Development of Toolkit under "Sustainable Urban Transport Project"

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Toolkit on Environmental Analysis – Strategic Environmental Assessment and Environmental Impact Assessment

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The Institute of Urban Transport (India) is a premier professional non-profit making organization under the purview of the Ministry of Urban Development, Government of India (MoUD). The National Urban Transport Policy (NUTP), 2006 has empowered IUT to serve as a National Level Facility for continuous advice and guidance on the principles of sustainable urban transport. The objective of the Institute is to promote, encourage and coordinate the state of the art of urban transport including planning, development, operation, education, research and management at the national level.

The Institute has been nominated as the project monitoring unit for Component 1A of the SUTP. IUT is responsible for overseeing the preparation of the training modules, subject toolkits and conduct of training of 1000 city officials in urban transport.

The Ministry of Urban Development (MoUD), Government of India (GoI) has initiated the Sustainable Urban Transport Project (SUTP) with support of Global Environment Facility (GEF) and the World Bank to foster a long-term partnership between GoI and state/local governments in the implementation of a greener environment under the ambit of the NUTP. The aim of the project is to achieve a paradigm shift in India's urban transport systems in favor of sustainable development. The MoUD is the nodal agency for the implementation of the project, to be implemented over a four-year period starting from May, 2010 to 30 November 2014. Project cost is Rs. 14,161.55 Million. The project's development objective (PDO) is to promote environmentally sustainable urban transport in India and to improve the usage of environment-friendly transport modes through demonstration projects in selected cities.

The Energy and Resources Institute (TERI) was established in India in 1974. Deeply committed to every aspect of sustainable development, TERI has a commitment towards creating innovative solutions for a better tomorrow. All activities in TERI range from formulating local and national-level strategies to suggesting global solutions to critical environmental issues. TERI is headquartered in New Delhi, India, and has several offices in various parts of the country. It has international presence through its offices in Washington, North America; TERI Europe in London; TERI South East Asia in Kuala Lumpur, Malaysia; TERI Japan in Tokyo; TERI Gulf Centre in Dubai; and TERI Africa in Addis Ababa, Ethiopia. The Centre for Research in Sustainable Urban Development & Transport Systems (CRSUD&TS) at TERI works extensively on various urban and transport issues with an aim to promote sustainable urban development. It was established in 1999 in response to the growing urban demands, particularly in the urban infrastructure sectors. It's activities range from carrying out energy-environment related analysis, giving inputs to policy and planning, improving urban service provision and governance, carrying out sustainability assessments, exploring climate change implications and mainstreaming climate resilience planning, and carrying out capacity building for various stakeholders, all in the context of the transport and urban development sectors.

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Preface

Government of India has initiated the Sustainable Urban Transport Project (SUTP) with support from the Global Environment Facility (GEF), the World Bank and UNDP. The primary objective of SUTP is to facilitate urban transport infrastructure development in a sustainable manner and under the ambit of the National Urban Transport Policy (NUTP).

Component 1A of GEF-SUTP project aims at capacity building amongst practitioners in the field of sustainable urban transport. The objective of the initiative is to create an enabling institutional framework for sustainable urban transport in India. This is to be accomplished by enhancing the capacity of policymakers, planners, researchers, executive agencies, service providers, managers and other professionals involved in urban transport to plan, implement, operate and manage sustainable urban transport.

To achieve the objectives of Component 1A, as part of the program, five sub-components have been identified which include the following:

- Sub-Component 1 – Institutional capacity development, focusing on strengthening of Institute of Urban transport (IUT)
- Sub-Component 2 – Individual capacity development
- Sub-Component 3 – Preparation of manuals and toolkits
- Sub-Component 4 – Promotion, awareness and dissemination of information to expand and enhance the impact of GEF-SUTP
- Sub-Component 5 – Technical assistance to cities to address emerging issues encountered during project implementation.

Sub-Component 3 aims at development of toolkits that will provide step by step guidance to cities and other concerned authorities and enable them to plan and implement projects related to urban transport, while also facilitating public decision makers and transport planners/engineers in overseeing urban transport projects. Toolkits include the brief concept behind the subject of the tool kit, applicable planning standards and norms and references to a code of practice wherever applicable. The toolkits being developed under the sub-component 3 are as follows:

a. Land use transport Integration
b. Urban Travel Demand Modelling
c. Transport Demand Management

d. ITS for Traffic Management System
e. Public Transport Accessibility
f. Urban Road Safety & Safety Audits
g. Planning, Design and Evaluation of Urban Traffic systems
h. Finance and Financial Analysis
i. Environmental Analysis/SEA & SIA
j. Social Impact Assessment and R &R plan

This Toolkit on '**Environmental analysis - Strategic Environmental Assessment and Environmental Impact Assessment**' aims to serve as a step by step guide for the city officials for rapid environmental assessment of urban transportation plans, programs and projects. It is expected that this Toolkit will help the city officials to conduct environmental assessment and appropriately choose and implement environmental friendly options for the city's transport system. With the help of this Toolkit, the city officials would also get equipped to evaluate and monitor the work carried out by consultants, who typically carry most of the transport related planning, designing and impact assessment work at the city level.

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Abbreviations

ITS – Intelligent Transport System

SC – Smart Card

AVLS - Automated Vehicle Locator System

AFCS – Automated Fare Collection System

GPS – Global Positioning System

ATC – Area Traffic Control

CCTV – Close Circuit Television Camera

VMS – Variable Message Sign

TMS - Traffic Management System

ANPR – Automatic Number Plate Recognition

CW – Carriage Way

ROW – Right of way

ASDS - Automatic Speed Detection System

ETM – Electronic Ticketing Machine

ISS – Intelligent Signalling System

PIS – Passenger Information System

BRT - Bus Rapid Transit System

DIMTS – Delhi Integrated Multi Model Transit System

IRC – Indian Road Congress

TSR – Three Wheeler Scooter Rickshaws

BS – Bus Concession operations

GPRS – General Packet Radio Service

PTZ – Pan Tilt Zoom Camera

IP – Internet Protocol

IVRS – Interactive Voice Response System

PMC- Pune Municipal Corporation

CPPSS – Critical Public Place Surveillance System

GVMS – Garbage Vehicle Management System

RVDS – Red Light Violation Detection System

SVDS – Speed Limit Violation Detection System

SCMS – Service Crew Monitoring System

IPLMS – Intelligent Parking Lot Management System

DCMS – Distress Call Management System

VDSS – Vehicle Dispatch and Scheduling System

DMS – Depot Management System

GUI – Graphic User Interface

GSM – Global System for Mobile Communication

NIC – National Informatics Centre

USB – Universal Serial Bus

CCD – Charged Couple Device

FTA – Federal Transit Administration

LED – Light Emitting Diode

MTBF- Mean Time between Failures

MTTR – Mean Time to Repair

BIS – Bureau of Indian Standard

JICA – Japan International Cooperation Agency

BMTC – Bangalore Metropolitan Transport Corporation

SCOOT – Split Cycle Offset Optimisation Technique

CRRI - Central Road Research Institute

Executive Summary

Aim of the Toolkit

'Strategic Environmental Assessment and Environmental Impact Assessment' aim to integrate environmental concerns in the process of planning, implementing and managing urban transport infrastructure aand services.

At the strategic level, SEA needs to be conducted for city transport/mobility plans. EIA is project specific i.e. for transport projects like construction of urban roads/ expressways, public transit systems like bus rapid transit system (BRTS), metro rail, mono rail, light rail transit (LRT), construction of public transit terminals and parking complexes, etc.

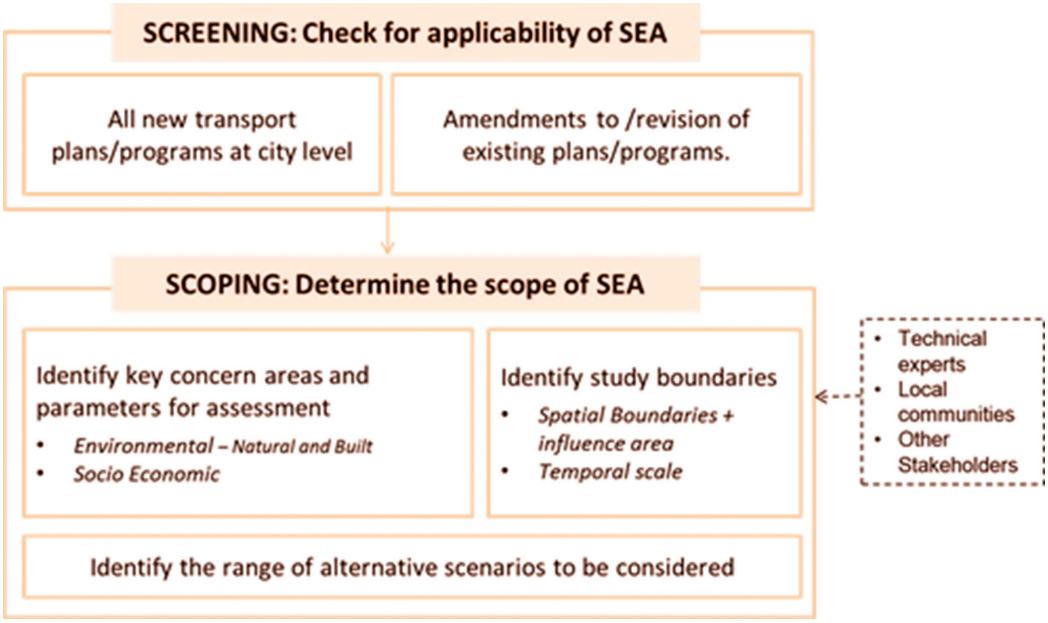
Strategic Environmental Assessment of urban transport plans/ programs

Strategic Environmental Assessment (SEA) is an analytical approach for mainstreaming environmental and social considerations in policies, plans and programs. It introduces environmental considerations into decision making process at a fairly early stage and hence allows decision makers to focus on the environmental effects of strategic choices, before specific projects are considered.

How to conduct SEA of urban transport plans/ programs?

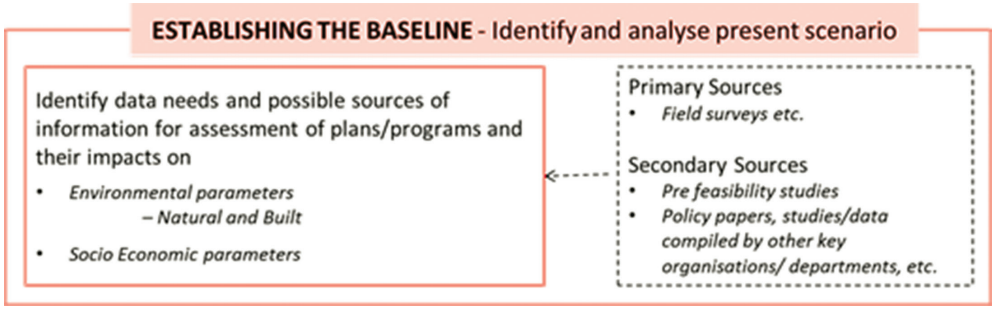
Step 1: Screening and scoping

In step 1, the plans or programs are assessed for their applicability/need for carrying out an environmental assessment exercise. If the plan or program calls for a need to conduct SEA exercise, the scope of the study is defined. Scoping helps in defining the boundaries of the SEA exercise, focussing the assessment to significant and relevant environmental impacts.



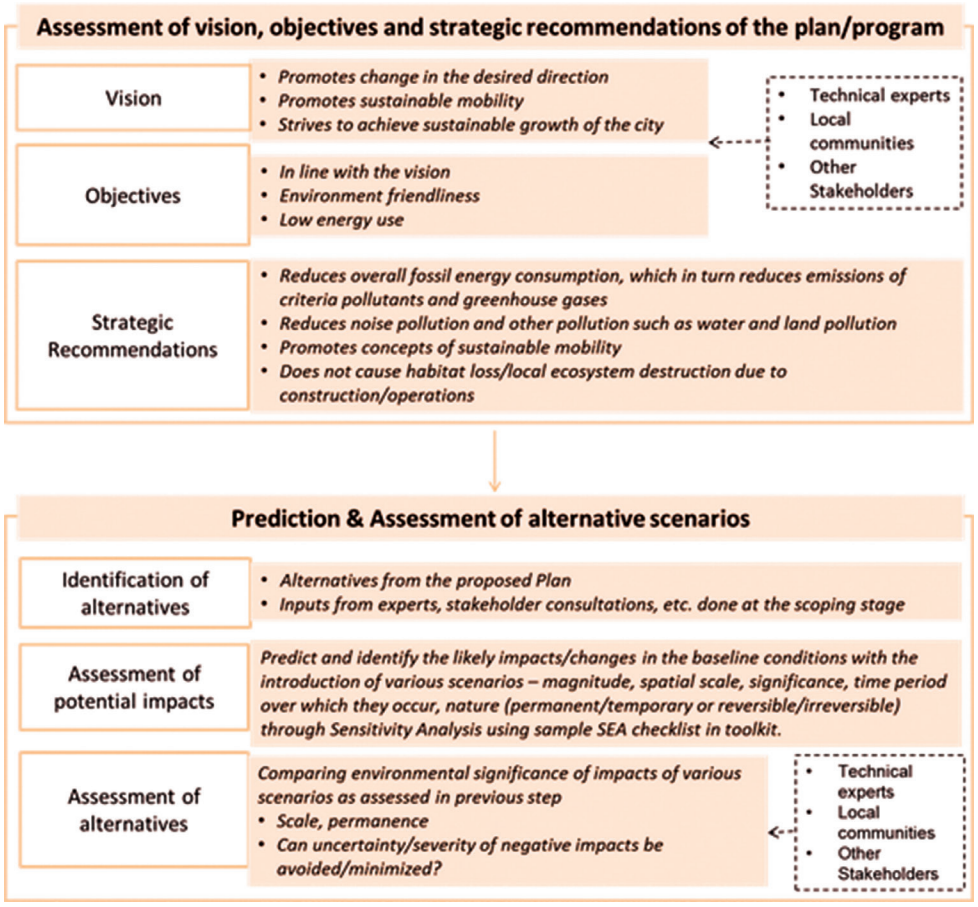
Step 2: Establishing the baseline

In step 2, the key environmental parameters that could be affected, directly or indirectly, by the proposed plan are to be identified and a description of their existing status is to be given in the SEA study report. Environmentally sensitive areas and issues that need special attention are to be highlighted.



The baseline data should be collected for the study area as delineated during the scoping exercise. A map of the delineated study area should also be shown in the SEA study report.


Step 3: Impact Assessment



In step 3, the proposed plan or program is to be examined for its environmental friendliness. For this, the vision, objectives and the strategic recommendations of the plan are to be assessed based on the parameters listed in Box 2.3 of the Toolkit. Secondly, alternatives to the Plan or the proposed strategies/ alignments are identified and evaluated for their impact on the environment. The rapid assessment checklist (Table 2.2, 2.3, 2.4) presented in the Toolkit are to be used for this purpose. Any need for further detailed assessment studies (EIA of the proposed projects under the plan) is also identified in this step.

Step 4: Strategies to avoid/reduce impacts

Following the impact assessment of the proposed plan and alternative scenarios, various mitigation measures are to be identified at the planning as well as implementation stages so as to prevent or minimize the likely adverse environmental impacts.

Identification of Strategies to avoid/reduce impacts

a) **Prevent/Avoid** adverse environmental impact - *Planning level*
- *Alternate transport options*

b) **Minimize and control** adverse environmental impact - *Implementation level*
- *Alternate alignments*
- *Technologies*

Step 5: Monitoring and Evaluation

In step 5, a monitoring plan is to be developed for effective mitigation of the adverse impacts. This should include a program/ schedule for carrying out regular monitoring and follow up assessment during the implementation and operation phases.

A performance checklist for SEA has been given at the end of the toolkit and may be referred by proponent to help assess the work of the consultant. It will help to evaluate if all the steps of SEA have been carried out as prescribed in this Toolkit.

