May 2012

ENVIRONMENTAL ASSESSMENT GUIDELINE FOR ROADS AND HIGHWAYS

National Environment Commission
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Foreword

In 1999, the National Environment Commission published six sectoral environmental assessment guidelines for the mining, roads, industries, hydropower, power transmission lines and forestry sectors. These guidelines were intended to guide different project proponents through the process of acquiring an environmental clearance for their projects. These sectoral guidelines were later revised in the year 2003 to make them more practical and relevant to the Bhutanese context and also to streamline with the provisions of the Environmental Assessment Act 2000 and its Regulation 2002.

The revised sectoral guidelines of 2003 have played a very instrumental role in guiding the proponents and the sector agencies in the Environment Assessment (EA) process. However, these sectoral guidelines were long overdue for revision and through the World Bank IDF grant the guidelines were revisited and proposed for revision. All the relevant stakeholders were consulted several times for this revision and through the expert input from both local and international consultants the guidelines were revised to align with the changing government policies and rules and with the long-term objectives of protecting our pristine environment.

The NEC is grateful to the World Bank for their financial assistance to revise and update these guidelines. The revision and updating of these guidelines were accomplished through close consultation with all the relevant stakeholders. We would also like to express our gratitude and appreciation to all the ministries and stakeholders for their active participation, support and inputs. The NEC would also like to thank the team from the Centre for Science and Environment, New Delhi for their hard work and inputs in updating these guidelines especially Mr. Chandra Bhushan, Mr. Sujit Kumar Singh and Ms. Swati Singh Syambal. We are confident that the revised guidelines will be more useful documents that facilitate and expedite the environmental clearance process.

The environmental assessment process endeavors to mitigate and prevent undesirable impacts of developmental activities. It is in no way intended to hamper socio-economic development in Bhutan but to guide project proponents and sector agencies in making right investments in land, manpower, technology and mitigation measures to ensure that their projects have the least possible impacts on the environment. It's the sincere wish and hopes of NEC that all the stakeholders' make the best use of these guidelines, which in turn will help in protecting our fragile ecosystem. Sound implementation of these guidelines will go a long way in minimizing the negative impacts of developmental activities on Bhutan's environment.

Dr. Ugyen Tshewang
Secretary, NEC

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List of Abbreviations

BAP	Biodiversity Action Plan
CA	Competent authority
CSE	Centre for Science and Environment
CSR	Corporate Social Responsibility

EA	Environmental Assessment
EC	Environmental Clearance
EIA	Environmental Impact Assessment
EMP	Environment Management Plan
ETP	Effluent Treatment Plant
FDM	Fugitive Dust Model
HAPs	Habitat Action Plans
SOx	Oxides of Sulphur
NOx	Oxides of Nitrogen
CO	Carbon mono-oxide
NEC	National Environment Commission
NEERI	National Environmental Engineering Research Institute
NGO	Non Governmental Organisation
NOC	No Objection Certificate
PAP	Project Affected Population
PM	Particulate Matter
R&R	Resettlement and Rehabilitation Plan
RoW	Right of Way
SAPs	Species Action Plan
STP	Sewage Treatment Plant
ToR	Terms of Reference

CHAPTER 1

An Introduction to the Road and Highway Sector

1.1 Background

Roads in Bhutan are categorized as *national highways, feeder roads, farm road and forest roads*. Under the existing legal framework, all roads require Environmental Clearance (EC) from the concerned authority. Apart from the environmental and social impacts, road and highway projects lead to better mobility, bring economic prosperity, creates facilities for uninterrupted traffic-flow with enhanced safety features including better road geometry and better traffic management.

Road and highway projects in most countries today require an Environmental Impact Assessment (EIA) study before they are accorded environmental clearance. This holds true for Bhutan as well. It is regulated ***under the Environmental Assessment (EA) Act, 2000 and Regulation for Environmental Clearance of Projects 2002.*** The EA Act and its Regulation establishes procedures for the assessment of potential effects of strategic plans, policies, programs and projects on the environment, and for the determination of policies and measures to reduce potential adverse effects and to promote environmental benefits. According to the EA Act, Environmental Clearance (EC) is mandatory for any project/ activity that may have adverse impact(s) on the environment. The Regulation for Environmental Clearance of Projects 2002 defines responsibilities and procedures for the implementation of the EA Act concerning the issuance and enforcement of environmental clearance. According to the legal framework, the National Environmental Commission (NEC) is the nodal agency for administering and granting Environmental Clearance (EC).

The scope of the guideline is as follows:

- Provide guidance and assistance to various stakeholders involved in the EA process.
- Assist the regulatory agency and EIA practitioners to understand the main areas of concern and use that understanding to enhance the quality of the EIA study and report.

- Inform the regulatory agency and EIA practitioners about the best environmental management practices in the highways and roads sector.
- Assist the regulatory agency to better assess the EIA report and arrive at a sound decision.

1.2 An Introduction to Environmental Impact Assessment (EIA)

According to the United Nations Environment Programme's Division of Technology, Industry and Economics, an EIA is a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, finding ways and means to reduce the adverse impacts, shaping projects to suit the local environment, and presenting options to decision-makers.

An EIA can bring about both environmental and economic benefits, such as reduction in costs and time taken for implementation and design of a project and lesser intervention of legalities and regulations. A properly conducted EIA lessens conflicts by promoting community participation, informs decision-makers, and helps lay the base for environmentally sound projects (*See Box 1: Integration of EIA in the project cycle*).

1.2 Generic steps in the EIA Process

The EIA process comprises of six key steps:

i. **Screening**: Screening helps decide whether an EIA is required for a project or not. An appropriately designed screening system can prove to be an effective tool to prevent the squandering of time and money on assessing projects with insignificant environmental impacts.

ii. **Scoping**: Scoping is considered the backbone of an EIA process, and is ideally undertaken at the project planning stage. The main objective of the scoping process is to establish the environmental and social priorities, set the boundaries for the study and

SCOPING HELPS FIND ANSWERS TO QUESTIONS LIKE:

- What are the issues to be addressed?
- How should one proceed with the EIA study?
- What is the extent of the analysis needed?
- What is the infrastructure needed?
- What kind of people should be involved in the

define the Terms of Reference (ToR). Systematic and well planned scoping forms the basis of an effective and efficient EIA process. It also helps avoid unfocused and voluminous reports. Ideally, the role of scoping is to determine three key issues: (a) Site alternatives, (b) Design alternatives, (c) Justifications for the project.

iii. **Baseline data generation**: Baseline data provides a detailed description of the existing status of various environmental and social components in the study area. Both primary and secondary data is collected to describe this status.

iv. **Impact assessment**: In this step, the characteristics of potential impacts are identified, evaluated and predicted using the baseline information on one hand and the features of the project on the other (cause-effect relationship). Impact predictions are normally done by using common methodologies and models, expert judgments etc.

v. **Mitigation of impacts**: At this stage, the possible preventive, remedial and compensatory measures for each adverse impact are determined and recommended.

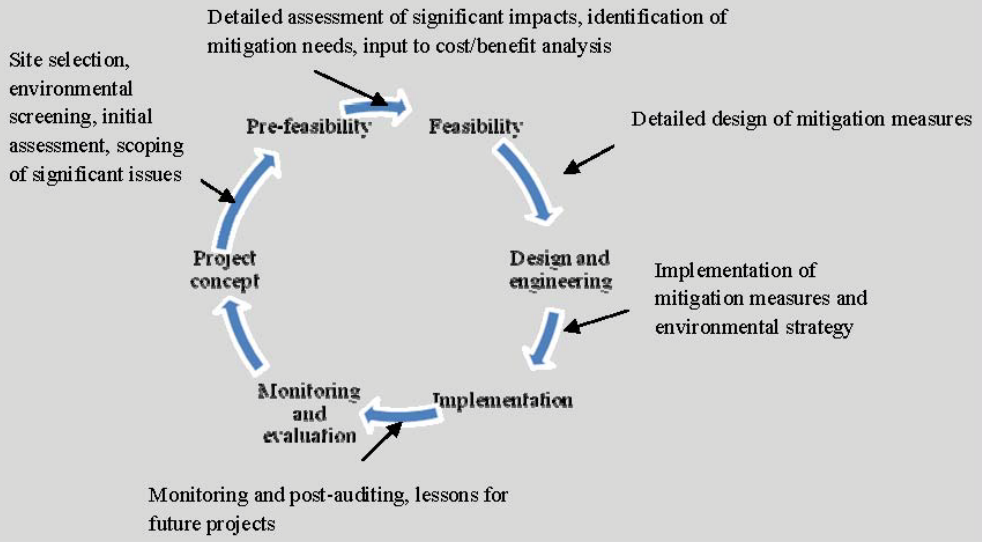
vi. **Environment Management Plan**: An environment management plan (EMP), also referred to as an impact management plan, is usually prepared as part of the EIA reporting process. It translates recommended mitigation and monitoring measures into specific actions that have to be carried out by the proponent. Depending upon specific requirements, the plan may be included in the EIA report or can be prepared as a separate document.

