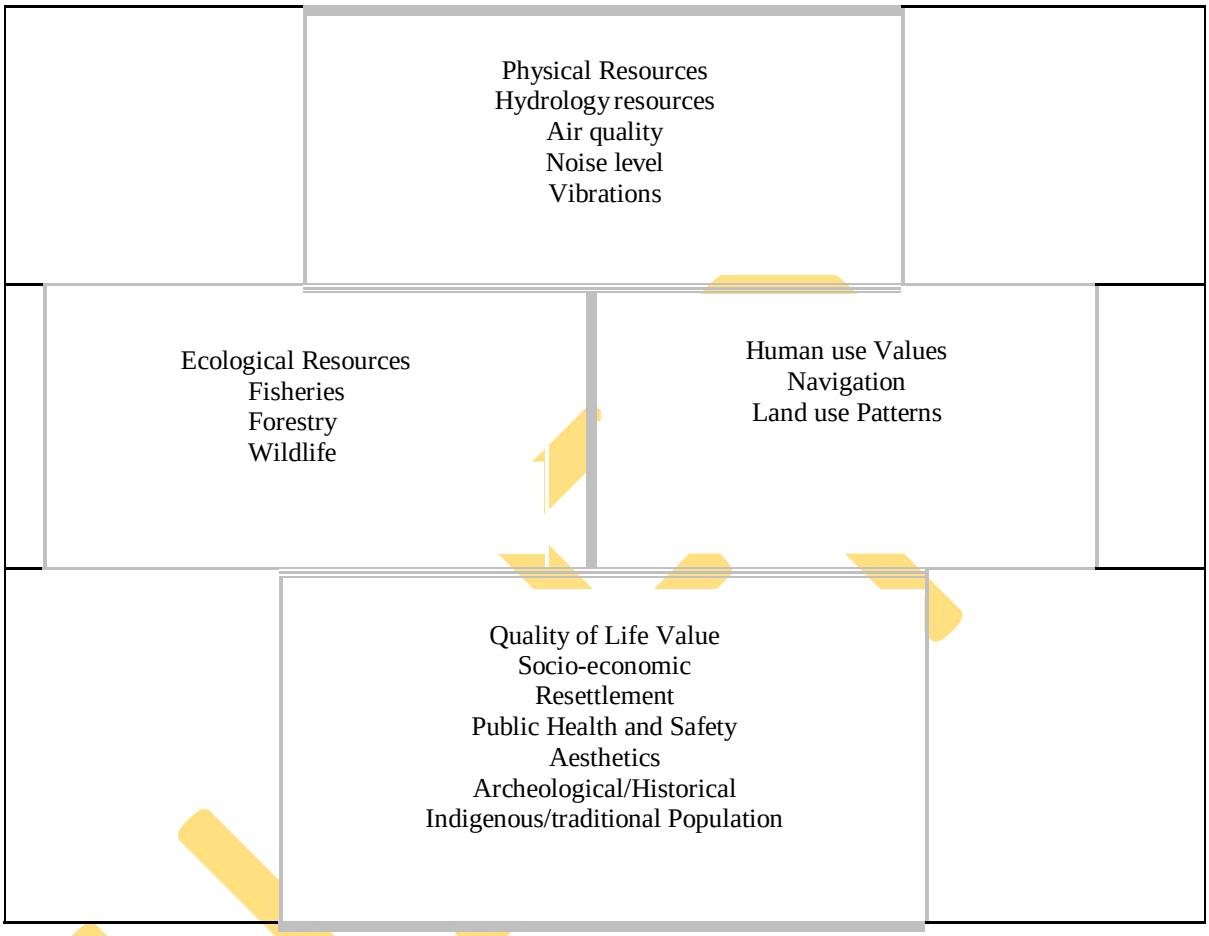

FIG. 1. ENVIRONMENTAL IMPACTS ROADS/HIGHWAYS