Develop a Monitoring Plan

Propose a program for monitoring

- Provisions of various regulatory authorities
- Inputs from technical experts

- Critical parameters based on observations of baseline scenario to be monitored
- Application of sample SEA checklist for follow up assessment

- *Plan Implementation*
- *Operations*

Environmental Impact Assessment of urban transport projects

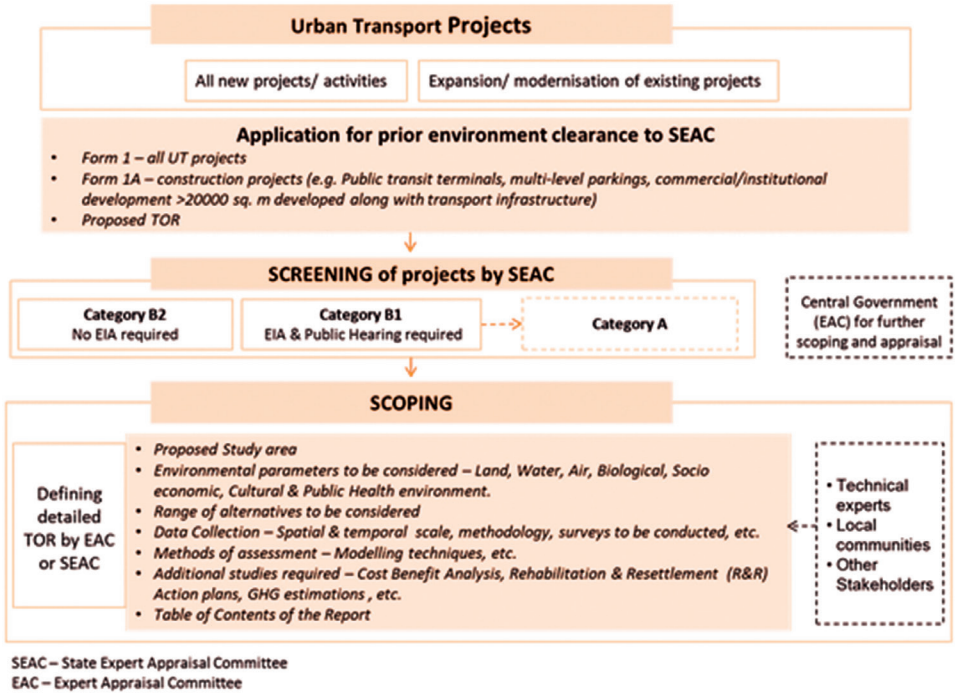
EIA is the process of identifying and evaluating the potential impacts of the proposed projects on the environment prior to implementation of the project. In India, it is mandatory to carry out an EIA study as an essential part of the “prior environmental clearance” process for scheduled development projects under Environmental Protection Act, 1986 as per the provisions of the EIA Notification of 2006 (last amended in 2009). The Notification at present does not bring urban transport projects within its purview. EIA however should be done as a best practice.


How to conduct EIA of urban transport projects?

Step 1: Screening and scoping

In step 1, all new as well as expansion projects are to be assessed to check if they qualify for a detailed Environmental Impact Assessment (EIA) exercise; the study boundaries/ terms of reference are to be defined at this stage. This is called Screening and Scoping for the EIA study and involves applying for prior environmental clearance with the State level Environmental Appraisal Committee (SEAC) along with Form 1/ 1A, a project brief and the proposed Terms of Reference. As per the EIA Notification, all category A and B1 projects require an EIA study.

Once the need for a detailed EIA is established, the broad scope of the study is determined by the concerned authorities in form of the ToR outlining the proposed study area, environmental parameters and range of alternatives to be considered, methods and techniques of modelling and assessment, and any additional studies to be conducted.



Step 2: Establishing the baseline

Step 2 entails identification of the study area and the key environmental parameters to be assessed. Typically, environmental components that can be considered in EIA of urban transport projects are: Land Environment, Water Environment, Air Environment (air quality, meteorology and noise), Biological Environment, Socio-economic, Cultural and Public health environment. At the same time, data needs and sources are also identified for detailed analysis of the existing situation. Once information needs are identified, baseline environmental information may be assembled through the collection of existing data, by carrying out specific field studies, and/or input from consultations.

ESTABLISHING THE BASELINE: Identify and analyze present scenario

Identification of Study Area *(including influence area)*	• *Transport Corridors – right of way as well as area falling within 500 metres on either side of ROW.* • *Public transit terminals , parking complexes– guidelines similar to construction/townships projects have to be applied.*
Identify parameters to be assessed, data needs and possible sources • *Environmental – Natural and Built* • *Socio Economic* • *Cultural* • *Public Health*	Primary Sources • *Field surveys etc.* Secondary Sources • *Pre feasibility studies* • *Policy papers, studies/data compiled by other key organisations/ departments, etc.*

Step 3: Impact Assessment

In step 3, the potential impacts of an urban transport project during construction and operation stages are assessed. This typically involves 1) identifying and assessing the potential impacts of the project on the environment, 2) an analysis of various alternative scenarios, and 3) any detailed additional studies that need to be carried out.

IMPACT ASSESSMENT

Identification & description of potential impacts on the baseline conditions	• *Assess impacts due to project location, design, construction, regular operations, possible accidents, or rehabilitation of a completed project, etc. (Modelling techniques enlisted in the Annexure VI to the toolkit)* • *Describe the anticipated changes – magnitude, time frame, nature of permanence, affected populations, etc.*
Analysis of Alternatives	• *Description of each alternative* • *Likely impacts* — *Spatial requirements of each alternative* — *Natural resources (including productive land) consumption* — *Human resource benefits and costs (Resettlement versus better accessibility and mobility)* — *Waste production during the construction and operation/maintenance period.*
Additional Studies	• *Risk assessment exercises* • *Social Impact assessment* • *Resettlement & Rehabilitation Action Plans* • *Environment Cost Benefit Analysis* • *Estimation of GHG emissions*

Step 4: Strategies to avoid/reduce impacts

As per the EIA Notification, 2006 (as amended in 2009), any EIA exercise is to be followed by an Environmental Management Action Plan (EMAP) to mitigate the impacts of the project. The EMAP has to suggest an action plan which includes steps to be taken in the a) Pre-construction b) Construction and c) Operational stages of the project to prevent/minimize the adverse environmental impacts and also propose a mechanism for monitoring the significant environmental impacts. Some generic mitigation measures for typical environmental impacts of urban transport projects/ activities have been presented in the Toolkit.


Identification of strategies to avoid/ reduce impacts

a) **Prevent/Avoid** adverse environmental impact - *Planning/designing level*
- *Most optimum site location, alignment, technology options, etc.*

b) **Minimize and control** adverse environmental impact - *Implementation level*
- *Adherence to on-site regulations*

Step 5: Monitoring and Evaluation

The project proponent has to prepare an environmental monitoring plan as part of the EMAP report. This involves identifying critical parameters to be monitored at different stages of project implementation and operation and also a program/ schedule for monitoring and follow up assessment.

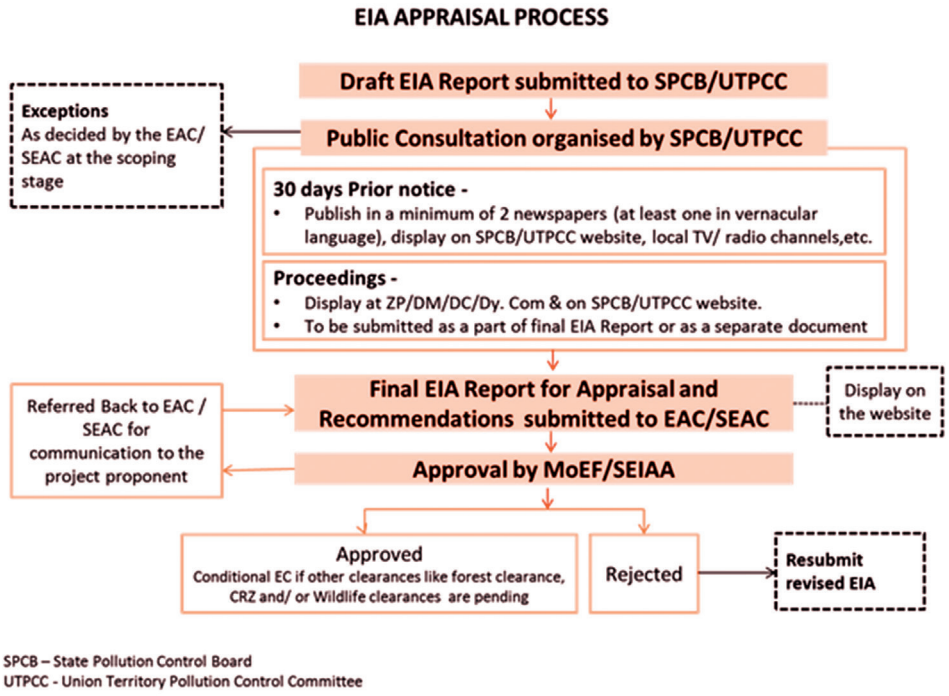
MONITORING AND EVALUATION: Develop a Monitoring Plan

Identify critical parameters to be monitored at different stages based on observations of baseline and results of impact assessment
- *Project implementation*
- *Operations*

Propose a program for monitoring and follow up assessment
- *Planning a survey and sampling program for systematic collection of data/information relevant to environmental assessment and management*
- *Conducting the survey*
- *Analysis of samples and data/information collected, and interpretation of data and information*
- *Preparation of monitoring reports to be submitted to the SEAC.*

Appraisal process

Once the Draft EIA report has been prepared by the project proponent, it is to be submitted to State Pollution Control Board (SPCB) or the Union Territory Pollution Control Committee (UTPCC) in case of Union Territories. SPCB or UTPCC will organize the public consultations for the EIA studies. The project proponent has to make necessary/ required changes in the EIA report and also recommend appropriate changes in the project DPR, if any, as per the feedback received in the consultation. The Final EIA report is then submitted by the project proponent to the EAC/ SEAC.



SPCB – State Pollution Control Board
UTPCC - Union Territory Pollution Control Committee

A performance checklist for EIA has been given at the end of the Part III in Volume I and may be referred by proponent to help assess the work of the consultant. It will help to evaluate if all the steps of EIA have been carried out as prescribed in this Toolkit.

Chapter 1

Background

1.1 Introduction to the Toolkit

1.1.1 Background

The Government of India (GoI) has initiated the Sustainable Urban Transport Project (SUTP) with the support from the Global Environment Facility (GEF), United Nations Development Program (UNDP) and the World Bank. The objective of the project is to facilitate the provision of urban transport infrastructure and services in a manner that is consistent with sustainable environmental considerations and the National Urban Transport Policy (NUTP) of GoI. The Ministry of Urban Development (MoUD) has been appointed as the nodal agency for implementation of the project.

One of the components of the SUTP aims at 'National Capacity Development in Urban Transport'. This is targeted through multiple strategies, one of them being 'Selection and preparation of Toolkits' for capacity building of local officials who are dealing hands-on with urban transport problems.

A total of ten toolkits are being developed currently under this initiative. These are:

- ITS Toolkit for Traffic Management System
- Finance and Financial Analysis
- Environmental Analysis - Strategic Environmental Assessment and Environmental Impact Assessment
- Public Transport Accessibility
- Social Impact Assessment and Resettlement and Rehabilitation Plan
- Transport Demand Management
- Urban Road Safety Audit
- Urban Road Traffic System
- Travel Demand Modelling
- Land Use Transport Integration

The Toolkit on Environmental analysis - Strategic Environmental Assessment and Environmental Impact Assessment is presented in this report.

1.1.2 Aim of the Toolkit

The Toolkit on Environmental analysis - Strategic Environmental Assessment and Environmental Impact Assessment presented in this report is aimed at providing guidance to the concerned city officials and consultants in conducting Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) of urban transport plans, programs and projects in order to integrate environmental concerns in the process of planning, implementing and managing urban transport infrastructure and services

1.1.3 Who should be using this Toolkit?

The Toolkit has been developed for city level officials who are responsible for formulation and implementation of transport related plans, programs and projects. Following are some of the key target beneficiary groups for this Toolkit.

- Urban local bodies,
- City/regional planning and development authorities,
- Special agencies constituted to plan and implement urban transport infrastructure,
- City bus service operators,
- Metro rail corporations, and
- Agencies responsible for construction of urban roads, flyovers, etc. (PWD, roads department)
- Consultants who carry out formulation of urban transport plans and projects and conduct SEA & EIA for public agencies

1.1.4 What is the scope of this Toolkit?

As this report will concern itself with the Toolkit on Environmental analysis – Strategic Environmental Assessment and Environmental Impact Assessment, it is important to understand the scope of this Toolkit.

The Toolkit on Environmental analysis – Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) will focus on informing the city level officials and consultants involved in planning and implementing transport sector projects on the:

- Concept of SEA and EIA ;
- Importance of conducting SEA and EIA of transport plans and projects; and
- How to conduct SEA and EIA.

At the strategic level, the Toolkit will guide how SEA can be conducted for city transport/mobility plans. The Toolkit will give guidance for conducting EIA of major urban transport projects like construction of urban roads/ expressways; public transit systems like bus rapid transit system (BRTS), metro rail transit system (MRTS), mono rail systems, light rail transit systems (LRT), etc.; construction of public transit terminals and parking complexes, etc.

It is aimed that with the help of this Toolkit, the city officials will be in a position to either conduct the SEA and EIA themselves or be able to evaluate the SEA and EIA carried out by the hired consultants effectively.


1.1.5 How to use this Toolkit?

The Toolkit has been divided into 4 Chapters as discussed below.

Sections	Relevance to the user
Chapter 1: Background This section introduces the concepts of Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA), explaining the importance of carrying out environmental assessment of proposed urban transport plans, programs and projects.	• What is SEA & EIA? • What are the benefits of carrying out environmental assessment of urban transport plans/ projects?
Chapter 2: Strategic Environmental Assessment of urban transport plans/ programs This section discusses the present Indian regulatory & policy context for SEA and the prerequisites in terms of institutional and regulatory arrangements to enable and integrate SEA in the process of planning and implementation of urban transport plans/ programs. The section also gives a step-by-step methodology for carrying out SEA of urban transport plans/ programs.	• What are the laws/ regulations/ policies that have to be followed? • What are the enabling institutional and regulatory requirements for conducting SEA of urban transport plans/ programs? • How to conduct SEA of urban transport plans or programs?
Chapter 3: Environmental Impact Assessment of urban transport projects This section discusses the present Indian regulatory & policy context for EIA and the prerequisites in terms of institutional and regulatory arrangements to enable and integrate EIA in the process of planning and implementation of urban transport projects. The section also gives a step-by-step methodology for carrying out EIA of urban transport projects	• What are the laws/ regulations/ policies that have to be followed? • What are the enabling institutional and regulatory requirements for conducting EIA of urban transport projects? • How to conduct EIA of urban transport projects?
Chapter 4: Literature Review -Case Studies This section discusses some case studies on SEA and EIA studies carried out for urban transport plans, programs, and projects in cities around the world. The section also discusses similar Toolkits on SEA and EIA of other agencies like the World Bank, Asian Development Bank, etc.	• How are SEA and EIA concepts being applied for urban transport infrastructure plans/ projects globally?

1.2 Introduction to environmental assessment

1.2.1 Why environmental analysis is required for urban transport projects/ programs/ plans?

Transportation involves mobility of people, goods and the delivery of services, and has an important role to play in supporting regional & local development and enhancing the quality of life. From the perspective of a developing country like India, transport infrastructure has a key role in economic development and up-gradation of quality of living.

From the point of view of environmental sustainability, transport development has the potential to give rise to significant adverse impacts. This is because transportation is material intensive, and its use has implications on carbon emissions, local air quality, noise and health and well-being. Another important point to be noted here is that as opposed to most of the infrastructure/ development projects, the impacts of urban transport plans/ projects are very extensive.