Box 1: Integration of EIA in the project cycle

Road and highway project is accomplished in six stages: (1) Project concept (2) Pre-feasibility (3) Feasibility (4) Design and engineering (5) Implementation and (6) Monitoring and evaluation. Environment Impact Assessment plays an important role in every stage of this cycle. Most of the EIA activities take place during the pre-feasibility and feasibility stages. Between project concept and pre-feasibility stage, the EIA process involves site selection, screening, initial assessment and scoping on significant issues. Detailed EIA assessment starts at the project feasibility stage. This includes an evaluation of significant impacts, including the gathering of baseline information, prediction and quantification of impacts, and a review of the EIA by the regulatory agency.

Following these initial steps, environmental protection measures are identified, environmental operating conditions are determined, and environmental management is established. In the last phase of the feasibility study, the monitoring needs are identified, and an environmental monitoring programme and environment management plan are formulated.

Environmental monitoring is designed to generate information on the actual impact due to the project activity, compliance with environmental conditions and the effectiveness of the environmental mitigation measures. The environmental management plan, which describes the mitigation measures, is considered in the project cycle right from the implementation of the project (during construction, operation and maintenance); the plan's aim is to reduce the environmental impacts.



1.3 Good practices in EIA

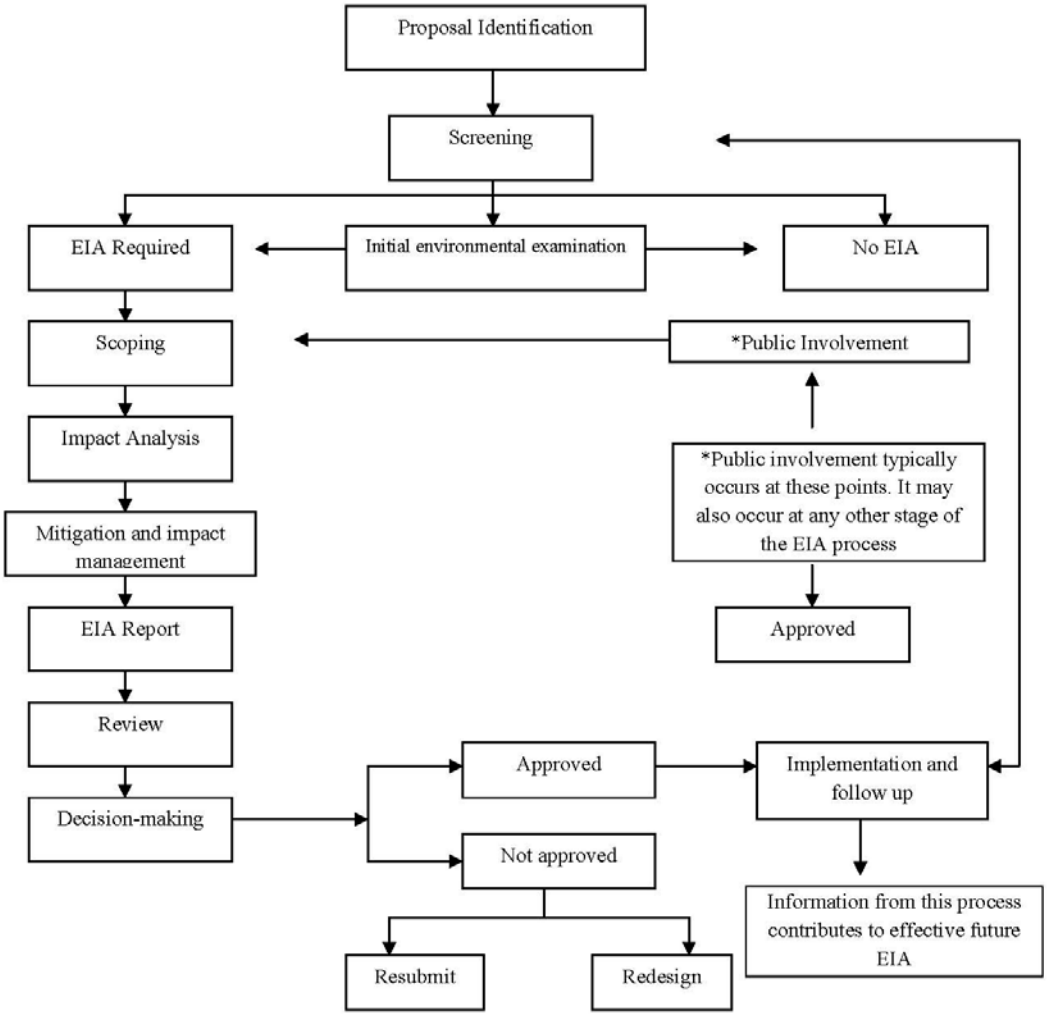
An EIA should not be used just as a tool for obtaining an environmental clearance; rather, the project implementer should see it as a management tool for sound planning of the road and highway projects. On the other hand, it should be the responsibility of competent authorities to ensure that the project causes minimal environmental impacts and brings maximum economic benefits as a whole.

The effectiveness of the EIA process depends on many guiding factors – these include: (a) the extent and kind of legal support it is getting in the host countries, (b) how the EIA is being conducted, (c)the stakeholders involvement at different stages, (d) the quality of the EIA report, (e) accreditation status of consultants who prepare the EIA, (f) how the environmental, social and economic findings are presented, (g) composition and skills of the review committee.

As a good practice, it is always recommended to conduct an initial environmental examination of the project to determine if it requires an EIA or not. It is also advisable to involve the public from the very beginning in the scoping process and in all the other phases of project development (*See Figure 1.1: Best Practices in EIA*). It is also recommended to consider the size, scale, site sensitivity and pollution potential while deciding the study area, duration and scope of EIA.

Best practices in an EIA process include preparing a report which is comprehensive and focused, and contains only the significant parameters instead of data and information which are irrelevant to the overall assessment of the project. The extent of the assessment required should be decided after careful examination of likely impacts on the environmental and existing socio-economic settings along the Right of Way (RoW) of the proposed route/ alignment. While dealing with such project in a densely populated area or when a project passes through eco-sensitive areas, option for realignment and diversion should be considered at the project planning stage to minimize the adverse impacts.

Figure 1.1: Best practices in EIA



1.4 Environmental and socio-economic impacts of the road and highway sector

Almost every stage of road construction, right from clearing/leveling to the project completion has some potential environmental impacts. In the initial stages of road/highway development, the impacts include loss of biodiversity due to forestland diversion and land clearing; economic loss or loss of livelihood due to displacement and diversion of agricultural land; and loss of local water resources due to change in drainage pattern.

The impacts of road/highway projects on a hilly terrain vary as compared to a plain area. The magnitude of impact on forest, wildlife and water resources in a hilly area is much higher as compared to plain areas. The activities such as blasting, drilling, cutting, filling, tunneling may lead to slope destabilization and thus cause landslides.

1.4.1 Impact on land, air, water and noise environment

In addition to significant impacts on land and land resources, road and highway projects also cause air and water pollution which depends on the nature of the terrain, nearness to water bodies, quantity of waste generation, etc. Air pollution is significant during all phases of the road development. [1]The potential source of dust generation includes cutting/filling, drilling, blasting, material handling, transportation, hot-mix, crushing and storage area. The problems associated with land degradation include erosion, compaction, habitat fragmentation, construction activities, borrowing and quarrying. [1]Being a linear project, the impact of project may seem minimal, but when the width of the RoW of road is multiplied by the length, the impacts are significant. It has been observed that area up to 500 meters of RoW is considered as high impact zone in the plain area.[1]

Water pollution problems arise most often during the construction of highways and are prevalent during the operational phase too. The impact of noise environment depends upon the type of cover, the land-use pattern, traffic volume, construction and maintenance activities, distance from the sensitive receptors and speed of vehicles.[2]

[1]*Roads and the Environment: A Handbook, World Bank*
[2]*Roads and The Environment: A Handbook, World Bank*

Some of the potential impacts of road/highway projects are summarized in *Table 1.1: Impacts of road development activities on land, air water and noise environment.*

Table 1.1Potential environmental and socio-economic impacts on the land, air and water environment