Urban transport infrastructure construction, use and maintenance can have significant implications on land use, natural environment, and the functioning of hydrological systems, etc. Therefore, environmental analysis of projects/ programs/ plans needs to be carried out before implementation to ensure that they will not harm the environment on a short or long-term basis. Any development activity will have both positive as well as negative impact on environment and economy of the city/ city-region. For instance, construction of a new expressway may help in increasing the connectivity of a city to its suburbs/ satellite towns; but on the other hand it may result in degradation of the natural or human environment. It can have wide ranging environmental impacts and can catalyse dramatic land use changes not only in the immediate vicinity but also in adjacent hinterlands, offsetting the possible benefits. As example, the impacts of transport infrastructure development may be as follows:

- **Impacts on physical resources**
    - Impact on surface and ground water hydrology
    - Impact on surface water quality during construction and operation
    - Impact on air quality – dust and emissions from construction vehicles & equipment during construction phase; vehicular exhaust during operation phase
    - Impact on soil through cut-and-fill operations, soil erosion and disposal of waste
    - Impact on geological conditions in case of construction in mountainous terrain
- **Impacts on ecological resources**
    - Impact water ecology and fisheries in case of construction in vicinity of water bodies and in coastal areas
    - Impact on flora/ green cover due to cutting of trees for site clearance, etc.
    - Impacts on land use patterns mainly due to improved accessibility & consequent real estate development, etc.
    - Impact on quality of life and public health


Owing to the scale of impacts that transport infrastructure development may have on the environment, as discussed above, it becomes important to carry out environmental analysis of projects and plans to estimate and address the impacts of transport infrastructure development. This can be done by carrying out Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) of urban transport plans and projects.

In India, presently only EIA is carried out for certain category of development projects (including some types of transport projects like highways, airports, ports & harbours). However, SEA is equally important as it introduces environmental considerations into decision making early and hence allows decision makers to focus on the environmental effects of strategic choices, before specific projects are considered. Thus, SEA can help to consider a broader range of alternative proposals and mitigation measures. Moreover, SEA allows for the consideration of cumulative and broad scale (i.e., regional and global) environmental effects.

The following sections will introduce the concepts of SEA and EIA in the context of urban transport plans/ projects.

1.2.2 What is Strategic Environmental Assessment?

Strategic Environmental Assessment (SEA) is an analytical approach for mainstreaming environmental and social considerations in policies, plans and programs. SEA is expected to support decision-making and implementation processes at the strategic level. However, the scope of SEA cannot be restricted to consideration of environmental effects only as implementation of policies and programs also cause some economic and social effects. These economic and social effects often cause indirect environmental effects (ADB, 2003). SEA is geared towards upstream issues and is aimed at sustainability (Partidario, 2003).

SEA is defined as "a systematic process for evaluating the environmental consequences of a proposed policy, plan or program initiatives in order to ensure that they are fully included and appropriately addressed at the earliest appropriate stage of decision making on par with economic and social considerations" (Sadler and Verheem, 1996). There are two main types of SEA:

Impact-centered SEA – It focuses mainly on impact assessment and its goal is predicting environmental impacts to identify prevention, mitigation and control measures to protect the environment.

Institutions-centered SEA - It focuses on assessing the institutional and governance conditions needed to effectively deal with environmental and social effects of policies, plans or programs.

The basic components of a SEA exercise are (Bonde and Cherp, 2000):

- Understanding the affected environment extending beyond the physical boundaries of the plan or program, focusing on key assets, sensitive areas and threats;
- Review of environmental and sustainability objectives of the plan;
- Identification of a set of criteria, targets or indicators for evaluating the effects of the plan's policies and their alternatives;
- Systematic identification, prediction and evaluation of potential impacts, including indirect and cumulative ones, with a level of detail appropriate for appraising the plan and the information needs of decision-makers;

- Recommendations on preferred alternatives and a description of suggested mitigation measures;
- Recommendations for monitoring and follow-up assessment;
- Recommendations for translating its results to environmental assessments at lower levels of the planning hierarchy.

Some important advantages of conducting a SEA are (ADB, 2003):

- SEA introduces environmental considerations into decision making early and hence allows decision makers to focus on the environmental effects of strategic choices, before specific projects are considered. Thus, compared to a project-level EIA, a SEA can consider a broader range of alternative proposals and mitigation measures.
- SEA allows for the consideration of cumulative and broad scale (i.e., regional and global) environmental effects.
- SEA provides a mechanism for incorporating considerations related to sustainable development into the decision-making process as it can draw attention to potential environmental problems early so that environmentally damaging steps may be filtered out.

1.2.3 What is Environmental Impact Assessment?

Environmental Impact Assessment (EIA) is "a process of identifying, predicting, evaluating, and mitigating the biophysical, social, and other relevant effects of proposed projects and physical activities prior to major decisions and commitments being made "(Sadler, 1996). Canter (1996) defines EIA as "the systematic identification and evaluation of the potential impacts (effects) of proposed projects, plans, programs or legislative actions relative to the physical, chemical, biological, cultural and socio-economic components of the environment (Canter,1996).

EIA was developed in the 1970s as a tool to assess and reduce adverse impacts on the environment caused by projects. EIA exercises are primarily focused on understanding the impacts (positive and negative) of specific developmental projects on environment. It usually adopts a broad definition of 'environment' considering socio-economic as well as environmental health effects as an integral part of the process. The main objectives of EIAs are to provide information on the environmental consequences for decision-making, and to promote environmentally sound and sustainable development through the identification of appropriate alternatives and mitigation measures (UNEP, 2002). An EIA exercise can therefore help to support decision making when conducted at the planning/design stage of specific projects to avoid or minimise potentially damaging and costly negative impacts, and maximise positive impacts. EIA is referred to as project based and is geared towards local environment.

The three basic components of an EIA exercise are (UNEP, 2002):

1 Establishment of environmental, socio-economic, and public health baseline data for the project site and its influence areas before construction.

2 Prediction and evaluation of potential – direct and indirect – environmental, socio-economic, and public health impacts of the proposed project.

3 Identification of appropriate alternatives and mitigation measures to avoid, minimize, remediate or compensate for any environmental, socio-economic, and public health impacts resulting directly or indirectly from the project.


EIA is now a common practice worldwide. In India, it is mandatory to carry out an EIA study as an essential part of the "prior environmental clearance" process for scheduled development projects under Environmental Protection Act, 1986 as per the EIA Notification of 2006 (last amended in 2009). The notification has classified these projects as Category A & B. Category A projects (including expansion and modernization of existing projects) require clearance from Ministry of Environment and Forests (MoEF), Govt. of India (GoI) and category B from State Environmental Impact Assessment Authority (SEIAA), constituted by the Govt. of India. The environmental clearance process for all these projects comprises of the following stages (MoEF, 2006):

- Screening of the Project to determine whether the project requires a detailed EIA for its appraisal prior to the grant of environmental clearance
- Scoping relevant environmental concerns for the preparation of an EIA report
- Preparation of EIA Report
- Public consultation to account "all material concerns" in the project
- Appraisal of the final EIA report by the regulatory authority for grant of environmental clearance.

As per the Notification, transport infrastructure projects like highways, airports, ports & harbours require an EIA. However, considering that many large scale urban transport infrastructure projects like bus and metro rail transit systems, construction of expressways, etc. are being implemented widely in Indian cities, it becomes important to understand and address their environmental impacts also, for the benefit of the city & its region. In this context, EIA can be conducted to understand the environmental impacts of major construction projects like:

- Construction of urban roads/ expressways
- Construction of flyovers/underpasses
- Construction of public transit systems like bus rapid transit system (BRTS), metro rail transit system (MRTS), mono rail systems, light rail transit systems (LRT), etc.
- Construction of public transit terminals, parking complexes, etc

1.2.4 What is the difference and inter-linkage between SEA and EIA??

SEA is different from EIA in terms of the scale of application and also in its approach. It focuses on decision-making processes rather than the final assessment report of these processes as in case of EIA. The scope of SEA is also wider and more sustainability oriented; therefore its time scale tends to be longer as compared to EIA. There are also differences between SEA and EIA in procedures and methods (Partidario, 2004). For example, SEA requires mostly qualitative information and only necessary quantitative data, while EIA is generally based on the latter.

Ideally, SEA should be conducted well in advance in order to ensure selection of most environmentally suitable options. In the context of urban transport, it may be conducted for national and state level policies and programs related to urban transport. SEA can also be conducted to understand the broad impact of strategies suggested in city transport/mobility plans. EIA, on the other hand, should be conducted at the project level.

Chapter 2

Strategic Environment Assessment of Urban Transpot Plans/Programs

2.1 Indian context, policies and regulations

Strategic Environmental Assessment (SEA) has been recognized as an important decision making tool globally. It involves assessment of the environmental consequences of proposed policies, plans and programs. While the Ministry of Environment & Forests (MoEF) in India has made prior environmental clearance for certain developmental 'projects' mandatory through its EIA Notification, issued on 14th September 2006 and as amended on 1st December 2009, it does not make any provision for environmental assessment at the policy/plan/program formulation level. It is only as recent as in March 2012 that the National Green Tribunal (NGT) has issued a directive citing the case of the POSCO steel plant in Orissa stating that MoEF shall establish clear guidelines/directives for project developers to carry out SEA for very large scale projects and "apply for a single EC alone if it involves components that are essential part to the main industry such as the present case where main industry is the Steel plant, but it involves major components of port, captive power plant, residential complex, water supply, etc." The directive states that separate environmental approvals "can have the effect of playing down their environmental impact, since each piece is judged separately, and there is no overall judgment of the impact from the project as a whole". Therefore, there is recognition at the apex level in India on the importance of conducting SEA for large scale projects at a fairly early stage in order to ensure that the best solutions/options for development are selected. SEA at policy/plan/program formulation stage can help choose the most environment-friendly policy options/interventions at the macro level. This can have a long-term impact in terms of choice of projects and actions that have minimum impact on the environment. It is hence recommended that SEA of important policies, plans and programs is conducted while the same are being formulated.

2.1.1 Application of SEA to urban transport plans

SEA introduces environmental considerations into decision making process at a fairly early stage and hence allows decision makers to focus on the environmental effects of strategic choices, before specific projects are considered. Thus, SEA can help to consider a broader range of alternative proposals and mitigation measures. Moreover, SEA allows for the consideration of cumulative and broad scale (i.e. regional and global) environmental effects. SEAs can hence be useful decision supporting tools at macro policy/plan-making level. Specifically, in the context of urban transport sector that involves large scale projects that are highly capital intensive and irreversible in nature, SEAs can play an important role in evaluating the proposed interventions in urban transport plans or the mobility plans. Conducting SEA at/during the plan formulation stage can help in identifying the most environment-friendly interventions/projects for the

city. SEA can hence be carried out for the strategies recommended in the city transport/mobility plans. It can also be conducted to understand the impacts of urban transport programs/ group of projects in a city for example integrated multi-modal transit systems.

2.2 Pre – requisites: Changes in laws, regulations & institutions

Environmental assessment of urban transport plans is not a mandatory requirement in India. As a result, no assessment studies are being conducted during/after the plan formulation stage. In order to mainstream environmental concerns, it is important that SEA should be made an inevitable part of the regulatory framework for assessment of policies/ programs/ plans in general and also for the urban transport plans. This will bring environmental considerations into decision making early, before specific projects are considered for implementation. As stated earlier, SEA can be conducted to understand the broad impact of strategies suggested in the city mobility plans and identify alternative strategies or mitigation measures at an early stage. As a prerequisite to conducting SEA for urban transport plans, the regulatory framework at the central/state level should define/ recommend:

a. The applicability of SEA to urban transport plans,

b. The statutory process of carrying out the study (including public participation and hearing),

c. Guidelines for establishing baseline, conducting environmental assessment and reporting.

d. The structure, role and capacity of institutions (including the urban local bodies and other relevant city level authorities) that will be involved in conducting and evaluating the assessment studies. Ideally, there should be a team of experts in the relevant city level authorities who could be responsible for carrying out the SEA exercises for urban transport plans/ programs or evaluate the work being done by the consultants.

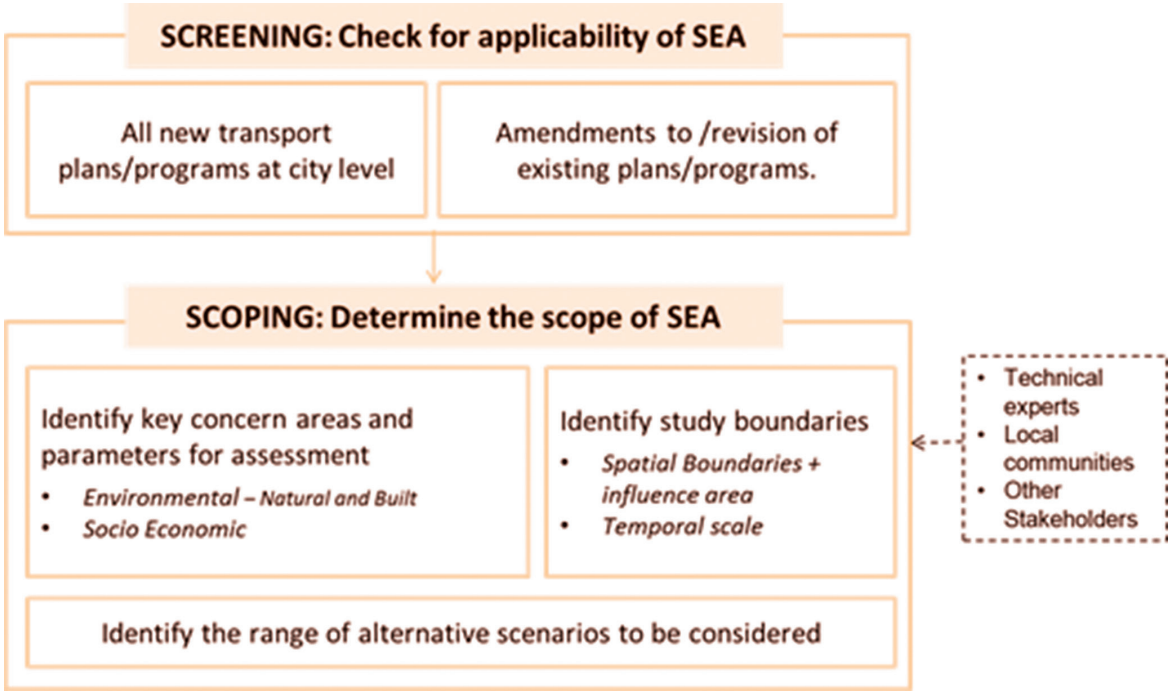
Due to lack of any regulatory framework for conducting SEA, this Toolkit will address the subject of SEA of urban transport plans not as a statutory requirement but as a best practice that may be adopted by the city authorities, consultants, professionals to conduct a rapid SEA and mitigate the environmental impacts of urban transport strategies. However, the Toolkit will use similar terminology as the EIA notification while discussing the steps for conducting SEA, for convenience of understanding and easy integration into the regulatory framework in future.


2.3 How to conduct SEA of urban transport plans or programme?

2.3.1 Step 1: Screening and scoping

The first step while conducting any environmental assessment exercise at the strategic level is to check if the plan/ program in question qualify for a SEA study. If it qualifies for SEA, then the scope of the SEA study has to be defined. From this point forth, the Toolkit will refer to this process as 'screening' and 'scoping' in line with the terminology used in the EIA Notification. Figure 2.1 recommends the process to be followed while screening and scoping in case of SEA of an urban transport plan or program.

Figure 2.1: Screening and scoping for SEA of urban transport plans/ programs



Screening

As per the EIA Notification 2006, projects have to be screened in order to establish the applicability/ need for carrying out an environmental assessment exercise. As there is no regulatory framework for conducting SEA in India, there is no statutory requirement of screening of plans/ programs for environmental assessment. However, as observed in the literature review, ideally SEA should be applicable to all plans/ programs at national, state and city/ metropolitan area level for sectors including agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, urban and regional planning or land use, which set the framework for future development and have likely environmental impacts at the macro and micro level.

In case of urban transport sector, SEA can be applied to plans and programs at city level that recommend strategies/projects for future development of transport infrastructure development and may have impacts on the environment. This will include plans and programs like:

- City/ sub-city level mobility plans, traffic/ transport plans
- Other plans and programs which set the framework for future projects for urban transport infrastructure development

Any significant modifications/revisions in the plans or programs should also be considered for SEA.

Scoping

Scoping defines the boundaries for environmental assessment and helps in focussing the assessment to significant and relevant environmental impacts. Typically, the scoping exercise should result in (MoEF, 2006 & ODPM, 2005):

- Determination of spatial and temporal scale for the assessment exercise in terms of the study area boundaries (including the influence zone) and the time period for which the impacts will be assessed.
- Identification of key environmental concerns related to a plan and the relative importance of issues. These may include impacts on air quality, ambient noise, water quality, natural environment & biodiversity, land uses, built environment, built heritage & archaeology, public welfare, health & well-being.
- Defining the work program, including a plan for public and stakeholder involvement
- Identification of existing information sources and local knowledge

At the scoping stage, the alternatives considered to the large infrastructure proposals in the plan should be identified and it should be decided at this stage itself that while conducting the SEA, which alternatives will be considered for assessment so as to identify the most optimum choices from an environmental point of view. For example, there could be alternatives like a BRTS, LRT, metro rail, etc. that could have been considered in a mobility plan of a city. Strategic assessment of all these alternatives should be carried out to assess their environmental impacts and help choose/justify the most environment friendly alternative. Similarly, alternative networks and alignments may have been considered for transport infrastructure proposals in the plan. These alternatives should be evaluated during plan formulation/while conducting SEA. In addition to the alternatives considered in the Plan, more alternatives can be considered based on inputs from experts and key stakeholders (process for consultation outlined in Annexure VIII).

Box 2.1 gives typical methods used for scoping a SEA exercise.

The scoping exercise minimizes the subjectivity of the study as it defines the boundaries and work plan, including the public consultation process to be carried out during the study. The scoping exercise also helps to establish the contents of the study report and avoid conflicts and delays later in the process. Box 2.2 gives a sample Table of Contents for a SEA study report for urban transport plan/ programs that could be designed at the scoping stage.


Box 2.1 Possible methods for scoping for SEA

- Review of similar case studies
- Public participation methods, including public meetings, open houses, etc. with representation from public representatives, local community and other potential PAPs (plan/ project affected persons)
- Group process methods, including: interactive group meetings, workshops, etc. with technical experts, managers and policy-makers, community representatives as well as the potential plan/ project proponents. Such methods typically bring together approximately 20 to 25 people for "brainstorming" to identify issues and potential impacts, and available information. Then priorities are set for information needs and study requirements. ***Source:*** *ODPM, 2005 & E7, 1997*

2.3.2 Step 2: Establishing the baseline

Any SEA exercise for an urban mobility plan/program should analyse the likely impacts that the plan/ program might have on the existing environment. Therefore, it should contain a description of the existing status of the environmental parameters that are likely to be affected, directly or indirectly, by the proposed plan. The term 'baseline' refers to conditions existing before development against which subsequent changes can be referenced (E7, 1997). The environment is broadly defined to include the natural, cultural, socio-economic systems and their interrelationships. However, the focus has to be on those environmental parameters that are important from the perspective of impact prediction, assessment and decision-making. The objectives of establishing the baseline should be:

Box 2.2 Sample Table of Contents for a SEA study report

Chapter 1: Introduction

This chapter contains the general information on the proposed plan/program, environmental analysis (SEA) process followed and the key stakeholders.

Chapter 2: Description of the plan/program

An outline of the main objectives of the plan or program, its spatial extent and population likely to be affected by the activities proposed as part of the plan and relationship with other relevant plans and programmes. The environmental protection objectives, established at international, community or national level, which are relevant to the plan or program and the way those objectives and any environmental considerations have been taken into account during its preparation.

Chapter 3: Description of Environment

The relevant aspects of the current state of the environment including environmental characteristics have to be discussed in this chapter.

Chapter 4: Analysis of plan/program strategies and alternatives

A discussion on the plan/program strategies and alternative scenarios/ options analyzed should be brought out here. An outline of the reasons for selecting the strategies and alternatives, and a description of how the assessment was undertaken should be discussed clearly.

Chapter 5: Anticipated Environmental Impacts and mitigation measures

The likely significant effects on the environment including impacts on land use, environmental quality/ quality of life standards, loss of open/green areas/ water bodies, loss of vegetation/ biodiversity, risk to Air/ Water/ Land Environment, risk to Public Health, vulnerability of Heritage areas or landscapes, which have a recognized national, community or international protection status should be reported in this chapter. For the proposed strategies/projects in the plans/programs, this chapter should also discuss the measures envisaged to prevent or reduce significant adverse effects on the environment \.

Chapter 6: Environmental Monitoring program

This chapter should give a description of measures envisaged for monitoring. It should include the technical aspects of monitoring the effectiveness of mitigation measures.

Chapter 7: Summary & Conclusions

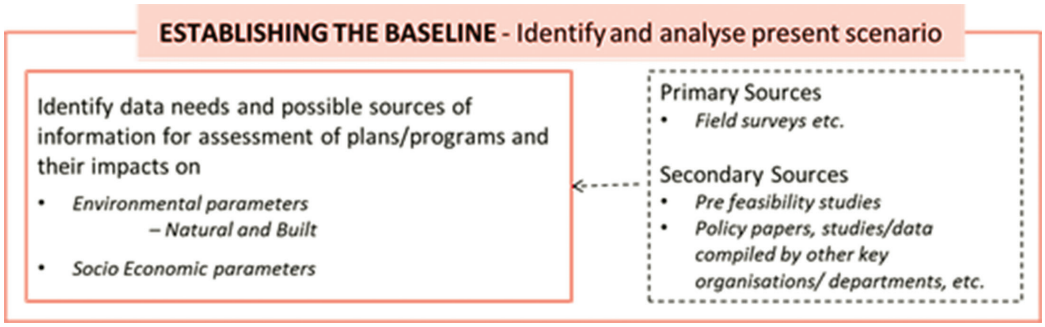
This chapter forms the summary of the full report. It should provide the overall justification for implementation of the plan and should explain how the adverse effects are proposed to be mitigated.

** **Note:** A report of the public consultation may also be a part of this report.*

- To identify existing environmental conditions that are likely to be affected and which might influence strategic/ design decisions
- To identify environmentally sensitive areas and issues that need special attention
- To provide input data for analysis (e.g. for analytical models used for predicting effects)
- To provide baseline information against which future monitoring may be done

It is important that the baseline considers those aspects of the plan or program that are critical from the perspective of key environmental impacts that may result due to plan or program implementation.

Figure 2.2: Establishing baseline for SEA of urban transport plans/ programs



This section highlights the data that needs to be collected to assess the pre-implementation status/ baseline (Figure 2.2). In case of SEA of urban transport plans/ programs, baseline could focus on the city/ sub-city level or on a larger region depending on the scope of the plan or strategy being evaluated. A typical checklist of the baseline information required in the context of SEA of an urban transport plan/ program is given in Table 2.1.


Table 2.1: Checklist of data to be collected for establishing the environmental baseline while conducting SEA of urban transport plans/ programs

Aspect	Data required	Sources
1. Natural environment		
Land environment	Physical terrain: topography, slopes, soils	Geological Survey of India National Bureau of Soil Survey and Land Use Planning (NBSS&LUP)
	Land use: settlements, forests, agricultural land, CRZ area, water features, drainage lines, etc.	Survey of India District Gazetteer State Revenue Department City Master Plan/ Development Plan Archaeological Survey of Indian (ASI)
	Vegetation: coverage, density	State Department of Environment & Forests
	Protected areas: natural parks, bird sanctuaries, heritage sites/structures and other protected areas, etc.	Wildlife Institute of India (WII) Archaeological Survey of Indian (ASI) Zoological Survey of India (ZSI)
Water environment	Water quality: biological and chemical quality of surface and ground water	State Ground Water Board/ Central Ground Water Board, River Board Authorities, Lake authority Central Pollution Control Board/ State Pollution Control Board/ Union territory Pollution Control Committee
	Aquatic habitat: flora and fauna, wetlands, other significant water habitats	
	Hydrology: surface and ground water systems, drainage patterns, Biological and chemical quality of water, etc.	
Air environment	Ambient air quality: sulphur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO), Hydro carbons (HC), particulate matter, ground level ozone (O3), dust, etc.	State Pollution Control Board/ Union Territory Pollution Control Committee
	Climate: Temperature, rainfall, extreme events	Indian Meteorological Institute Delhi/ Pune, Regional Meteorological Centre
	Vibration and Noise: day time and night time levels in different areas; esp. for the sensitive zones	State Pollution Control Board/ Union Territory Pollution Control Committee
2. Socio-economic environment		
	History	City Master Plan/ Development Plan
	Economic base and employment rates, access to economic opportunities	Census of India Directorate of Economics & Statistics (State level/ city level departments) City Master Plan/ Development Plan
	Demography and population	Census of India Directorate of Economics & Statistics (State level/ city level departments) City Master Plan/ Development Plan

Aspect	Data required	Sources
	Infrastructure and services: Access to water supply, sanitation, waste management, drainage and other services	City Master Plan/ Development Plan Urban local body for information on urban infrastructure assets & services State line departments on urban infrastructure – PWD, PHED, Jal Board, Power Corporation, Sewerage and Sanitation Departments, State departments for Education, Health, etc.
	Transportation- infrastructure and accessibility	State level Transport Department, PWD, Roads & Building department, Urban development authority, Municipal corporation City Development plan (CDP)/ City Mobility Plan (CMP)
3. Resources		
	Agriculture: type of crops, areas under agricultural use, barren areas	Department Of Agriculture & Cooperation State level Agriculture departments
	Fisheries: species, areas of water or seabeds	Department of Animal Husbandry and Dairying (AH&D) State level fisheries department
	Wildlife : populations, number of species, species of 'endangered' or 'protected' status	Zoological Survey of India(ZSI) Wildlife Institute of India (WII)
	Forestry and vegetation: species, number of trees, forest areas, areas with protected/ conserved status	State Department of Environment & Forests
	Mining: mineral reserves, mining zones, type of minerals and metals, protected areas	Geological Survey of India (GSI) Indian Bureau of Mines (IBM) State Department of Geology and Mining/ Union Territory Department of Geology and Mining
	Tourism: tourism sites, tourist visitations/ floating population, existing infrastructure and services, infrastructure stress/ gap, tourism revenue	State level tourism department/Union territory tourism department
4. Heritage		
	Natural/ built heritage assets: monuments, sites with 'protected' or 'to be conserved' status	Archaeological Survey of Indian (ASI) Indian National Trust For Art and Cultural Heritage (INTACH)
	Sites with archaeological importance	Archaeological Survey of Indian (ASI) Indian National Trust For Art and Cultural Heritage (INTACH)


The baseline data should be collected for the study area as delineated during the scoping exercise. A map of the delineated study area should also be shown in the SEA study report.

General Considerations

Once information needs are identified, baseline environmental information may be assembled through the collection and analysis of existing data, by carrying out specific field studies, and/or by inputs from consultations. Before embarking on an extensive and costly field studies program, maximum effort should be directed at secondary data collection. A lot of information may also be availed from pre-feasibility studies, background/ policy papers, etc. Primary studies should generally be done to fill in the data gaps and/or provide more timely or focused information and only in the most relevant & inevitable cases. All the data referred from secondary sources should be properly sourced.

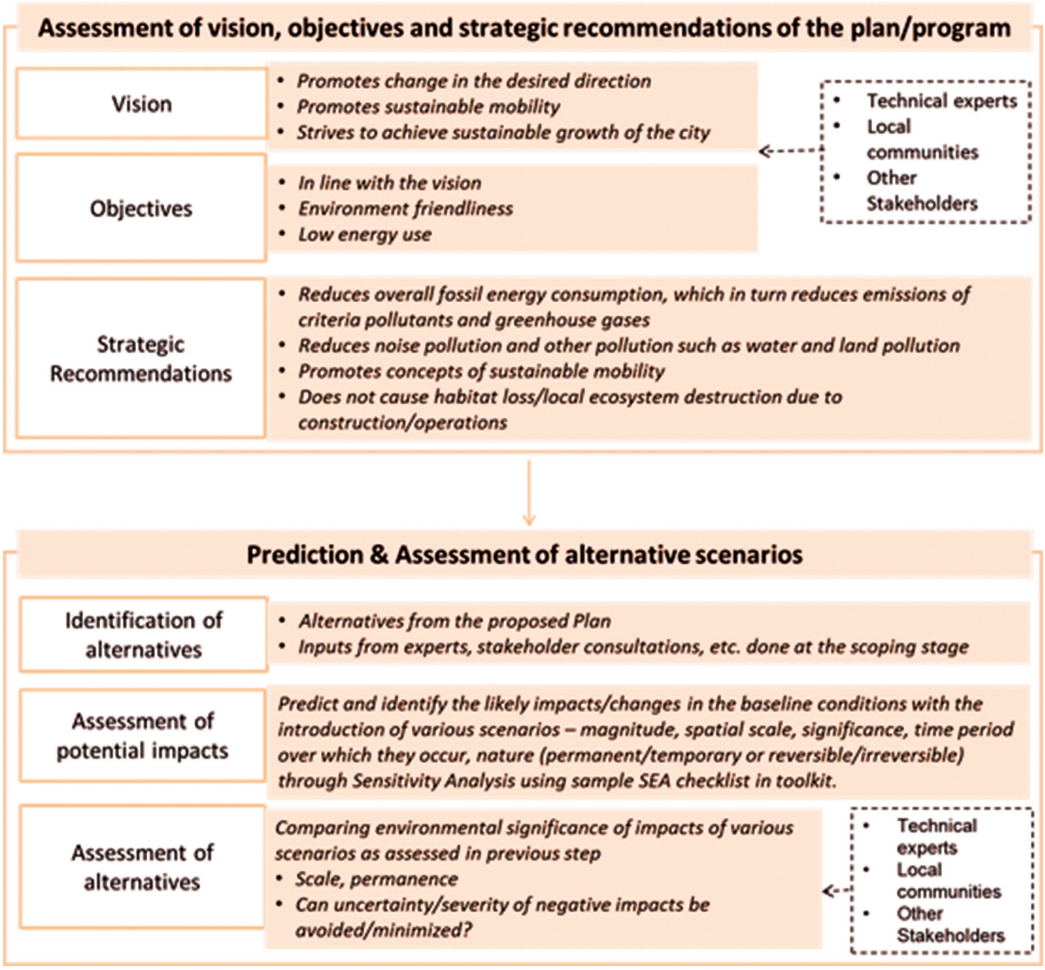
2.3.3 Step 3: Impact Assessment

This section focuses on detailing out the methodology for carrying out impact assessment in SEA exercises of urban transport plans and programs. Typically, scope of SEA includes assessment of likely environmental, social and economic impacts. The methodology discussed here for assessment of impacts at strategic level takes the current practices into account. It is aimed that through this methodology, the proponents (city authorities) would be able to carry out a rapid SEA themselves, without requiring any specialised consultancy services.

Methodology for assessment of impacts of proposed urban transport plans/ programs

Strategic assessment of urban transport plans/ programs typically comprises of 1) an assessment of the objectives of the plan and 2) prediction and assessment of the alternative scenarios (Figure 2.3). These two important steps of impact assessment at strategic level are discussed in detail subsequently. Apart from these, it is felt that an assessment of the strategic recommendations of the plan/ program should also be inevitably carried out. This is due to the fact that many a time the vision and objectives of plans/ programs are very comprehensive, but are not effectively translated into corresponding targets and proposals, leading to gaps in implementation. Figure 2.3 depicts the methodology to be followed in this step to assess the impacts of a proposed urban transport plan/ program. The subsequent sections provide a detailed discussion on the same.

Figure 2.3: Step 3: Assessment of impacts of urban transport plans/ programs



1. Assessment of vision, objectives and strategic recommendations of the plan/ program

As the environmental analysis is done at strategic/ perspective planning level, it becomes imperative to evaluate the vision and objectives of the plan. This assessment will help in understanding if the plan or program promotes change in a desired direction.

To start with, an analysis should be done to check if:

- A vision for future has been formulated in the Plan?
- If yes, does vision encompass environmental concerns and strives to achieve sustainable growth of the city?