Pre-construction phase	• Displacement of people • Loss of livelihood • Loss of properties (movable and immovable) • Change in land use patterns • Site clearance activities may lead to a) Civil works such as earth moving and building of structures: Dust pollution, noise pollution, loss of biodiversity b) Site runoff: Increase in erosion / sediment deposition c) Influx of construction workers: Pressure on local resources and amenities d) Heavy equipment movement and operation: Noise pollution, dust generation, annoyance, health impacts on workers • Risk of erosion during site preparation due to cutting of hill slopes
Construction Phase	• In a hilly terrain in preparing the base road, some of the potential impacts due to cut and fill are as follows: a) Loss of vegetation due to land clearing b) Loss of fertile lands and diversion of natural surface water flows. c) Slope destabilization triggers landslides d) Land degradation caused by borrow pits/quarry (See *Table 1.2 Quarry-related activities and potential environmental and social impacts*) • Site preparation like excavation can lower the water table in surrounding areas while embankments and structures can raise water table by restricting flow. The impact on the ground water table is illustrated in *Figure1.2: Modifications in Water Table due to road construction activities* where there is a significant drop in the groundwater table for fill roads. In hilly terrains, a cut road leads to slope destabilization as well as in lowering of the groundwater table. Also, *Refer Figure 1.3:Chain reaction due to road development projects.* • Imprecise rock cuts leading to future rock slides • Activities such as material handling, transportation and storage area, excavation, back-filling and concreting lead to generation of fugitive dust emissions.

	• Emission of pollutants such as PM_{10}, SO_x, NO_x, carbon monoxide etc due to vehicular movements • Generation of noise and air pollution due to Diesel Generator (DG) set • Land contamination due to the following activities: a) Maintenance of machinery and operation of diesel generator sets. b) Oil spills during operation of the mechanical workshops, diesel pumps, its storage, transportation and transfer. c) Operation of the emulsion sprayer and lying of hot mix. d) Storage and stock yards of bitumen and emulsion. e) Excess production of hot mix and rejected materials.
Operation stage	• Road accidents • Landslides in rainy season • Increase in air pollution due to gaseous pollutants such as SOx, NOx, CO. • Nuisance and disturbance to people living on both sides of the road alignment • Annoyance due to increase in noise levels • Soil contamination by spill from accidents or leakage from vehicles carrying hazardous chemicals.

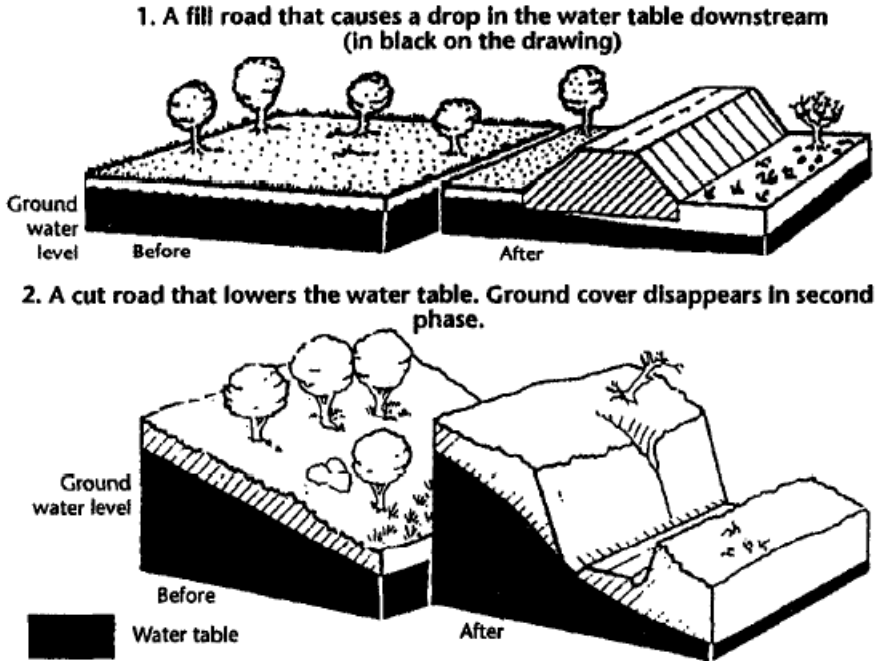
During road construction activity, quarry processes also have significant impacts such as pollution, loss of habitat etc. (*Refer to Table 1.2:Impacts due to Quarry related activities).*

Table 1.2Quarry-related activities and potential environmental and social impacts

Activity	**Potential Impacts**
Site clearing for project development	• **Civil works such as earth moving and building of structures:** Dust pollution, noise pollution, loss of biodiversity • **Site runoff:** Increase in erosion / sediment deposition • **Heavy equipment movement and operation:** Noise pollution, dust generation, annoyance, health impacts on workers • Loss of productive land. • Loss of habitat for animals. • Discharging sediment material into water courses affecting in-stream habitat
Waste (Overburden, spoil, debris, muck) and stockpiles	• Dust emissions affecting amenity and health. • Land instability from incorrect earth removal or unstable deposition of spoil, leading to landslides or erosion events. • Discharge of sediment into water courses affecting in stream habitat.

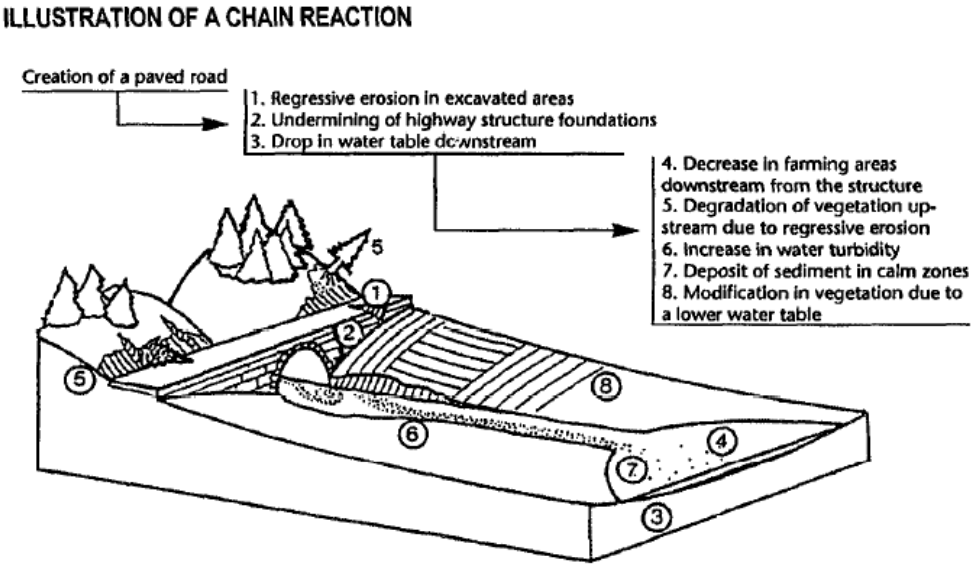
Dust emissions due to activities such as blasting, transportation etc.	• Nuisance and health issues for locals. • Air and noise pollution
Noise, air blast and vibration from blasting, machinery and traffic	• Disturbances to livelihoods and amenity. • Damage to structure
Quarry traffic	• Nuisance and safety issues for locals. • Noise and dust
Storage and use of fuel, chemicals and explosives.	• Discharges to water courses affecting water quality and aquatic life. • Risk of land contamination.
Altering water flow	• Reduced water flow from springs to water ways and irrigation / drinking water schemes • Changes in water flow direction • Increased stormwater run off
Site restoration.	• Erosion and landscape scarring after quarrying has ceased. • Weed infestations.

Figure 1.2: Modifications in water table due to road construction activities



(Source: Roads and The Environment: A Handbook, World Bank)

Figure 1.3 Illustration of a chain reaction due to highway project



(Source: Roads and The Environment: A Handbook, World Bank)

1.4.2 Impact on biodiversity

Road and highway projects tend to have significant impacts on the bio-diversity of the area the road passes through. The impact on biodiversity foremost depends upon the season, climatic condition and sensitivity of the area. *Table 1.3 illustrates the various impacts caused by road development projects on biodiversity*.

Table 1.3 Impacts caused by road development projects on biodiversity

Fragmentation of Habitat	• Roads tend to fragment an area into weaker ecological sub-units. • Various species of plants and animals are on the decline due to habitat fragmentation and overexploitation (destroys and fragments wildlife habitat, blocks migration routes, facilitates encroachment, and encourages poaching and death of animals).