Subsequently, it is to be examined if the Plan translates the vision into achievable objectives and strategic recommendations that aim towards having minimal impact of transport activities on environmental quality and local ecosystems and reducing its energy consumption levels, which implies that the transport system (TERI, 2011):


- Reduces overall fossil energy consumption, which in turn reduces emissions of criteria pollutants and greenhouse gases
- Reduces noise pollution and other pollution such as water and land pollution
- Promotes concepts like green streets, etc.
- Does not cause habitat loss/local ecosystem destruction due to construction/operations

To evaluate whether the plan/ program aims to promote environmental friendliness and low energy use, the strategies proposed in the plan should be evaluated to analyse if there are recommendations such us promoting mass transport, non-motorized transport (NMT), clean alternative fuels and using effective traffic demand management principles and systems (TERI, 2011). Box 2.3 enlists the parameters that may be used for this purpose (TERI, 2011).

Box 2.3 Parameters to evaluate the environmental friendliness of an urban transport plan

- **Promoting mass transport**
  1. Proposes public transport systems serving the entire population
  2. Gives recommendations to improve access to public transport nodes – introducing feeder services, integration of NMT corridors with public transport nodes, provision of adequate parking space for private and NMT modes at public transport nodes
  3. Suggests integration of IPT as a support/feeder to public transport systems
  4. Suggests measures to ensure quality of public transport services (reliability, travel time, comfort, safety, security)
  5. Promotes a multi-modal public transport system – single ticketing, easy interchanges
  6. Recommends use of ICT to improve delivery of public transport services to commuters
- **Promoting NMT**
  1. Creating Segregated rights of way for bicycles and pedestrians
  2. Creating safe bicycle parking spaces, facilities like shade giving landscaping, provision of drinking water and resting stations along bicycle corridors and pedestrian pathways
  3. Public bicycle program – rent and use a bicycle
  4. Preference in the allocation of parking space for non-motorized modes

- **Using effective traffic demand management principles and systems**
  1. Promotes smooth movement on roads – reducing travel time (linked to congestion, idling, signal timings)
  2. Incentives for shifting to collective transport modes; disincentives for using personal motorized transport-
     - higher fuel taxes, higher parking fees, graded scale of parking fee, park and ride services
     - reduced availability of parking space, no free parking on carriage ways in residential areas
     - longer time taken in travelling by personal vehicles vis-à-vis public transport, etc.
     - congestion pricing schemes
  3. Encourages virtual commuting
- **Promoting use of clean alternative fuels like electricity from clean/renewable sources in public, private and IPT vehicles and promoting environmental quality**
  1. Subsidies/concessions on vehicle technology
  2. Provision of supporting infrastructure to promote use of alternative fuel technology
  3. Street concepts proposed (like green streets)

Based on the parameters discussed above, Sample SEA checklist (Table 2.2) may be applied for environmental assessment of the Vision, objectives and strategic recommendations of an urban transport plan/ program.

Table 2.2: Sample checklist for SEA of urban transport plans/ programs (Part 1)

Components of the Plan	Assessment criteria	Remarks
Vision	Does the Vision promote sustainable mobility?	
	Does the Vision strive to achieve overall sustainable growth of the city?	
Objectives	Are the objectives in line with the vision? Do they translate the vision into achievable objectives?	
	Will the objectives lead to reduction of overall fossil energy consumption, which in turn will reduce emissions of criteria pollutants and greenhouse gases?	
	Will the objectives lead to reduction of noise pollution and other pollution such as water and land pollution	
	Do the objectives promote concepts of sustainable mobility	


Strategic recommendations	Are the recommendations in line with the vision and objectives?	
	Do the recommendations promote environment friendliness and low energy use? • Mass transport • Non-Motorized Transport (NMT) Effective traffic demand management principles and systems • Use of clean alternative fuels like electricity from clean/ renewable sources • Integration of land use and transport – Improvement in accessibility	

If the objectives and strategic recommendations reflect the above mentioned principles/ proposed actions, the plan/ program may be deemed 'relatively fair' in terms of its environmental impacts. The SEA report may suggest appropriate changes, based on this evaluation, to be incorporated in the plan vision, objectives and recommendations wherever required, so that the plan/ program meets these environmental criteria.

2. Prediction and Assessment of alternative scenarios

Once an evaluation of the plan vision, objectives and strategic recommendations has been done, prediction and assessment of alternate future scenarios/ alternatives and evaluating related secondary and cumulative impacts are an integral part of the strategic assessment exercise. This helps to choose the most optimum approach and benchmarking for monitoring & follow-up assessment.

Typically, the recommendations of a city master plan or a city mobility plan (CMP) result in corresponding proposals, projects etc. along with spatial conceptual/ network plans. For example, a city master plan may propose a new network of urban roads, development of passenger/ freight terminals/ container depots, parking areas, area circulation/ traffic management plans, identification of 'no-vehicle' streets/ zones, etc. A CMP, typically, has to do detailed modelling/ scenario building exercises to come up with proposals that spatially identify the locations and alignments of the proposed infrastructure. Such proposals of the plan/ program may be subjected to alternative scenario assessment to understand their environmental implications and to enhance positive effects and reduce negative ones.

The following important steps form the approach for predicting and assessing alternative scenarios:

a. Identifying alternatives

In order to identify the strategic alternatives, the different ways of fulfilling the objectives of a plan or program should be proposed. It may be possible to identify some of the alternatives from the plan itself. Other alternatives may also be identified based on inputs from experts, stakeholder consultations, etc. at the scoping stage as discussed in Step 1. This exercise will result in building of different scenarios/ alternatives e.g., the scenario without introducing/ implementing the proposed plan or the 'business-as-usual' scenario. Other possible alternatives could be in terms of choosing an alternative solution to a transportation problem e.g. choosing from 2 different mobility options like a rail-based MRTS and a BRTS or choosing between 2 alternative route alignments.

Each alternative then has to be compared against the common SEA criteria, considering both positive as well as negative effects as discussed in the next steps. This kind of evaluation will be an iterative process,

with the alternatives being revised as part of the SEA to enhance positive effects and reduce negative ones. It may be noted that some baseline conditions might change as per the assumptions of the different scenarios/ alternatives. Therefore, it may be necessary to revisit earlier tasks such as the collection of baseline information, as new information and issues emerge.

b. Identification and assessment of potential impacts

Identification of the impacts/ changes which are predicted to arise in the baseline conditions with the introduction of the various alternative scenarios has to be done and a description of the same has to be given in the SEA report. The description should entail the likely changes in terms of their magnitude, spatial scale, time period over which they occur, if they are permanent or temporary, positive or negative, and whether or not they will lead to secondary, cumulative effects. This would primarily give an understanding of impacts on the components of natural, built and socio-economic environment as identified earlier.

It is also important to understand the synergistic (induced) and cumulative impacts of the proposals as many of the environmental issues that arise due to infrastructure development result from the accumulation of multiple and often indirect effects. For example, a development that changes water table and thus affects the ecology of a nearby wetland, construction of one project that facilitates or attracts other developments, etc. Cumulative effects arise where several developments together have a significant effect; or where several individual effects of the plan (e.g. noise, dust and visual) have a combined effect (ODPM, 2005). Often the term 'cumulative effects' is taken to include induced effects. For example, in the POSCO case in Orissa as discussed earlier, main industry is the steel plant, but it involves major components of port, captive power plant, residential complex, water supply, etc. In this case, individual environmental assessments through EIA for all these may play down their cumulative environmental impact. Assessment of cumulative impacts of the plan/project, as a whole, is hence required. Also, it is important to highlight the spatial and temporal scale to understand their significance and nature of permanence.

Table 2.3 & 2.4 represent a sample SEA checklist template that may be used for description and assessment of potential impacts of the various alternative scenarios of a plan/ program.

Typically, it is good to express the predictions in quantitative terms however, quantification is not always possible in case of SEA as the assessment is being done at the strategic level and detailed baseline data required for quantification may not be available or easy to model. Moreover, modeling based quantification of impacts will be a time consuming exercise. Alternatively, qualitative predictions can be equally valid and appropriate. As per current practice, a number of qualitative techniques like sensitivity analysis, expert judgments, public participation (process for consultation outlined in Annexure VIII), etc. are used to identify, predict and evaluate impacts.

The template in Table 2.3 uses a kind of sensitivity analysis that may be used to assess if the proposal will result in impacts of high, moderate or low magnitude, which is represented as the 'sensitivity'. Such sensitivity analysis may be done for all the alternatives to understand if the identified impacts are 'getting better or worse' with each alternative.


Table 2.3: Sample checklist for SEA of urban transport plans/ programs

Potential Impacts	Sensitivity		
	High	Moderate	Low
1. Characteristics of the likely effects and of the areas likely to be affected			
• Change in land use (more intensive land uses as a result of the plan/ program)			
• Exceeded environmental quality/ quality of life standards (due to increased densities or requirement for infrastructure/ basic services)			
• Loss of open/green areas			
• Loss of water bodies			
• Loss of vegetation			
• Loss of biodiversity			
• Risk to Air Environment (due to pollution, noise, generated waste, land degradation, etc.)			
• Risk to Water Environment (due to pollution, generated waste, land degradation, etc.)			
• Risk to Land Environment (due to pollution, generated waste, land degradation, etc.)			
• Risk to Public Health (due to pollution, noise, accidents, etc.)			
• Vulnerability of Heritage areas (areas with special natural characteristics or cultural heritage, or landscapes which have a recognized national, community or international protection status)			
2. Scale of likely effects			
• Magnitude - size of the population likely to be affected			
• Spatial extent - geographical area likely to be affected			

Note: *The list may be interpreted in terms of 'sensitivity' to negative impacts, i.e. more negative are the impacts, higher the sensitivity*

Table 2.4. Sample checklist for SEA of urban transport plans/ programs (Part 3)

Significance of likely effects in terms of:	Remarks by the proponent
• Does the plan or program set a framework for development of future infrastructure projects and other activities?	
• Does the plan or program influence other plans or program?	

• Does the plan or program take into account and is dovetailed with other plans/ programs linked to waste-management, water conservation, protection of green areas, etc.?	
• What is the relevance of the plan or program for the integration of environmental concerns and for promoting sustainable development?	
• What are the environmental problems relevant to the plan or program? What is their extent?	
• Does the plan/ program analyse alternate scenarios/ options taking into cognizance and minimizing environmental impacts?	
• What is the relevance of the plan or program for the implementation of other environmental legislations/ regulations?	
• What is the probability, duration/ frequency and potential for reversibility of the likely effects?	
• Do the likely effects of the plan or program have a cumulative nature? What is the environmental significance of these cumulative impacts?	
• What are the trans-boundary effects of the plan or program, if any?	

Note: *The templates presented in Table 2.2, 2.3 & 2.3 are just an indicative list of parameters that can be used while conducting the SEA exercise. The proponent may further qualify this list based on experience and the context & baseline of the plan under examination.*

In addition to evaluating the sensitivity through the rapid assessment checklists as described above, each of the parameters in item 1 in Table 2.3 may be mapped in terms of their spatial extent highlighting the areas with high, moderate and low sensitivity to the impacts in order to understand the spatial scale of the likely impacts (item 2 in Table 2.3). Based on the technical capacity of the proponent, ICT based methods like GIS may also be used for this purpose. This mapping exercise will help in comparing various alternatives in terms of their scale and magnitude of impacts and in recommending mitigation measures to prevent/ minimize the likely impacts.

c. Assessment of alternatives

Assessing the alternative scenarios for predicted impacts will involve evaluating the environmental significance of the predicted impacts in each of the alternatives in order to make the most optimum choices. For example, if a city master plan or CMP proposes a mass transit system for the city, the biggest strategic question that arises is whether a rail-based MRTS or a BRTS would be more suitable and sustainable in the long run. A rail based MRTS is material intensive and has high life cycle energy and emission costs during construction stage (TERI, 2012). However, it is a high capacity system and is highly energy efficient if the ridership is very high, in addition to being a zero-emission system at tail-pipe. On the other hand, in case of a lower expected ridership range, a BRTS may be a more optimum alternative as it is relatively less material intensive and will have lower life cycle construction costs (TERI, 2012). Such large scale projects also have a number of cumulative and synergistic (induced) impacts. An environmental assessment at the strategic


level that evaluates the social and environmental impacts of both the alternatives can act as an effective tool for choosing the most optimum option for developing mass rapid transit system for the city from an environmental perspective.

Based on the sensitivity analysis through the sample SEA checklist (Table 2.2) and by mapping the 'sensitive' areas as discussed above, a comparative analysis of the impacts of various alternatives may be done. The proponent may seek inputs from experts and key stakeholders at this stage (process for consultation outlined in Annexure VIII).

Alternatives which result in lesser parameters having 'higher sensitivity' from the assessment (Table 2.3) may be deemed 'relatively fair' in terms of negative environmental impacts. Also, the assessment must consider liable impacts on the relevant components of the natural and social environment in terms of scale and permanence, and impacts/ linkages with other plans, projects, regulations (item 2 in Table 2.2 & Table 2.3). Larger scale of impacts in terms of spatial extent or affected population, irreversibility/ uncertainty, higher cumulative effects, larger influence on other plans, projects, and regulations will reflect higher significance of the likely negative impacts of an alternative. The issues to be considered while assessing the alternative scenarios should include (ODPM, 2005):

- Is the alternative likely to have a significant adverse or beneficial effect in relation to environmental objectives or targets of the plan and the SEA exercise?
- If so, can the adverse effect be avoided or its severity reduced, or can the beneficial effect be maximized?
- If the adverse effect cannot be avoided, e.g. by conditions or changes to the way it is implemented, can the alternative be changed or eliminated?
- If its effect is uncertain, or depends on how the plan is implemented, how can this uncertainty be reduced?

Based on the comparative analysis of the likely effects as discussed above, some alternatives may be dropped from further consideration. Moreover, it is recommended to carry out a quantitative assessment of the likely impacts of the selected optimum alternative. This will help in identifying the critical impacts of the plan and benchmarking for monitoring and follow up assessment.

The report must give a description of the alternatives considered by the plan or the SEA exercise and the results of the alternative scenarios analysis. The report must also document any limitations in the information and assumptions made while doing the assessment.

d. Identification of need for further detailed assessment studies

A plan sets the context for individual projects; these projects need to be assessed to broadly predict significant environmental effects to be able to indicate which projects will require an EIA at the later stage. This will also be helpful to decide whether to propose a particular project, or if particular alternatives have to be excluded or significantly reduced at the plan stage itself.

The process of impact assessment of various alternative scenarios as discussed above can be used to assess and identify the most optimum approach for planning/ implementation of urban transport infrastructure plan/ programs.

2.3.4 Step 4: Strategies to avoid/reduce impacts

The aim of any environmental assessment exercise at the strategic level or at the project level is to ensure that potential environmental problems are foreseen and avoided at an early stage in planning cycle. The previous chapter had discussed the approach and methods to identify and assess the potential impacts. This section focuses on informing the readers what kind of solutions/strategies can be taken up to avoid/ reduce the potential environmental impacts of urban transport plans/ programs. Generic mitigation measures to avoid/reduce some typical expected impacts have been discussed here.

Mitigating environmental impacts of urban transport plans

The usual mitigation mechanism applied in practice involves (Figure 2.4; MoEF, 2010; ADB, 2003):

- Prevent/ Avoid environmental impact

Figure 2.4: Step 4: Mitigating impacts of urban transport plans/ programs

- **Minimize** and control adverse environmental impact

As shown in Figure 2.4, preventive measures are generally applicable at the level of planning. The analysis of the alternative scenarios during impact assessment should be taken into consideration by the proponent for coming up with alternate planning solutions for a transport problem, in order to prevent/ avoid adverse environmental impacts. For example, while planning for a mass transit system in a city, there could be multiple options - a rail based MRTS or a BRTS? The choice of the most optimum option will have to be on the basis of assessment of likely significant adverse impacts, externalities and cumulative impacts from the two alternative scenarios, the high life cycle energy and emission costs of the material intensive rail based MRTS may be justifiable if the expected ridership is very high. However, in case of lower expected ridership range, a BRTS may be a more optimum alternative as it is relatively less material intensive and will have lower life cycle costs. Such large scale projects will also have a number of cumulative and synergistic (induced) impacts. A large number of the adverse environmental impacts may be prevented/ avoided by choosing the right alternative at the strategic level itself.