	• Removal of vegetation and uprooting of trees leads to negative changes in micro-level wildlife habitat and the surrounding environment.
Loss of Habitat	• Cutting of hill slope, earth removal from borrow areas and quarrying activities may affect aquatic ecology and wildlife. • Roads intersect the habitat of wild species and also the availability of resources to them.
Corridor Restrictions	• The construction of highways blocks a wildlife corridor; the result is either termination of use of the corridor because animals are reluctant to cross the road, an increase in mortality because of collisions with vehicles, or a delay in migration which may result in the weakening or disappearance of an entire generation of the population. • The chances of accidental deaths and poaching of animals also increases during the operational phase of roads. • Increases the conflict between humans and wildlife.
Injury and Mortality of Wildlife	• Road kills can have significant impacts on the population dynamics of species, especially those with restricted and declining species.
Impact due to pollution	• Impact due to changes in water quality, soil profile, noise, light and air pollution, which may affect the nature and character of habitat.

1.4.3 Impact on socio-economic environment

Roads and highway projects brings about development by improving mobility, improving living standards by bringing economic growth, prosperity and development, where roads are developed. But, road/highway projects also have significant social impacts, due to displacement- the affected people lose their movable and non-movable assets, including their homes, communities, productive lands, pastoral lands, cultural sites, livelihoods, social and cultural networks etc. The effects of such impacts are mostly permanent and irreversible. It may also lead to spread of new diseases such as HIV/AIDS. Also, during the operational stage, issues like increase in road accidents and pollution that is generated from vehicular movements affect the people residing in and around the RoW.

CHAPTER 2

Scoping

2.1 Introduction

The primary function of scoping also referred to as setting the Terms of Reference (ToR) of an EIA, is to establish the environmental priorities and set the boundaries for the study. The objective of the ToR is to make the assessment process concise and focused, and avoid creating a voluminous or data deficient report. The ToR provides the benchmark for data collection and limits the possibility of inefficiency in the EA process. It is also acts as a benchmark to be used by the competent authority/NEC to decide whether the EIA report has been compiled after meeting all the requirements or not.

There are various tools that can be used for scoping, such as ***questionnaire checklists, network method, comparison with other similar projects, matrix and ad-hoc methods, etc***. The selection of scoping tools largely depends on the size of the project and the existing environmental and social setting.

The ToR given below is a generic one and can be framed as per the project requirements. While framing the ToR, ground realities, background information of the study area, site sensitivity, existing guidelines, policies, applicable laws, rules, and project-specific peculiarities need to be added to make it relevant and realistic. Site visit is also recommended before framing the ToR; this enhances the scope of EA process and makes it more efficient.

2.2 Terms of Reference (ToR) for road/ highway projects

The ToR of road and highway project should include the following:

2.2.1 General information

- Executive summary of the project, which gives an account of the project characteristics, environmental and social issues, and proposed mitigation measures.
- A timeline for conducting the EIA study

- Information about the project proponent (a) Name of the project (b) Name of the applicant (c) Present mailing address including telephone number, fax, and email (if any) (d) Name of the environmental focal person (e) Telephone number of focal person

- Project Objectives: List the main objectives of project in bullet form.

- Specify the Category of road.

- Justification chosen for the preferred alignment and list of alternatives considered.

- Name of organization/consultant preparing the EIA report, qualifications and experience of experts involved in the EIA report preparation.

- List of complains/litigations against the particular project, if any.

- List of all regulatory approvals and No Objection certificate (NOC) required for the project and the status of these approvals.

- Project financial statement and the project activity schedule.

- Project Location: Provide the name and location of the take-off point for the road. If the place has no name, mention the name of the nearest place and identify the takeoff point as being e.g. *2.4 km west of xxxx*. Follow the same procedure for the termination point. Show the estimated length of the road either in meters or in kilometres. Construct a Table similar to Table 2.1 specifying the road location by stating which *Dzongkhag*, *geog* and town the road is located in or passing through. The location must be specified in terms of road chainage. For example chainage 0+000 – 12+230, Wangdue Dzongkhag, Lobesa Geog. *12+230 should be read as 12 km and 230m*(*Refer to Table 2.1: Road location details by Dzongkhag and Geog*).

Table 2.1 Road location details by Dzongkhag and Geog

C Road Chainage		**Dzongkhag**	**Geog**	**Town/Village**
From	**To**			

- A declaration stating that the information disclosed in the EIA report is correct

2.2.2 Essential maps for EIA of road/highway projects[3]

- A map specifying rivers, protected area boundaries, Dzongkhag HQ, important historical sites and other main towns located along the length of the road.

- A map specifying the forest cover along the length of the road/highway project, if applicable, and marking the presence of biological corridors, national park, sanctuaries, occurrence of any endangered/threatened flora and fauna species and/or plants and animals of economic/ecological importance.

- Drainage map along the length of the road.

- A map specifying the land use pattern along the proposed route/alignment.

- A topographic map of scale 1:50,000 showing the proposed road alignment together with alternative options, the location of quarry sites, excavated material dump sites and existing infrastructure.

Note: Depending upon the type of road, road length and sensitivity, NEC/CA can define the study area and recommend an appropriate scale for Environmental Assessment.

2.2.3 Project description

- Details of villages, districts, elevation above mean sea level, latitude and longitude of important locations from where the alignment will pass.
- Name of the project and provide brief description of the project mentioned in *Table 2.2.*

[3] Application for Environmental Clearance Guideline for Highways and Roads, 2004

Table 2.2 Road specification/quantities

Description	Unit
Name of the project	
Road RoW width	M
Formation width	M
Pavement width	M
Pavement material	
Volume of excavated material	m^3
Maximum road gradient (from chainage to chainage)	%
Cross drains(pipes)	No
Box culverts	No
Bridges (major, minor)	No
Total length of bridges	No
V-shaped side drain dimensions (horizontal *vertical)	Cm
Total length of V shape drains	M
Box shape side drain dimensions (l*b*h)	Cm
Total length of box drains	M
Number of bridges (Major,Minor)	
Length of bridges	M
Width of bridges	M
Number of villages through which alignment passes	
Population of the villages through which alignment passes	
Length of new alignment proposed in agricultural land	
Width of new alignment proposed in agricultural land	
Length of new alignment proposed in forest area	
Width of new alignment proposed in forest area	

Source: Application for Environmental Clearance Guideline for Highways and Roads, 2004

- Details of the topography of length of new alignment *(Refer to Table 2.3:Topography and observations along the road).*

Table 2.3 Topography and observations along the road

Chainage (km+m)	Distance (m)	Side Slope in percentage (% or degrees)	Observations on geology and possible problems arising from required	Method of Slope-terrain stabilization Above road Below road
From To				

Note: *In the column observations describe the area's geology and possible problems arising from the terrain, such as susceptibility to landslides.*

- Detailed geological investigation and highlight the technical and environmental issues arising from this investigation.

- Briefly state the technique of excavation of materials, how the excavated materials will be managed and how they will be safely disposed off so as to avoid landslides and associated pollution risk.

- If the project requires explosives, discuss the total quantity (approx) of explosive material required and state the blasting technique that will be adopted.

- **Information on existing land use pattern**

  a) Describe the land use pattern along the RoW (as per the Road Act, 2004).

  b) Presence of sensitive areas (if any) along the length of new alignment proposed such as forests, national parks, historical or archaeological sites, residential areas, parks or playing fields, tourist resorts etc in the study area and their distances from the road alignment.

  c) If the proposed route involves any migratory path of animals, details about fauna, habitat and period of the year in which the activity takes place.

  d) Describe the characteristics of topsoil, its thickness and estimates of total quantity of topsoil (approx) to be produced during land clearing;

the EIA should discuss the management plan for topsoil conservation and utilization in the EMP, *wherever applicable*.

2.2.4 Activities for site preparation

The activities involved during site preparation are:

- For a hilly terrain, out of the length of new alignment proposed, the percentage of cut road and fill road to be specified in detail, *wherever applicable.*

  (a) If the proposed route is passing through low lying areas, details of fill materials and initial and final levels after filling above MSL along with sourcing of fill materials, mode of transportation and pollution control measures for air and water pollution, *if applicable*.

  (b) If the proposed route involves stripping/cutting of earth, the details of the area to be stripped/cut including depth of cut, locations, volume and quantity of earth to be removed including top soil details, *if applicable*.

- If the proposed route involves tunneling, the details of number of tunnel to constructed, length, locations of tunnel along with volume and quantity of earth to be removed and its proper disposal and reclamation.

- In case the road passes through a flood plain of the river, the details of flood plain characteristics such as micro drainage, flood passages and information on flood periodicity in the area should be provided.