Minimization measures are generally applicable at the stage of plan implementation or construction. These include interventions like alternative site/ alignment. For example, in case of the Delhi Metro, the alignment of the Central Secretariat – Badarpur corridor was modified as it was found from the environmental assessment that the original alignment would have had significant impact on the Okhla Bird Sanctuary. Similarly, alternative technology measures may be adopted to prevent and minimize the negative environmental impacts.

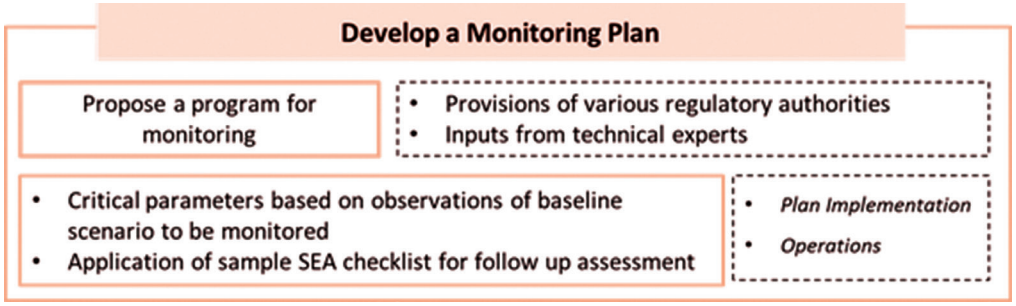

2.3.5 Step 5: Monitoring and Evaluation

The environmental assessment of plans and projects predicts and assesses 'likely' or 'potential' impacts. Therefore, in order to effectively mitigate the adverse environmental impacts, it is necessary that regular monitoring and follow up assessment is carried out during plan implementation and operation phases.

Environmental monitoring normally starts with the implementation stage to understand the changes that have been brought about in the baseline conditions. It continues through operation stage to detect changes in the key environmental quality parameters, which can be attributed to the plan. The results of the monitoring program are to be used by the proponent to evaluate the extent, severity and trends of the environmental impacts against the predicted impacts; performance of the mitigation measures; and compliance with pertinent rules and regulations.

The critical impacts have to be identified based on the observations from the baseline scenario and have to be monitored at different stages of plan implementation and operation. A quantitative assessment of the critical impacts as recommended earlier in Step 3 could be carried out at the time of follow up assessment as well to understand the relative performance of the Plan. In addition, the rapid assessment checklist used during impact assessment should be applied for follow up assessment/ evaluation every time as per the proposed monitoring plan (Figure 2.5). This will help in understanding the nature and extent of the impacts that actually arise from implementation of the Plan. Therefore, the proponent should, inevitably, include a program for monitoring and follow-up assessment in the SEA report.

Figure 2.5: Step 5: Monitoring and evaluation of environmental impacts of urban transport plans



Eventually, the monitoring exercise should be able to evaluate the following:

- How good or bad is the situation as compared to the baseline scenario? Do trends show that it is getting better or worse?
- How far is the current situation from any established thresholds or targets?
- Are particularly sensitive or important elements of the environment affected, e.g. vulnerable social groups, non-renewable resources, endangered species, rare habitats?
- Are the problems reversible or irreversible, permanent or temporary?
- How difficult would it be to offset or remedy any damage?
- Have there been significant cumulative or synergistic effects over time and if any more are expected in the future?

2.4 Performance Checklist for SEA

It is aimed that the team of experts within the concerned city level planning/ implementation agency will be able to carry out the SEA exercise using the methodology and templates provided in this Toolkit. However, if required, the proponent may hire an expert consultant for this purpose. To help assess the exercise carried out by the consultant, a checklist is being provided in Table 2.5. It may be used by the proponent to evaluate if all the steps of SEA have been carried out as prescribed in this Toolkit.

Table 2.5 Performance checklist for SEA

No.	Step by step activities to be carried out in a SEA exercise	Yes	No
a.	Did the plan/program under consideration undergo a screening process?		
b.	Was the scoping exercise carried out to – • delineate the study area for SEA • define the spatial scale and time scale for which assessment is to be carried out		
c.	Was the scoping exercise done in consultation with the technical experts and other stakeholders?		
d.	Were the key concern areas (environmental and socio economic) identified?		
e.	Were relevant alternatives considered for the assessment exercise?		
f.	Was a detailed baseline prepared for the SEA study? *(Application of the data collection template presented in Table 1)*		
g.	Were the vision, objectives and strategic recommendations of the plan/program evaluated for their environment friendliness? *(Application of Sample checklist presented in Table 2a)*		
h.	Was sensitivity analysis done for alternative scenarios? *(Application of Sample checklist presented in Table 2b)*		
i.	Was the most environmentally optimum alternative selected?		
j.	Was quantitative assessment done for the selected alternative?		
k.	Were relevant mitigation measures suggested at various stages of plan formulation and implementation?		
l.	Was a program suggested for monitoring and follow up assessment of the plan?		
m.	Was a detailed SEA study report prepared? *(Refer Box 2 for a sample Table of Contents for a typical SEA study report)*		
n.	Was the SEA study report submitted to the concerned city/ state level urban transport planning authority?		

Chapter 3

Environment Impact Assessment of Urban Transport Projects

3.1 Indian context, policies and regulations

3.1.1 History

In India, little or no attention was given to the environmental issues emerging out of the implementation of developmental projects until 1980's. The subjects of environment and forests until then were the concern of the Dept. of Science and Technology and the Ministry of Agriculture, respectively. Later these subjects came under the purview of the Department of Environment set up in 1980 which was further upgraded to the Ministry of Environment and Forests in 1985.

The foundation of Environmental Impact Assessment (EIA) in India was laid in 1976-77 when the Planning Commission called in for the examination of the river valley projects from the environmental perspective. But, it was more of an administrative decision and lacked legislative support at that time. To fill this gap, the Environment (Protection) Act (EPA) was enacted by the Government of India in 1986. A major legislative measure was undertaken in 1994 when the Union Ministry of Environment and Forests (MoEF), Government of India, under the EPA (1986), issued an EIA notification making Environmental Clearance (EC) mandatory for various projects/activities likely to have significant environmental impacts and health implications. Since then, the EIA notification has undergone several amendments from time to time and has been revised once in 2006.

This chapter focuses on giving an understanding of the current policies, regulations, acts, guidelines, etc. for carrying out EIA in the Indian context. It also discusses the legal and institutional context in which the EIA exercises have to be conducted. The Toolkit takes into account the current statutory requirements while defining the process and methodology for conducting EIA for urban transportation projects in the later chapters.

3.1.2 The process of environmental clearance in India

The Ministry of Environment & Forests has made prior environmental clearance for certain developmental projects mandatory through its notification issued on 14th September 2006 and as amended on 1st December 2009. The notification brings under its purview, a large number of development projects. The following sections would give a detailed discussion on the scope and the process outlined for environmental assessment by the aforementioned notification.

1. Scope

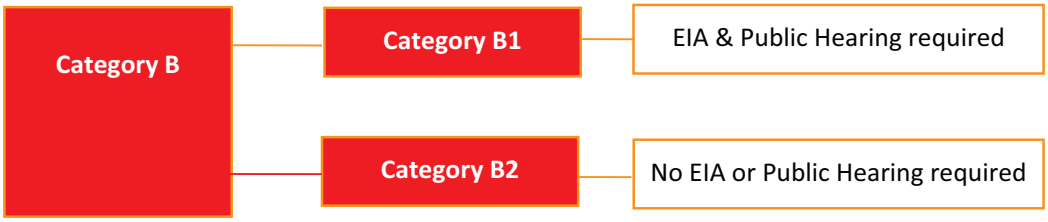
As per the notification, all projects/developmental activities requiring "Environmental Clearance" (EC) have been divided into 8 major heads. Annexure I gives the Schedule of projects requiring EC. As per this Schedule, transport projects fall under category '**Physical Infrastructure including Environmental**

Services'. Transport projects include airports (Category 7a), ports & harbours (Category 7e), roads and highway projects (Category 7f) and aerial ropeways (Category 7f). The notification also classifies the project activities under each head into two main categories 'A' and 'B', where category 'A' projects are appraised at the Central level and category 'B' at the State level. As an example, Table 3.1 gives the classification for the highway projects (Category 7f) in the EIA Notification of 2006.

Table 3.1 Categorization of highway projects as per EIA Notification, 2006 (as amended in 2009 and 2011)

Project Activity	Category	Criteria	Concerned approving Authorities
Highways (including Expressways)	**A**	New National Highways & expansion of National Highways greater than 30km, involving additional right of way greater than 20m, involving land acquisition and passing through more than one state.	**Centre Level:** Ministry of Environment and Forests (MoEF) on the recommendations of an Expert Appraisal Committee (EAC) constituted by the Centre.
	B1	All new State Highway projects and State Highway expansion projects in hilly terrain (above 1000 m AMSL) and/ in ecologically sensitive areas	**State Level:** State/Union Territory Environment Impact Assessment Authority (SEIAA) on the recommendations of a State or Union Territory level Expert Appraisal Committee (SEAC)
General conditions: Any project or activity specified in category B will be treated as category A, if located in whole or in part within 10 km from the boundary of: (i) Protected areas notified under the Wildlife (Protection) Act, 1972; (ii) Critically polluted areas as identified by the Central Pollution Control Board from time to time; (iii) Eco-sensitive areas as notified under section 3 of the Environment (Protection) Act, 1986, and (iv) Interstate boundaries and international boundaries **Exception:** The requirement regarding distance of 10km of the inter-state boundaries can be reduced or completely done away with by an agreement between the respective states or U.Ts sharing the common boundary in the case the activity does not fall within 10 kilometres of the areas mentioned at item (i), (ii) and (iii) above.			

As stated earlier, Category 'A' projects require clearance directly from the Centre i.e. MoEF whereas Category 'B" projects require clearance from the state government, which further classifies the projects into two categories: Category 'B1' (projects required to submit EIA report) and 'B2' (project activities, which do not require EIA report). In order to make the EIA procedure transparent, all projects under categories 'A' and 'B1' are required to carry out "Public Hearing" as per the procedure stipulated in the notification.




As may be observed, the transport projects covered include only the airports, ports & harbours, roads and highways and aerial ropeways. Several other key transport projects, especially the urban transport projects like urban metro rail projects, bus rapid transit systems, etc. are not specifically identified in the notification. These large scale projects should however be evaluated for their environmental impacts and should be brought under the purview of the notification.

2. Prior environmental clearance: the process

Prior environmental clearance primarily involves thorough assessment of the potential environmental impacts of a proposed developmental project/activity before implementation. This is done through an Environmental Impact Assessment (EIA) study, which forms an essential component of the environmental clearance process as per the statutory process outlined in the EIA notification (2006).

Prior environmental clearance is required from the State level Expert Appraisal Committee (SEAC) for matters falling under Category 'B', before any construction work, or preparation of land by the project management (except for securing the land). It includes the following:

- All new projects or activities
- Expansion and modernization of existing projects or activities
- Any change in product - mix in an existing manufacturing unit beyond the specified range.

EIA process

Preparation of an EIA study report is the responsibility of the project proponent. If the proposed activity/ project falls under the purview of the environmental clearance, the project proponent has to conduct an EIA study with or without the help of external consultant or institution.

The proponent shall then apply for an environmental clearance through a prescribed application format i.e. Form- 1 or Form 1 & 1A in case of construction projects along with the required documents (as per Form 1/ 1A) to the SEAC. Form 1 & 1A are given in Annexure II.

As per the EIA notification (2006), the EIA process involves four main stages. These stages are discussed below.

i. Screening

This is the first and the simplest step of the EIA process where all Category B projects seeking environmental clearance (mentioned in the Form 1) are examined and further categorised into B1 and B2 projects by the State level Expert Appraisal Committee (SEAC) depending upon the nature and location specificity of the project. A brief of the project is submitted along with the details required in Form 1/ Form 1A (Annexure II) by the project proponent to the SEAC for this purpose. Category B1 projects are required to prepare an EIA report and subsequently require 'Public hearing'. No screening is required for category A projects.

ii. Scoping

After establishing the need to perform EIA study for a proposed project/activity, the projects are subject to scoping by the concerned authority (EAC for Category A and SEAC for Category B1 projects), which involves preparation of detailed and comprehensive Terms of References (TOR) addressing all the issues of environmental concern. The EAC/SEAC issues the TOR to the project proponents within a time period of 60 days.

A draft EIA report is prepared by the project proponent based on the TOR.

iii. Public consultation

After the draft EIA report is submitted by the project proponent, public consultation is conducted by the concerned State Pollution Control Boards (SPCBs) in order to address the concerns of the local communities who are likely to get affected by the developmental activities. The results and recommendations of the EIA study are presented by the project proponent and subjected to consultation. EIA Notification 2006 (as amended in 2009) makes public consultation a mandatory requirement for all category A and category B1 projects. However, in some cases exceptions may be made, subject to the decision of the EAC/ SEAC during the approval of ToR. Some of such exceptions in the past have included:

- Projects involving expansion of Roads and Highways, which do not require any further acquisition of land, and
- All projects or activities concerning national defence and security or involving other strategic considerations as determined by the Central Government.

A prior notice for 'environmental public hearing' of development projects is to be issued in a minimum of two newspapers (at least one in vernacular language of the concerned community) and circulated in the region, 30 days in advance of the finalised date for the hearing process. All the suggestions or comments or concerns brought out during the public consultation process are required to be addressed and necessary changes are to be made in the report before finally sending it for appraisal to the EAC/ SEAC. The public consultation is allotted a maximum time period of 45 days.

The State Pollution Control Board and the concerned District Magistrate's office play a crucial role in organizing the public consultation process.

iv. Appraisal

The final EIA report after incorporating all issues and concerns brought out during the public consultation process is submitted to the concerned authority (EAC or SEAC) for appraisal. Recommendations are made by the appraisal committees regarding the issuance of environmental clearance for the concerned projects after careful evaluation of the project application and other documents (like final EIA report, outcome of the public consultations including the public hearing proceedings, etc.). Accordingly, the final decision regarding the approval or rejection is taken by the MoEF/ SEIAA (State/Union Territory Environment Impact Assessment Authority) based on the recommendations of the appraisal committees. In case of rejection of environmental clearance, the decision is communicated to the project proponent along with the reasons for the same.

The maximum time to be spent on processing an application for issue of environmental clearance as indicated in the EIA Notification (2006) is about 10 to 12 months (for the above four stages).

Other Clearances: As per the provisions of the EIA Notification of Sept. 14th, 2006 (as amended in 2009), environmental clearance of any project may require certain other clearances apart from the prior environmental clearance as applicable before any construction work is started. These clearances are:

- **Forest clearance** for Diversion of Forest Land for Non-Forest Activities as per The Forest (Conservation) Act, 1980 including The Forest (Conservation) Rules, 2003. For this, MoEF is the nodal agency.
- **Clearance under Coastal** Regulation Zone (CRZ), 2011 replacing earlier CRZ notification, 1991 as per The Environment (Protection) Act, 1986. For this, MoEF is the nodal agency.
- **Wildlife Clearance** as notified under the Wildlife (Protection) Act, 1972.


Annexure III gives a detailed discussion on the three clearances mentioned above. These clearances are pre requisites for environmental clearance and form an integral part of the whole process. Any project or activity may require none or any of the above clearances as part of the overall environmental clearance. Further, if a road/highway project comes under the purview of EIA notification as Category B and is also found to be subject to these other clearances, then as per the 'General Conditions' of the Notification, the project is treated as Category A project instead of Category B/B1.

The project proponent can apply or initiate the process of obtaining the other applicable clearances simultaneously with the environmental clearance from the concerned divisions of the MoEF. However, the concerned Environment Appraisal Committee (EAC) of the MoEF may grant the prior environmental clearance on a conditional basis, in case the other clearances are still pending with MoEF or are under process.

Other site-level applicable laws and regulations: Apart from the clearances required prior to the commencement of any construction work, certain other site specific legislations or rules, which are generally applicable in various urban infrastructure projects, are to be complied with.

Annexure III gives a list of these rules. Any project irrespective of whether it requires a prior environmental clearance or not, has to comply with the applicable environmental laws, rules, regulations and acts during the different phases (pre-construction, construction and operation) of the project, if applicable. Non-Compliance may result in closure of the project and punishment as specified under The EPA, 1986.

Preparation of an Environmental Management Plan (EMP)

Typically, an EIA is followed by preparation of an Environmental Management Plan (EMP), which can either be a part of the EIA report or a separate document. An EMP is intended to minimise the impacts identified in the EIA report through various measures (mitigation, management, monitoring, and institutional measures) to be taken up during the project implementation or operation phases.

i. Validity of environmental clearance

The clearance granted is valid for a period of five years during which the commencement of the construction or operation of the project should take place. The concerned regulatory authority (EAC/ SEAC) may extend this validity period by a maximum period of five years.

ii. Post environmental clearance actions

After the environmental clearance is granted for category A projects, the project proponent shall as a mandatory requirement make public the clearance granted for their project along with the environmental conditions and safeguards at their cost. To do so, the proponent should advertise it in at least two local newspapers of the district or state where the project is located. The same should also be displayed on the project proponent's website permanently in addition to the above. In case of category B projects also, the project proponent should advertise in the newspapers indicating that the project has been accorded environmental clearance and also provide the details of concerned website where it is displayed (MoEF or SEAC/SPCB website).

As per the prior environmental clearance stipulated terms and conditions, half-yearly compliance reports should be submitted by the proponent. All such reports should be public documents displayed and timely updated on the website of the concerned regulatory authority (EAC/ SEAC).

3.1.3 Application of EIA to urban transport projects

Environmental clearance for urban transportation projects is not mandatory in India. In the present context, roads in urban areas require an environmental clearance only when they are classified as National/State Highways and further meet the threshold criteria as specified under the EIA notification.

Apart from the above, the notification does not include urban transportation projects like mass rapid transit systems (e.g. Metro rail system, Bus Rapid Transit System (BRTS), etc.) in its Schedule and hence, conducting an EIA or carrying out Public Hearing is not mandatory in case of these projects. However, some recent Metro rail, BRTS projects, etc. (as discussed in the literature review) have carried out an EIA study to estimate and reduce the potential impacts of infrastructure development. This has happened with the growing realisation of the high potential of the transport sector, especially large scale infrastructure projects, to give rise to significant adverse impacts on the environment. In some cases, it has also been done due to the procedural requirements of the international agencies funding these projects where reduction and mitigation of environmental impacts of development is a mandate of the funding organizations.

However, there are still a large number of urban transport projects that are implemented without any concern for their environmental impacts owing to the lack of regulatory provisions. There is a growing need to address this gap and mainstream environmental analysis into the process of planning and development of urban transport infrastructure by mandating EIA of large scale urban transport projects. These will include projects, which are proposed under the city development plans, transport/mobility plans. Also, quite a number of large scale urban transport projects are coming up or are being implemented in metropolitan and medium sized-cities in the country, under the centrally or state funded programs/ schemes; for example, a network of high speed roads/ flyovers; such projects should be evaluated for their environmental impacts.

3.2 Pre – requisites: Changes in laws, regulations & institution

Prior environmental clearance is not a mandatory requirement for urban transport projects in India. As a result, no EIA studies are being conducted as a regulatory requirement.

Therefore, in order to mainstream environmental assessment in the formulation of urban transport projects, there is a growing need that an institutional and regulatory framework is devised. This framework, apart from setting up of the institutional structures, should also guide in terms of applicability, statutory process, approach for environmental assessment and reporting, and the capacity required at the level of local bodies to carry out such studies.

As per the present context, the EIA Notification, 2006 (as amended in 2009 and 2011) under the Environment (Protection) Act, 1986 makes EIA a statutory requirement for certain categories of projects as listed in the Schedule (see Annexure I). The transport projects that feature in this list are highways, ports and harbours and airports; the Schedule does not include the urban transport projects. In view of the significant impacts that large scale urban transport projects like MRTS, BRTS, mono-rail systems, LRT systems, etc. may potentially have, these should be brought within the scope of the prior environmental clearance process.

The EIA Notification should:

1. Establish the applicability of EIA to urban transport projects by bringing them in the Schedule of projects

2. Define the statutory process of carrying out the study (including public participation and hearing)


3. Formulate guidelines for establishing baseline, environmental assessment and reporting, data management, monitoring and evaluation mechanism.

4. Define the structure, roles and capacities of various institutions (including the urban local bodies and other relevant local authorities) that will be involved in conducting and evaluating the assessment studies

Once included in the EIA notification, based on the provisions as discussed above, constitution of a team/ group/ department will be required within the urban local bodies (ULB)/ relevant local public agencies, which can conduct or supervise the environmental assessment of urban transport projects in a city.

3.3 How to conduct EIA of urban transport projects?

3.3.1 Step 1: Screening and scoping

An important objective of this Toolkit is to inform the city level officials involved in planning and implementing transport sector projects on how to conduct EIA. It is aimed that with the help of this Toolkit, the city officials will be in a position to either conduct the EIA themselves or be able to evaluate the EIA study carried out by the hired consultants effectively. The subsequent chapters will discuss in detail the steps involved in carrying out the EIA exercise.

This chapter focuses on the methodology for screening and scoping of urban transport projects which is required as the first step so that only those projects that qualify may be taken up for detailed Environmental Impact Assessment.

Screening

It is important to understand that all urban transport projects may not require a full-fledged, detailed environmental analysis. Carrying out EIA studies can be both costly and time consuming. Therefore, it is important to focus on projects that have potentially significant and irreversible impacts. For example, widening of an urban road or construction of a flyover/ underpass on an existing road may not involve any new land acquisition or green field development. In such a scenario, the environmental impacts will be highly localized and may be reduced/ mitigated by compliance of site level regulations (Annexure III) for environmentally safe practices during pre-construction, construction and operation stages and carrying out a detailed EIA study may not be required. EIA can be conducted to understand the environmental impacts of major construction projects like construction of networks of new urban roads; construction of public transit systems like bus rapid transit system (BRTS), metro rail transit system (MRTS), mono rail system, light rail transit system (LRT); and construction of public transit terminals, parking complexes, etc.

Therefore, as a first step, the screening of a project is required to establish the need for environmental assessment. For this purpose, it is important to follow a rational approach to understand:

- What is the present status of the concerned area/ site?
- What are the activities proposed as per the plan/ project?
- What are the potential environmental implications of these activities?
- Has the project taken these potential environmental implications into account and suggested steps to address them?

Taking the above queries into consideration, qualifying projects may be taken up for detailed environmental assessment.

As per the EIA Notification of 2006 (as amended in 2009), all Category 'A' projects (Centre level) require a full EIA study. As a result, the step of screening is not applicable to them. In case of Category 'B' projects or activities, the screening stage entails the scrutiny of an application seeking prior environmental clearance made in Form 1 (see Annexure II) by the concerned State level Expert Appraisal Committee (SEAC). It is determined by the SEAC whether the project or activity requires an EIA study for its appraisal prior to the grant of environmental clearance. In case of construction projects listed under item 8 of the Schedule of projects (see Annexure I), Form 1A (see Annexure II) has to be submitted. The projects requiring an EIA report are classified under Category 'B1' and remaining projects are categorized under Category 'B2' and do not require an EIA study.

Urban development and transport, both being state subjects, most urban transport projects will fall in Category 'B' and their screening will be within the purview of the State-level Expert Appraisal Committee (SEAC) once they are brought under the scope of the EIA notification. Ideally, EIA would be applicable to all urban transport projects in case of:

- All new projects/ activities
- Expansion/ modernisation of existing projects

Consequently, the ULB or any other relevant local public authority, which is the nodal agency for the project may apply for screening to the SEAC as the project proponent. The project proponent may also apply for other clearances like CRZ, wildlife, forest clearance, etc. (in case these are required) simultaneously as the EC will only be conditional in case the others are still pending or under process. Figure 3.1 depicts the process for screening urban transport projects.

Most large scale city/ sub-city level transport infrastructure projects like MRTS, BRTS, LRTS, etc. will have significant impacts and will require a full EIA. Therefore, in this case, an application of Form 1 will hold good for screening of urban transport projects.

Moreover, there are also cases where public transit terminals are to be developed along with commercial and institutional uses within the terminal, e.g. with malls and office spaces as in case of HUDA City centre metro station on the Delhi Metro. In such a scenario, if the built up area exceeds 20,000 m^2, these projects fall under 8(a) of the Schedule. They require screening and prior environmental clearance separately from the SEAC. For such projects, Form 1 A will be applicable for the purpose of screening.

The said Forms include a checklist covering important relevant aspects about the projects that help in deciding whether it qualifies for a full EIA study (along with Public Hearing). The project details to be submitted as part of Form 1 include:

- Proposed activities of the project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)
- Use of natural resources for construction or operation of the project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply)
    - Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

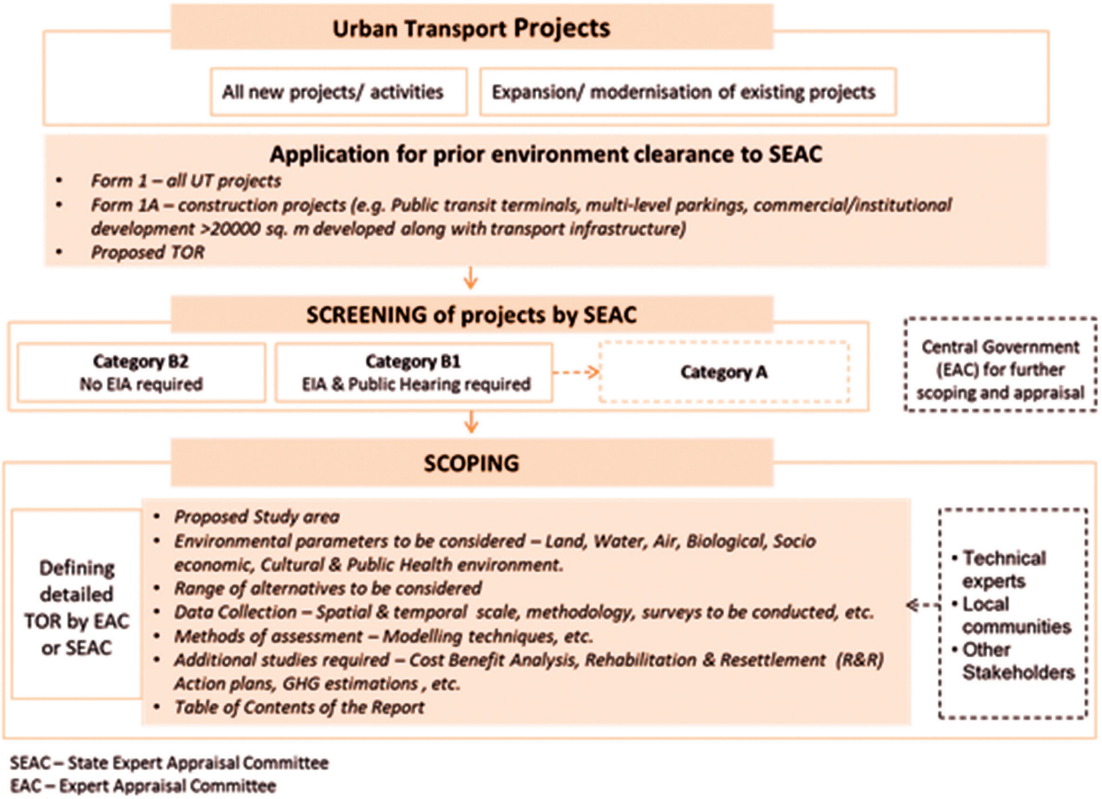

- Production of solid wastes during construction or operation or decommissioning
- Release of pollutants or any hazardous, toxic or noxious substances to air
- Generation of noise and vibration, and light and heat emissions
- Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea
- Risk of accidents during construction or operation of the project, which could affect human health or the environment
- Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality
- Environmental Sensitivity of the project – Environmentally sensitive areas within an aerial distance of 15 km

Similarly Form 1A, which will be applicable to public transit terminals, gives a checklist of potential impacts on:

- Land environment,
- Water environment,
- Vegetation,
- Fauna,
- Water environment,
- Aesthetics,
- Socio-economic aspects,
- Building materials, and
- Energy conservation.

The project proponent will need to apply for prior environmental clearance from the SEAC using Form 1/ 1A, whichever is applicable as per the above discussion. Along with the screening application, the proponent will also have to submit a proposed ToR and the exact study area, in case the SEAC recommends a detailed EIA study. This proposed ToR will help further in scoping the EIA study to be carried out. The remainder of this chapter will focus on describing how the scoping exercise can be done for urban transport projects.

Figure 3.1: Step 1: Screening and scoping for EIA of urban transport projects



Scoping

The primary purpose of the scoping exercise is to identify the key concerns and issues leading to the likely environmental impacts of a project, for which the impact assessment exercise will be carried out. As per the EIA Notification 2006 (as amended in 2009), scoping refers to the process by which the Expert Appraisal Committee in the case of Category 'A' projects or activities, and State level Expert Appraisal Committee in the case of Category 'B1' projects or activities determine detailed Terms of Reference (ToR) addressing relevant environmental concerns for the preparation of EIA report in respect of the project or activity for which clearance is sought (Figure 3.1). The ToR is determined on the basis of the information furnished in the prescribed application Form1/Form 1A including the proposed ToR submitted by the applicant (Figure 3.1). The proposed ToR should contain:

- Proposed study area
- Environmental parameters to be considered – Land, Water, Air, Biological, Socio economic, Cultural & Public Health environment.
- Range of alternatives to be considered
- Data Collection– Spatial scale, methodology, surveys to be conducted, etc. The time period for which the past trends, data would be observed also needs to be decided here.
- Methods of assessment – Modelling techniques, etc.
- Additional studies required – Cost Benefit Analysis, Rehabilitation & Resettlement (R&R) Action plans, GHG estimations, etc.


- Table of Contents of the Report

The ToR is conveyed to the applicant by the concerned appraisal committee within sixty days of the receipt of Form 1/ 1A. The approved ToR is displayed on the website of the Ministry of Environment and Forests and the Impact Assessment Authority. In case of urban transport projects also, the EIA process would adhere to the provisions of the notification. The finalized ToR would form the basis for the EIA study & preparation of the EIA document and determine the key components of the EIA study report. Box 4 gives a sample Table of Contents for an EIA study report for urban transport projects.

Box 3.1 Sample Table of Contents for an EIA study report

Chapter 1: Introduction

This chapter should contain the general information on project, environmental analysis (EIA) process followed and identification of the project proponent and stakeholders.

Chapter 2: Project Description

This chapter should cover the description of the project, such as, the type of project, need for the project, project location, proposed network alignment, expected traffic volumes/ ridership, implementation schedule, estimated cost of the project, etc.

Chapter 3: Analysis of Alternatives

This chapter should cover the details and consideration of various alternatives in respect of location of site, alignments and technologies, in case the initial scoping exercise considers such a need.

Chapter 4: Description of Environment

This chapter should cover environmental baseline data related to the project area and its delineated influence area.

Chapter 5: Environmental Monitoring program

This chapter should cover the planned Environmental Monitoring program. It should include the technical aspects of monitoring the effectiveness of mitigation measures.

Chapter 6: Additional Studies

This chapter should cover the details of the additional studies, if any, required in addition to those specified in the ToR and which are necessary to cater to more specific issues applicable to the particular project. These studies may be suggested either by the proponent itself or the regulatory authority.

Chapter 7: Project Benefits

This chapter should cover the benefits accruing to the locality, neighbourhood, region and nation as a whole. It should bring out details of benefits by way of improvement in the physical infrastructure, social infrastructure, employment potential and other tangible benefits.

Chapter 8: Environmental Cost Benefit Analysis

This chapter should cover the Environmental Cost Benefit Analysis of the project, if recommended by the Expert Appraisal Committee at the scoping stage.