Note: In case of widening/improvement of the existing road, the following additional information should be provided:

a) **Environmental compliance status** for the existing project should be explained in detail.

b) **Accident data and geographic distribution** should be reviewed and analyzed to predict and identify trends – incase of expansion of the existing highways

c) **Road factors:** (i) Land width (ii) Geometrics – curvature, gradient, and pavement width etc. (iii) structural condition of road and road structures

d) **Traffic factors:** Traffic volume- vehicles per day/traffic composition/average speed of travel/ Presence of road intersection – numbers /km and access control

2.2.5 Information on technologies and resource requirement

- Description of various utilities required for construction such as hot-mix, crushers, quarries, dumpers, sprinklers, etc., their capacities, raw material requirement and associated pollution potential and environmental safeguard for pollution abatement and control.

Note: For quarry operations refer to the sectoral guideline on mine and quarry.

- Water balance, detailing the water usage during construction of the road.

- Details of workforce to be employed (national/international) as well as necessity for imparting any specialized skills to them to be eligible for such employment in the project.

2.2.6 Baseline data

- Details of potential landslide/ avalanche area, wherever applicable to be provided along the RoW

- Data on surface and sub-surface water characteristics including an inventory of streams, rivers, springs, water-crossings, waterfalls.

- Detailed information on existing natural drainage/run-off patterns along the length of new alignment.

- *Data on ambient air quality:* This should include parameters such as PM_{10} and gaseous pollutants, and site-specific information on existing meteorological conditions such as temperature, humidity, rainfall and wind speed and direction.

- Details about the potential sources of fugitive dust emissions and list of activities that may generate fugitive dust.

- Inventory of hazardous wastes/chemicals, including its quantity, *if applicable.*

- Information on areas likely to be affected by noise including the identification of project activities, during construction and operation phases, which will affect the noise levels. Monitoring should be done for 24 hrs at each location.

- Inventory of trees to be cut down along the RoW.

A. Socio-economic

- Describe with the help of maps the number of villages getting affected, scope of land acquisition and how it is important from investment perspective. The report should provide option for alternative or any substitute to avoid or minimize land acquisition with appropriate justification.

- If land acquisition is involved, the report should give the extent of land to be acquired for the project along with name of affected people with following information:

a) Village-wise list of the affected persons or family-wise along the proposed route/alignment.

b) The extent and nature of land and immovable property to be acquired from affected persons

c) A list of agricultural labourers in such area including the names of such persons whose livelihood depends on agricultural activities;

d) A list of persons who are likely to lose their employment or livelihood or likely to be alienated wholly or substantially from their main sources of trade, business, occupation due to acquisition

e) Non-agricultural labourers, including artisans in such area, if applicable.

f) A list of indigenous groups, vulnerable communities etc., if any,

g) List of public utilities and government buildings which are affected or likely to be affected,

h) Details of public and community properties, assets and infrastructure, likely to be affected along the RoW.

B. Bio-diversity

If road/highway project is passing through ecological sensitive areas, EIA report should provide with following details:

i. Type of forest being diverted for non forest use and status of forest cover in the length of new alignment proposed.

ii. Presence of any of the following along the length of the new road alignment: unique habitat, endemic, threatened or declining species, or species of high economic and cultural value.

iii. Option for any alternative in case of areas which support unique habitats, endemic, threatened or declining species, or species of high economic and cultural value to society or ecosystem.

iv. Detail lists of flora and fauna.

2.2.7 Impact assessment

- Impact due to acquisition of land
- Impact on water resources due to land clearing, civil works, cutting, filling, blasting, tunneling and other allied project activities.
- Impact of project and allied activities on surface/subsurface water quality.
- Impact on biodiversity
- Impact of the project on natural drains and local hydrology.

- Impact of project due to slope destabilization caused due to cutting, filling, blasting and quarry activities.

- Impact of the road and highway construction project and other allied activities on ambient air quality.

- Impact of generation of waste (debris, spoil, muck) on air quality and water environment.

- Impacts of fugitive emissions and noise on workers and local community during the construction phase of road development project.

- Impact noise on workers and the local community.

- Impacts due to influx of construction workers.

- Accident data distribution should be reviewed and analyzed to predict and identify trends for correction and for future use – incase of expansion of the existing highways.

- Beneficial impacts of the project.

2.2.8 Mitigation and Environment Management Plan (EMP)

The EMP should discuss the mitigation measures to be taken against each impact**,** the timeline for completion, the responsible departments for implementation, and the budget for the EMP, post-monitoring provisions and reporting to the concerned regulatory authority.

- Detailed management plan to reduce landslides and ensure slope stabilization, *wherever applicable*.

- Progressive year-wise green belt development along the RoW of road/highway. An afforestation plan should be developed to compensate for the cutting of the trees during the proposed road construction activity.

- If the road/highway project involves land reclamation, EMP should provide details of the activities for which land is to be reclaimed and the area of land to be reclaimed, *if applicable*.

- Management plan for topsoil utilization and conservation.

- Management plan for debris/soil/muck generated.

- Mitigation measures for control of erosion and run-off.

- A detailed mitigation plan for biodiversity protection and conservation including protection of species affected by habitat fragmentation, *wherever applicable*.

- Preparation of a Resettlement and Rehabilitation plan (R&R) if displacement is involved. The plan should include details of the compensation provided, including land-for-land compensation, employment or money; provisions at the resettlement colony (such as basic amenities including housing, educational facilities, infrastructure and alternate livelihood potential); a clear timeline for implementation; responsibility; budgets; grievance mechanism, etc.

- Management plan to reduce fugitive emissions.

- Plan for noise abatement and control from equipments, operations (blasting and drilling) and transportation.

- Storm water management plan.

- Quarry management plan, including reclamation/restoration, *if applicable*.

- A management plan for occupational health and safety of the workers and nearby local community.

- Road safety measures planned to reduce road accidents

- Traffic management plan

- Plan for accident prone areas.

- Provision of speed breakers, safety signals, service lanes and footpaths should be examined at appropriate locations throughout the proposed road to avoid the accidents

- Emergency preparedness.

- The organizational set-up and requirement of manpower for environmental, health and safety management, including monitoring schedule.

- Provisions for various facilities to be provided in terms of parking, rest areas and canteens for workers and drivers.

CHAPTER 3

Impact Assessment

3.1 Introduction

The scientific and technical reliability of an EIA study depends on the skills of the EIA practitioners/reviewers, who estimate and review the nature and magnitude of the environmental change that the proposed project may entail. Impact prediction and evaluation is a vital exercise for assessing impacts, deciding alternatives, setting down mitigation measures and developing an environmental management plan. Predicting the magnitude of impacts and evaluating their significance is the core exercise of impact assessment. This process is also known as impact analysis and can be broadly broken down into three overlapping phases:

- *Identification*: To specify the impacts associated with each phase of the project and the activities undertaken

- *Prediction:* To forecast the nature, magnitude, extent and duration of the main impacts; and

- *Evaluation:* To determine the significance of residual impacts after taking into account how mitigation will reduce a predicted impact.

In assessing the environmental impacts and their significance, some key concerns have to be kept in mind:

- Identity who or what is affected
- Description of how they are affected
- Evaluation against a set of consistent assessment criteria

Normally, in impact assessment, potential impacts can be categorized into various parameters ranging from its type and nature to magnitude and reversibility, each signifying its importance in impact prediction and decision making (*See Table 3.1: Parameters which determine impact characteristics*).

Table 3.1 Parameters which determine impact characteristics

Parameters	Description
Type	Positive or negative
Nature	Direct, indirect, cumulative
Magnitude or severity	Low, moderate, high
Timing	Short term, long term, intermittent, continuous
Duration	Temporary/permanent
Reversibility	Reversible/irreversible
Significance	Local, regional or global

Source: *EA Training Resource Manual, Second Edition 2002, United Nations Environment Programme (UNEP), p 263*

3.2 Impact identification

In EA of a road/highway project, the potential impacts are globally well documented, and do not normally require extensive impact identification. However, there are some impacts such as displacement, loss of livelihoods, influence of topography and site clearance on water and air pollution, feasibility with respect to land use, geological characteristics, other sensitive receptors such as forest/biodiversity etc., which are site-specific and can only be identified once the data on them is available or generated. There are various tools that can be used for impact identification, such as questionnaires, checklists, network method, comparison with other similar projects, matrix and ad-hoc methods.

To ensure effective impact identification, one should always opt for a simple, logical and systematic approach. As a good practice in EA, it is always recommended to consider all potential project impacts and their interactions. At the same time, it is important to ensure that indirect and cumulative effects which may be potentially significant are not unintentionally omitted. All the identified impacts may not require a detailed analysis and evaluation – the level of detailing should match the scale, sensitivity and complexity of the impact. The choice of the chosen methodologies should reflect these criteria.

3.3. Impact Prediction

Predictions of impacts are normally based on commonly used qualitative and quantitative methods and models. Expert judgment and comparison with similar projects can also be used for impact prediction. While there are a number of

models for predicting impacts on physical environment (air, water and noise), modeling socio-economic and cultural impacts is difficult and is generally done through qualitative assessment or economic analysis. A model can be effective only if the input data is correctly inserted. The use of models, therefore, should be done with care and prudence considering factors like availability and reliability of data.

The sophistication of the prediction methods to be used should be kept in proportion to the 'scope' of the EA. For instance, a complete mathematical model of atmospheric dispersion should not be used if only a small amount of relatively harmless pollutants is emitted. However, if the project has very high air pollution potential then all possible modeling exercises should be done to predict the impact on ambient air quality. All prediction techniques involve assumptions and uncertainties. While quantifying and stating an impact, these assumptions should be clearly identified. Also, uncertainty of prediction in terms of probability and the margins of error should be mentioned. *Table 3.2* gives the list of general prediction models/methods used for assessing the impact of road and highway projects.

Table 3.2: General models/methods used for impact prediction

Impacts	**Assessment method/model**
Air quality	Air dispersion models • **ISCST 3** (appropriate for point, area and line sources; applicable for flat or rolling terrains; requires source data, meteorological data and receptor data as inputs). • **PTMAX** (screening model applicable for a single point source; computes maximum concentration and the distance of maximum concentration occurrence as a function of wind speed and stability class). • **PTDIS** (screening model applicable for a single point source; computes maximum pollutant concentration and its occurrence for the prevailing meteorological conditions; requires average meteorological data (wind speed, temperature, stability class etc.); used mainly to see the likely impacts of a single source. • Fugitive dust model (FDM)
Soil erosion	• Soil loss models such as revised universal soil loss equation (RUSLE)
Floods (if applicable)	• Peak flow hydrograph for rainfall-runoff events in large river basins or small urban watersheds • HEC-HMS

	• FLO-2D • TUFLOW
Ecology	• Ecological models • Comparative evaluation of conservation value • Expert opinion *(See 5:Summary of field techniques for establishing ecological assessment)*
Land use	• Map overlay techniques • Comparative valuation against structure and/or local plans
Noise	• *Dhwani:* For prediction of impacts due to multiple noise sources, developed by NEERI, Nagpur, India • SoundPLAN: Noise and air pollution planning and mapping software • FHWA (Federal Highway Administration): Noise impact due to vehicular movement on highways
Socio-economic	• Cost-benefit analysis • Metaphors and analogies: Experience gained in similar kinds of projects is used to predict the socio-economic impacts. • Extrapolative methods: Prediction based on the linear extrapolation of current trends. • Normative methods: Desired socio-economic goals specified, and an attempt made to project the social environment backwards in time to examine whether existing or planned resources and environmental programmes are adequate to meet the goals.
Potential risk and disaster	• Risk assessment

3.4. Impact evaluation

In impact evaluation, the predicted adverse impacts are judged for their significance. Therefore, the criteria for evaluating the significance of impacts and their effects should be set in advance (*See Box 2: Impact evaluation criteria*).The criteria for evaluating the significance should be based on local standards wherever possible. Where local standards are not available, acceptable international standards should be used (e.g. IFC, WHO or USEPA standards and guidelines of others countries, etc.). In all cases, the choice of the appropriate standard must be robust, defensible and relevant to the local situation. If there are no appropriate existing standards available, then the criteria should be developed and their use must be clearly explained in the EIA. As a good practice in impact evaluation, it is better to use established procedures or guidelines, or relevant criteria which are comparable. While doing impact evaluation, it is equally important to understand the nature and characteristics of impacts on potential target areas, such as air, water, land, human beings, etc. to understand the significance, importance and intensity (*See Box*

Box 2: Impact evaluation criteria

- Comparison with laws, regulations or accepted national or international.
- Consistency with international conventions or protocols.
- Reference to pre-set criteria such as conservation or protected status of a site, features or species.
- Consistency with government policy objectives.
- Comparison with best practices
- Existing environmental and social stress in the area.
- Extent of impact on biodiversity.
- Acceptability to local community or general public.
- Severity of the impact (reversible or irreversible).

Box 3: Possible evaluation criteria for determining impact significance

- No impacts
- No significant impacts without or with available and practicable mitigative measures
- Impacts, but significance not quantifiable
- Significant impacts even with available and practicable mitigative measures
- Impacts cannot be mitigated

3: Possible Evaluation Criteria for determining impact significance). It is also essential to find out the answers to the following three questions:

- Are there residual environmental impacts?
- If yes, are these likely to be significant?
- If yes, are these significant effects likely to occur? Is the probability high, moderate or low?

CHAPTER 4

Mitigation and Environmental Management Plan (EMP)

4.1 Introduction

Mitigation is the process of providing solutions to prevent impacts, or reduce them to acceptable levels.

The objectives of mitigation are:

- To enhance the environmental and social benefits of a proposal;
- To avoid, minimize or remediate the adverse impacts; and
- To ensure that the residual adverse impacts are kept within acceptable levels.

A good road/highway development project should incorporate environmental and social alternatives at the initial stages of project development. However, there are some which can be managed only after impact identification and prediction.

Mitigation measures can be classified into **structural** and **non-structural measures**.

- ***Structural measures*** include design or location changes, engineering modifications and construction changes, landscape or site treatment, mechanization and automation, etc.

- ***Non-structural measures*** include economic incentives, legal, institutional and policy instruments, provision of community services and training and capacity building. Non-structural measures are increasingly being used now. They can be applied to reinforce or supplement structural measures or to address specific impacts.

An Environmental Management Plan (EMP) is a framework for the implementation and execution of mitigation measures and alternatives. It usually covers all phases of the project, right from pre-construction to the operation and

maintenance phases of the road/highway project. The plan outlines mitigation measures that will be undertaken to ensure compliance with environmental laws and regulations and to eliminate adverse impacts. The objectives of an EMP, thus, are:

- To ensure that mitigation measures are implemented;
- To establish systems and procedures for this purpose;
- To monitor the effectiveness of mitigation measures
- To ensure compliance with environmental laws and regulations
- To take any necessary action when unforeseen impacts occur.

The EMP outlines:

- The technical work schedule to carry out the mitigation, including details of the required tasks and reports, and the necessary staff skills and equipment;
- The detailed accounting of the estimated costs to implement the mitigation plan;
- A plan for operation or implementation of the mitigation plan, including a staffing chart and proposed schedules of participation by the members of the project team, and activities and inputs from various government agencies.

The EMP should also address the formation of a monitoring committee, with the objective of finding out whether different pollution-related issues and social development programmes related to health, education, roads, infrastructure, employment etc., are keeping to the time schedule or not. In case of delays, the reasons for the delay need to be identified and suggestions made for removing them.

EMP and post-project monitoring

A good EMP should contain the following:

- A summary of all potential impacts
- A detailed description of recommended mitigation measures
- A time-line for implementation of mitigation measures

- Resource allocation and responsibilities for implementation
- A programme for surveillance, monitoring and auditing
- A statement of compliance with relevant standards
- A contingency plan when the impacts are greater than expected

The programme for surveillance, monitoring and auditing should clearly identify the following:

- Parameters for monitoring all significant impacts, including impacts on bio-diversity and socio-economic impacts
- Monitoring locations, including sample surveys, to assess the socio-economic impacts
- Frequency of monitoring
- Reporting frequency to the regulatory agency
- Provision for annual environmental and social audit of the project

4.2 Mitigation measures and EMP

Some of the environmental and social mitigation measures for road and highway are given in *Table 4.1*

Table 4.1: Mitigation measures and EMP for road/highway

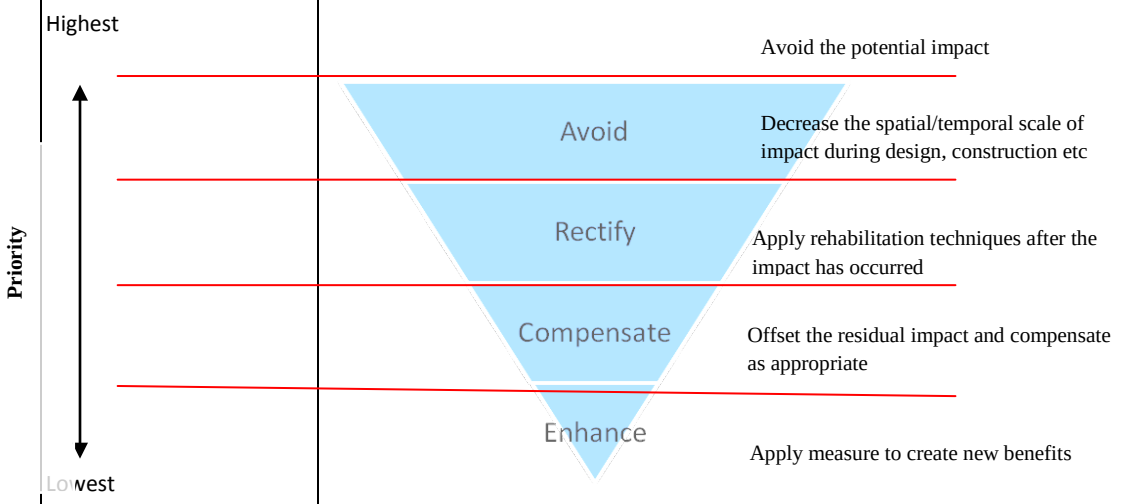
Mitigation Measure to reduce impact on land	• Minimizing the area of ground clearance • Avoiding sensitive alignments, such as those which include steep hillsides, ecological sensitive areas. • Balancing filling and cutting requirements through route choice • Avoiding the creation of cut slopes and embankments which are of an angle greater than the natural angle of repose for the local soil type • Scraped topsoil should be used immediately for plantation/agriculture. • **Replanting** cleared areas and slopes for reducing erosion and stability; it should be undertaken as early as possible in the construction process, before erosion becomes too advanced. Vegetation should be selected to serve a specific engineering function such as *Vetiver grass* having special properties in stabilizing slopes and thus helps in resisting soil erosion. • **Slope Protection**: Some of the well-established engineering measures for slope protection include: a. Terraced or stepped slopes to reduce the steepness of a slope. A

	berm (or risberm) is the level section between slope faces, riprap, or rock material embedded in a slope face, sometimes combined with planting. b. Retaining structures, such as gabions (rectangular wire baskets of rocks), cribs (interlocking grid of wood or concrete beams, filled with earth or rock), or other types of wooden barricades and gridwork, usually battered back against the slope; c. Geotexiles, more expensive retaining structures can also be used to protect slopes.
Mitigation measures for conservation and protection of water resources	• Avoiding alignments which are susceptible to erosion, such as those crossing steep slopes; • Minimizing the number of water crossings wherever possible; • Using only "clean" fill materials around watercourses, such as quarried rock containing no fine soil • Practicing the rainwater harvesting along the length of the road in order to enrich the ground water table, *if applicable*. • Leaving buffer zones of undisturbed vegetation (width increased in proportion to slope) between road and water-bodies which will reduce siltation and increase groundwater recharge. • ***Flow speed control:*** Examples include grasses, riprap, and other devices in water channels, as well as dispersal structures in main drains. ***Settling basins:*** Settling basins are sometimes used to remove silt, pollutants, and debris from road runoff water before it is discharged to adjacent streams or rivers. They are most appropriate where the downstream environment is particularly sensitive or where the levels of silt or pollutants are particularly high. • ***Infiltration ditches:*** Infiltration ditches can be used to reduce overland flow by encouraging the movement of runoff down through the soil profile. The volume of flow in downstream drainage structures is reduced, the flow of pollutants is localized, and groundwater is recharged. • ***In very dry areas, road drainage can be designed*** to retain water in small dams or maintain a high water table -for example, by raising the inlets to drainage culverts-which increases the availability of drinking water and the viability of many species of flora and fauna, and recharges local aquifers, *if applicable*. • ***In areas prone to flooding, road works can*** either incorporate retarding basins that reduce runoff peaks (and potentially save on drainage structures), or they can improve drainage in residential or farming areas that are excessively sensitive to flood damage. • ***Labour camps should not be located near to water bodies.*** No discharge from such establishments should follow their path

<table>
<tr><td></td><td>into nearby water bodies. Dumping of debris in or nearby water bodies should be strictly avoided.</td></tr>
<tr><td>Mitigation measures to prevent air pollution</td><td>The following mitigation measures should be adopted:
Providing sufficient capacity to avoid traffic congestion, even with projected increases in traffic flow.
Water sprinkling and transporting construction materials with proper coverage during the construction stage. During the sub-grade construction, sprinkling of water should be carried out on regular basis during the entire construction period especially in the winter and summer seasons. (see Table: Best practices for fugitive dust control)
Table : Best practices for fugitive dust control during road construction phase<table><tr><th>Activities</th><th>Best Practices</th></tr><tr><td>Civil works, site preparation (Cutting/Drilling/Tunneling) of road</td><td>• Water spray
• Drills should be provided with dust extractors (dry or wet system)
• Use of Personal Protective Equipment (PPE)</td></tr><tr><td>Blasting (if applicable)</td><td>• Water spray before blasting
• Water spray on blasted material prior to transportation
• Use of controlled blasting technique</td></tr><tr><td>Transportation of construction material</td><td>• Covering of the trucks/dumpers to avoid spillage of material
• Water spray
• Speed control on vehicles used during transportation of material
• Provision for mobile water sprinklers
• Compacted roads</td></tr></table>
Planting tall, leafy, and dense vegetation between roads and human settlements to filter pollutants
Hot mix units, if used on site, should be equipped with requisite air pollution equipment to meet the prescribed standards.
Use water to suppress dust at all times.
Keep stockpiles and exposed soils compacted and re-vegetate as soon as practicable.
Keep speeds low though populated areas.</td></tr>
</table>

	• The stone crushing units should adopt the following pollution control measures: a) Dust containment cum suppression system for the equipment b) The crushing plants should be operated with approved fitted dust control devices. c) Construction of wind breaking walls d) Construction of the metalled roads within the premises e) Regular cleaning and wetting of the ground within the premises f) Growing of a green belt along the periphery • Integration with the local government awareness campaign programmes on good practices of vehicle maintenance etc. to reduce the air emissions
Mitigation measures for noise	• Development of bypass roads to avoid noise sensitive areas • Use of controlled and advanced blasting techniques like shock tube technology for construction of tunnel roads in hilly areas • Delay the time between explosions. • Conduct education programs with the locals regarding the potential impacts of blasting, blasting warning systems, schedules etc. • Providing silencers or enclosures for noise generating machines such DG sets, compressors, etc; • Creating a green belt around potential noise-prone areas • Provision of protective devices like earmuffs/earplugs to workers, who are continuously exposed to high levels of noise during road construction activities.
Mitigation measures for biodiversity	• When planning new roads or changes in width or alignment, sensitive natural environments should be identified early in the planning process so that alternate routes and designs may be considered. • A buffer zone should be maintained along the RoW. • If the site is very sensitive, the best practice in an EA is to conduct an independent biodiversity assessment, rather than making it a part of the EA process. The mitigation measures for biodiversity include a Biodiversity Action Plan (BAP) for biodiversity conservation, Species Action Plans (SAPs) where mitigation is targeted for the protection of a specific species, and Habitat Action Plans (HAPs) to protect the habitats of rare and endangered species. (*Refer to Figure 4.1: Hierarchy of biodiversity mitigation measures*)

Figure 4.1: Hierarchy of biodiversity mitigation measures



Source:Modified from UNEP 2002 and Rio Tinto, 2005

- **Mitigating fragmentation and isolation**

a. Design tunnels, bridges, culverts and other crossing structures such that they are useable for transportation as well as wildlife movement corridors. *For example*, make bridges over streams high enough to accommodate the movement of large wildlife beneath them, and make culverts large enough to accommodate not only peak flows but also use by riparian wildlife species.

b. Where bridges for use by large animals like elephants are constructed over water channels, they should be at least 50 m wide, with high railings (walls).

c. Consider building road tunnels under mountainous areas particularly rich in biodiversity and with rare and endangered species

- Development of green belt on either side of the highway consisting of a variety of trees would help to enrich ecology of the area and add to aesthetics.
- **Compensation for habitat fragmentation or Loss**

The choices for compensatory measures include:

a. Re-establishment of wildlife habitats

b. Creation and restoration of habitat areas (for compensating biologically impoverished landscapes)

c. Upgrading other suitable and similar habitats to protected area status (creation of legally protected habitat units)

d. Relocation of wildlife species displaced by road development to other suitable habitat areas.

	• **Preventing Vehicle-Wildlife Collisions** Many wildlife deaths can be prevented by careful placement of the alignment and appropriate roadside plantations. Measures used to discourage animals from moving onto the road surface are: a. Flash mirrors or game reflectors on roads with moderate traffic. These work best with larger ungulates such as deer. b. Warning signs for drivers to slow down in areas where high-use crossing points or wildlife corridors are known. c. Regulating traffic during times when animals are most active, usually at night d. High fences (>3 m) in areas heavily used by large ungulates must be constructed in close consultation with wildlife ecologists.
Mitigation measures for socio-economic environment	• The splitting of a community can be minimized by taking account of local movements at the road design stage and by making provision for improved crossings or alternative access routes • Best practices in land acquisition and R&R are as follows: a. Land should not be acquired without the consent of the majority of the project-affected population. The project proponent should receive 'free, prior and informed consent' from the affected population. b. The affected population should include not only landholders but also people dependent on land for livelihood like share-croppers, landless labourers, etc. c. The R&R plan should be framed in consultation with the PAP. d. The affected population should have a say in the selection of the resettlement site and design of the housing and other infrastructure facilities. e. Attempt should be made to resettle the displaced people as near as possible, so that they can obtain access to facilities as well as economic benefits generated from the project. The R&R plan should recognise not only landholders, but also those dependent on land for livelihood like share-croppers and landless labourers, etc. Compensation should also be provided to them. f. Basic amenities should be provided at the new resettlement site. This should include roads, safe drinking water, sanitation facilities, educational and health facilities, markets, community centers, playgrounds, etc. g. Financial assistance and training for self-employment should be provided to the affected population. h. There should be a provision for land-for-land compensation for indigenous communities. i. Compensation for land should be based on the current market price.
Mitigation measures	• Waste rock or overburden material should be placed at a

for quarry management	designated area with proper biological stabilization. • Water spray to suppress dust. • Compaction and re-vegetation of exposed areas as soon as possible. • If the topsoil is to be stored for a long duration, it should have a vegetal cover of, preferably, leguminous species (grasses and shrubs). If biological reclamation is not done in time, leaching will drain away the nutrients and impair the nutrient cycle, thereby making the soil unproductive. • Good housekeeping.
Sanitation and solid waste management in construction camps	• Provision of mobile toilets for workers • Provision of movable accommodation • Proper management and disposal of solid waste generated
Road Safety and Management	The Road safety management system should be made an integral part of highway projects. It should follow: • Identification of accident prone areas and suggest alternatives to avoid accidents during the planning stage itself • Identification of habitat fragmentation and traffic accident of wildlife and mitigation measures • Provision of speed breakers, safety signals, under and over bridges, service lanes and foot paths at appropriate locations throughout the proposed road to avoid the accidents • Provision of traffic signals should be assessed • Provision of roadside rest areas at strategic locations to minimize driver fatigue • Provision of facilities for post-accident emergency assistance and medical care to accident victims. • Road accident forms, data collection, reporting and analysis covering the responsible departments should be addressed • Road safety audit should be made an integral part of the highway project during the planning, construction and operational stage. • Trained medical personnel and first aid facilities as well as safety equipments should be available at strategic location to combat any emergency.

CHAPTER 5

Review of an EIA report for a road/highway project

5.1 Introduction

The purpose of reviewing an EIA report is to take decisions with respect to the following:

- Should the project be cleared in the form proposed by the project proponent?
- Should the project be modified to reduce the impacts and then cleared?
- Is the 'No project' option justified, considering the social and environmental costs?
- If the project is cleared, then, what conditions may be prescribed for compliance during design, construction and operation of the project?

5.2 Composition of the EIA review team

To ensure a proper review of the EIA report, the monitoring committee should include experts from diverse fields with a good understanding of the process and potential impact areas. The reviewers should be technically sound and competent enough to review the report. They should be able to make valuable suggestions/ recommendations to the project proponent for taking corrective action. Ideally, in the case of a road/highway projects, the team should comprise of the following experts:

- **A civil engineer/road or highway expert** who is well versed with the technicality and potential impacts of road/highway projects.

- **An environmental scientist/engineer** to overview the adequacy of mitigation options suggested for air, water and waste management.

- **A groundwater expert/hydrologist** to review and assess the hydrology of the new road alignment and drainage pattern.

- **A social science expert/anthropologist** to review the social issues and the resettlement and rehabilitation plan

- **A biodiversity expert/botanist** who can review the biodiversity issues, biodiversity conservation and afforestation plan

- **A meteorological expert** who can review the meteorological parameters and adequacy and compatibility of air pollution model.

- **A geologist** to review the geological risks and associated impacts.

- **A safety engineer and occupational health expert** who can review the levels of safety, occupational hazards and plan strategies to combat road accidents at the planning and operational stages

5.3 Reviewing an EIA report of a road/highway project

While reviewing the EIA report, the following key aspects needs to be carefully examined:

- Has the EIA report evaluated the beneficial and adverse impacts of the project properly and clearly?

- Which are the unavoidable adverse impacts? Are they acceptable?

- Is the proposed mitigation plan sufficient to manage and control all adverse impacts?

- What kinds of safeguards need to be incorporated to ensure that the mitigation plan is implemented effectively?

- What are the parameters which need to be monitored during project construction and operation so that the state of the environment can be studied throughout the project life?

- Is the project acceptable to the local communities?

- Are the concerns of the local communities genuine and has the EIA report adequately addressed these concerns?

- Will the project improve the socio-economic status of the local communities?

Guidelines for using the reviewer checklist:

By using the reviewer checklist for road/highway project, the reviewer will be able to gauge the acceptability of the EIA report. This can eventually assist in determining the environmental feasibility of the project being assessed.

Scorecard approach: The checklist is designed to follow a "scorecard" approach, using a possible scoring range of 0-10. Scores for each relevant item in the checklist are totaled, and a calculation of the percentage of the total possible score is made.

Relevance: The checklist is a generic checklist for the road/highway projects. Not all questions may be relevant to all the road/highway projects. Therefore, the first step is to determine the ***relevance*** of each question, for the specific project being considered. For each question that is relevant, "1" is entered in the box under Column "A" of the checklist, "Is question relevant for *this* project?" Because the number of relevant parameters varies from project to project, the possible total score for each EIA report will vary accordingly.

Adequacy: It is then necessary to determine the ***adequacy*** of the EIA report in answering only those questions that are judged to be relevant. Under the "adequacy" heading (Column "B"), the reviewer is asked to assign a numeric score from 0-10. The numeric scoring for the various elements of the EIA report, based on their level of completeness, clarity, and quality, is as follows:

9-10: **Excellent:** Information provided is clear, comprehensive and detailed, with no gaps or weaknesses.

7-8: **Good:** Information provided is comprehensive, has only very minor weaknesses which are not of importance to the decision-making process.

5-6: **Adequate:** Information provided has some minor weaknesses, but the deficiencies do not strongly compromise the decision process; no further work is needed to add to the environmental information.

3-4: **Weak:** Information provided has gaps and weaknesses which will hinder the decision process; some additional work is needed to complete the information.

1-2: **Very poor:** Information provided has major gaps or weaknesses which would prevent the decision process from moving ahead; major work is required to rectify.

0: **Absent:** Information needed for decision-making is not included in the report, and needs to be provided in its entirety.

Importance: It is also necessary to determine the importance. In many cases, some of the issues is relevant for the project but is not very important or significant in impact assessment. For instance; name of project, project schedule is relevant for the project but it has not much importance in environmental and social impact assessment. Therefore, while assigning the value for "Importance", reviewer should always keep in his/her mind the level of importance, a) relevant but least important, b) relevant but average important, c) relevant but most important.

In addition, for each relevant item, the reviewer is instructed to fill in comments for each relevant item. This should be made a mandatory procedure, so that the justification for assigning a specific value for adequacy as well as importance is well documented. For those items where the information provided in the EIA report is not adequate, it should be indicated in the far-right column what types of information are still required, in order to adequately address the question.

As a rule of thumb, an EIA report achieving a score in the range of 50-60% or higher should be considered acceptable. Borderline scores, or scores much lower than this limit, indicate that the EIA report is likely not acceptable. It should be noted, that while this design (i.e., using a numeric scorecard, and requiring reviewers to provide comments and justifications for their itemized determinations) is intended to minimize subjectivity, this "semi-quantitative" approach cannot totally eliminate all subjectivity from the review process, because the assignment of numeric scores is itself, by nature, a subjective process.

At the end of each section of the checklist, space is left for "other questions." The space provided here may be used to elaborate on the listed questions in each section (referencing the question number), or to add questions that may have specific relevance for the project being reviewed.

Overall Evaluation: There are six components that need to be evaluated to give the total score.

1. Applicant Information
2. Project Description
3. Baseline information
4. Impact Assessment
5. Mitigation and Environmental Management Plan (EMP)
6. Other Requirements

The final section of the checklist provides a framework for giving an overall evaluation of the EIA report. Each topic covered in the checklist is assigned a score, from 1-10, according to the same system used in the main section of the checklist. The resulting value provides a further basis for determining whether or not the environmental information presented is adequate ("acceptable" or "not acceptable") for making an informed determination about the quality of the EIA report. This is simply a way to cross-check the results that were obtained through a detailed itemized review of the EIA report *(Refer reviewer checklist)*.