Chapter 9: Environmental Management Plan

This chapter should comprehensively present the Environmental Management Plan (EMP), which includes the administrative and technical setup, summary matrix of EMP, the cost involved to implement the EMP, both during the construction and operational Phases.

Chapter 10: Summary & Conclusions

This chapter forms the summary of the full EIA report. It should provide the overall justification for implementation of the project and should explain how the adverse effects are proposed to be mitigated

Chapter 11: Disclosure of Consultants Engaged

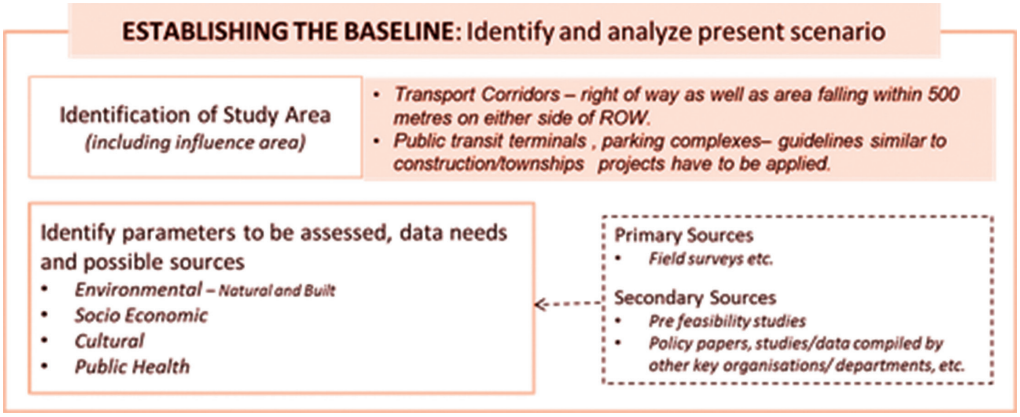
3.3.2 Step 2: Establishing the baseline

Any EIA study has to give an analysis of the impacts that a project / activity might have on the existing environment. Therefore, it should contain a description of the existing status of the environmental parameters that are likely to be affected, directly or indirectly, by the proposed project in from of the baseline. The EIA Notification 2006 (as amended in 2009) gives a guideline on the contents of the baseline study that it should include a description of environment in the study area and also the existing status of the valued environmental components, as identified in the scope. Figure 3.2 depicts the key components of establishing the baseline for EIA of urban transport projects.

Study Area

As per the EIA notification, for transport corridors, the proponent should collect primary baseline data for the right of way as well as the area falling within 500 meters on either side of the Right Of Way (ROW). Secondary data should be collected for areas within 15 km aerial distance as mentioned in Form 1. This can be considered as a guideline for development of transport corridors in urban areas. But the exact study area for different environmental components is to be submitted for review and appraisal to the expert appraisal committee as part of the ToR during the scoping stage as discussed earlier. In the case of development of public transit terminals, guidelines similar to construction/ townships projects in the notification have to be applied. The study area will comprise of the site earmarked for building construction with specified surrounding influence area.

Figure 3.2: Step 2: Establishing the baseline for EIA of urban transport projects



The baseline study should also include base maps of all environmental components including proposed location on a map, showing boundaries of the proposed site, major existing infrastructure, adjacent land uses, location of existing buildings and facilities, structures of heritage/ archaeological importance and any important environmental features. Map of the project area and study area clearly delineating the location of various monitoring stations (air / water / soil and noise) superimposed with locations of habitation should also be included. Box 3.2 gives a list of typical maps to be provided as part of the baseline study.


Box 3.2 Typical checklist of maps to be provided as part of the baseline study for EIA

- Alignment plan, with details such as nature of terrain (plain, rolling, hilly), details of Villages, tehsils, districts and states, latitude and longitude for important locations falling on the alignment shall be submitted
- A map derived from the recent satellite imagery covering aerial distance of 15 Km from the proposed alignment delineating environmental sensitive areas as specified in Form I of EIA notification dated 14th Sep 2006
- Land use map of the study area based on recent satellite imagery of the study area
- Area drainage map
- Detailed ground surveyed map showing the existing features like trees, structures including archaeological & religious monuments etc. in the study area
- CRZ maps indicating the High Tide Line (HTL), Low Tide Line (LTL), demarcated by one of the authorized agencies and the project activities superimposed on the map at the time of ToR and recommendations of the State Coastal Management Authority at the stage of EC

Typically, environmental components that can be considered in EIA of urban transport projects are: Land Environment, Water Environment, Air Environment (air quality, meteorology and noise), Biological Environment, Socio-economic, Cultural and Public health environment. It is necessary that the proponent collects baseline data to ascertain all these environmental components (Table 3.2). The subsequent sections in the chapter give a detailed discussion on each of these.

If the project falls totally or partially in CRZ area and attracts the provisions of CRZ Notification, the study should indicate the category of the area and also show under what provision this activity is permitted. As a primary requirement of the notification, the data should be collected for the project area as well as for the study area, which is likely to be affected by the project activity, for one season (non-monsoon). A lot of this information can be availed from the pre-feasibility study conducted for the project. The notification also accords it important that the baseline analysis should take into account both, the past trends in environmental quality and also the current or proposed development programs in the project area.

Table 3.2: Checklist of data to be collected for establishing the environmental baseline while conducting EIA of urban transport projects

Aspect	Data	Sources
Land environment		
Land use	Existing land use details - Details of villages/ settlements, agricultural areas, cropping pattern, sand dunes, details of the project activities falling totally or partially in CRZ area and applicable notified restrictions, major and minor irrigation tanks, quarries, stone crushers and borrow areas and an inventory of the environmental features such as trees/ forests if any, drainage lines, rivers and water crossings, irrigation water courses, water bodies, grazing lands, etc.	Survey of India District Gazetteer State Revenue Department City Master Plan/ Development Plan Field Survey

Aspect	Data	Sources
Geology	Rock types, history of any volcanic activity, seismicity, landslides and associated hazards should be covered. List of different seismic zones falling in the project area - details of precautionary measures proposed for area under zone 5 should also be listed.	National Atlas and Thematic Mapping Organization (NATMO) State Vulnerability Atlas (National Institute of Disaster Management) Survey of India Project Pre-feasibility Report Draft Detailed project Report (DPR)
Soil	Soil type, porosity, hydraulic conductivities, sand (%), silt (%), clay (%), texture, moisture retention capacity (%), infiltration rate (mm/ hour), bulk density (gm/cc), organic matter (%), nitrogen (mg/1000g), potassium (mg/1000g), phosphorous (mg/1000g), sulphates and sodium sulphates, etc. (CPCB norms).	National Bureau of Soil Survey and Land Use Planning (NBSS&LUP) Project Pre-feasibility Report Draft Detailed project Report (DPR)
Environmental sensitivity	Details to be submitted as per Form 1	State Vulnerability Atlas (National Institute of Disaster Management) State Disaster Management Authority State Department of Environment and Forests/ Lake Authorities Project Pre-feasibility Report Draft Detailed project Report (DPR)
Air environment		
Ambient Air Quality	Monitoring of the parameters for ambient air quality – sulphur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO), Hydro carbons (HC), particulate matter, ground level ozone (O3), dust, etc.	State Pollution Control Board/ Union Territory Pollution Control Committee Project Pre-feasibility Report Draft Detailed project Report (DPR)
Meteorological Data	Mean monthly normal of atmospheric parameters i.e. temperature, rainfall, humidity, etc. from previous 10 years recorded by the nearest station of the Indian Meteorological Department (IMD); History of cyclones, earthquakes and snowfall data to be collected for a period of 50 years.	Indian Meteorological Institute Delhi/ Pune, Regional Meteorological Centre Project Pre-feasibility Report Draft Detailed project Report (DPR)
Noise	Collection of day time and night time data, benchmarking the noise levels against the standards set by the Noise Pollution (Regulation and Control) Rules .	State Pollution Control Board/ Union Territory Pollution Control Committee Project Pre-feasibility Report Draft Detailed project Report (DPR)
Water environment		
Water	Hydro geological settings, details of surface water bodies , Ground water table, drainage pattern, quality monitoring data for surface and ground water, Biological and chemical quality of water, etc.	State Ground Water Board/ Central Ground Water Board, River Board Authorities, Central Pollution Control Board/ State Pollution Control Board/ Union territory Pollution Control Committee Project Pre-feasibility Report Draft Detailed project Report (DPR)
Biological environment		


Aspect	Data	Sources
Biological parameters	• Location of national park, sanctuary, and biosphere reserve, tiger reserve, elephant reserve and wildlife migratory routes with in aerial distance of 10 km on either side of proposed alignment should be furnished • Details of wild life sanctuaries and National parks, existing flora and fauna in the study area, along with classification as per Schedule given in the Wild Life Protection Act, 1972 and in the Red Book Data, • Specifications if the study area forms a part of an ecologically sensitive area or migratory corridor of any endangered fauna, list of endangered and endemic species. Details about any existing breeding/nesting ground, name of the aquatic organism, type of habitat and period of year in which activity takes place should be provided. • Information on dependence of ethnic minorities on minor forest products	City Master Plan/ Development Plan State Department of Agriculture/ Horticulture State Department of Environment & Forest Zoological Survey of India(ZSI) Botanical Survey of India (BSI) Wildlife Institute of India (WII)
Socio Economic, Cultural and Public Health Environment		
Existing built environment	Existing development (FAR/FSI, landuse) list and location of built heritage/ archaeological assets (size, structure, features, etc.)	City Master Plan/ Development Plan Land and Buildings Department in Urban local body and City Development Authority Archaeological Survey of India Indian National Trust For Art and Cultural Heritage (INTACH)
Infrastructure	Existing infrastructure, access to other education, employment, etc.	City Master Plan/ Development Plan Urban local body for information on urban infrastructure assets & services State line departments on urban infrastructure – PWD, PHED, Jal Board, Power Corporation, Sewerage and Sanitation Departments, State departments for Education, Health, etc. Project Pre-feasibility Report Draft Detailed project Report (DPR)
Physical Health	Traffic accident data, walking and cycling rates, generation of wastes etc.	Traffic Police and State Police Department Records City Municipal Department for Health & Hygiene

Land Environment

Land environment includes description of characteristics related to land use, environmental sensitivity, geology and soil (Table 3.2).

The land use information should include information on parameters like details of villages/ settlements,

cropping pattern, sand dunes, details of the project activities falling totally or partially in CRZ area and applicable notified restrictions, major and minor irrigation tanks, quarries, stone crushers and borrow areas and an inventory of the environmental features such as trees/ forests if any, drainage lines, rivers and water crossings, irrigation water courses, water bodies, grazing lands, etc. Additionally, information on environmentally sensitive areas as listed in Form 1 (Annexure II) should be provided.

The geological information such as rock types, history of any volcanic activity, seismicity, and landslides and associated hazards should be covered. Different seismic zones falling in the project area should be listed. Details of precautionary measures proposed for area under zone 5 should also be listed.

Safeguarding of soil quality (e.g. best and most fertile agricultural land) and safeguarding of mineral resources should be taken care of while implementing urban transport plans/ projects; which are likely to have impacts in terms of soil erosion, slope stability water sediments load, changes in soil texture and structure, etc. For this purpose, the parameters that may be studied include soil porosity, hydraulic conductivities, sand (%), silt (%), clay (%), texture, moisture retention capacity (%), infiltration rate (mm/hour), bulk density (gm/cc), organic matter (%), nitrogen (mg/1000g), potassium (mg/1000g), phosphorous (mg/1000g), sulphates and sodium sulphates, etc. The data pertaining to these should be collected and analysed as per CPCB norms on soil quality. Annexure IV enlists the methods of establishing baseline attributes for land environment as recommended by the MoEF. The soil series maps of National Bureau of Soil Survey and Land Use may be referred for this data. For field observations, expert consultancy services may be availed by the project proponent, in agreement with the SEAC. However, this may be discussed and decided upon at the stage of scoping itself.

Water Environment

Changes to the biological and chemical quality of surface waters and ground waters, and the use and management of water resources are likely to take place, as a result of construction and operations. Impacts on geo-hydrology and water table are also likely to occur due to implementation of urban transport projects.

Therefore, hydro-geological settings and the ground water levels should be examined and presented along with the drainage pattern in the area. Details of surface water bodies within the study area should be documented along with their present usage. This information can be availed from the State Ground Water Board (SGWB) and the State Irrigation Department who maintain records for ground water and surface water, respectively.

Quality monitoring data for surface water and ground water within the study area should also be furnished and analysed in comparison to the prescribed water quality standards by CPCB. The project proponent can obtain this data from the State Pollution Control Board (SPCB) and the SGWB. Usage of surface and ground water for construction activities should be done as per the norms of the Central Pollution Control Board. Annexure IV enlists the methods of establishing baseline attributes for water environment as recommended by the MoEF.

Air Environment

1. Ambient Air Quality

There is a high likelihood of impact on the air quality of the surrounding areas due to generation of dust from excavation of soil, cutting of embankments, movement of heavy vehicles carrying construction materials on the haul roads, stone quarrying, material handling, storage, operation of crushers and hot mix plants, movement of construction vehicles and construction activities. Potential impacts may also be


caused due to vehicular emissions from vehicles used for the purpose of transfer of materials, construction, etc. during construction stage and also due to movement of vehicles during operation stage.

Typically, the parameters for ambient air quality include monitoring of levels of sulphur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO), hydro-carbons (HC), particulate matter, ground level ozone (O3), dust, etc. Normally, CPCB collects and monitors the levels of criteria pollutants at a number of stations in most class I and class II cities and also other locations. This data may be availed for relevant stations based on the nature of project, meteorological conditions, topography, selected pollution pockets in the area and likely impact areas. These monitoring locations should also be presented on a map as part of the EIA study report. Baseline data of air pollutant parameters should be monitored at a number of locations and analysed as compared to CPCB norms (see Annexure V).

2. Meteorological Data

The key parameters that may be evaluated for assessing the impact on micro-climate are the changes that are likely to take place in the ambient temperature and rainfall. These impacts may be attributed to the loss of trees and also to the increase in hard surfaces and emissions from the vehicles. Although, it will be difficult to model and predict impacts on climate at such a small scale; recording this information will prove useful in monitoring and mitigating the impacts on climate parameters. The climatic data can help in using suitable building technologies and energy conservation measures. The methodology to be adopted for collection of climatic data specific to the site is to compile the mean monthly normals of atmospheric parameters i.e. temperature, rainfall, humidity, etc.; from previous 10yrs data recorded by the nearest station of the Indian Meteorological Department (IMD). Annexure IV enlists the methods of establishing baseline meteorological attributes as recommended by the MoEF. As recommended by the MoEF, history of cyclones, earth quakes and snowfall data should also be collected from the nearest meteorological station for a period of 50 years.

3. Noise and Vibrations

The change in ambient noise as a result of activities during implementation and operation stages is a likely impact especially in case of transport projects. Construction equipment and vehicular movement are the major sources of noise and vibrations. The impacts in terms of vibrations are particularly relevant in case of underground transport infrastructure like the metro rail owing to digging and tunnelling during the construction stage and subsequently during operations as well. Baseline data for noise and vibrations should be assessed in comparison to the existing noise levels. Annexure IV enlists the methods of establishing baseline attributes for noise and vibrations as recommended by MoEF.

While selecting the monitoring locations, sensitive environmental receptors like thickly populated areas, hospitals, schools, wildlife corridors etc., should be considered. The data collected from these locations should also be given in the report. Daytime and night-time data should be collected and presented in the EIA report. Noise standards have been designated for different types of land use, i.e. residential, commercial, industrial areas and silence zones as per the Noise Pollution (Regulation and Control) Rules, 2000 (Annexure V). These should be referred to as benchmarks for the purpose of implementation and monitoring of project activities.

Biological Environment

Changes to the biological environment are likely to take place as a result of urban transport projects. These may be in terms of impacts on plants, animals, habitats and areas, which are of importance based on their scientific and intrinsic value. Removal of trees from site before construction is another impact that is likely to be caused by implementation of transport projects in urban areas.

As per the EIA notification, Wild life sanctuaries and National parks located within 10km radius from project boundary should be identified based on secondary data, for any transport infrastructure/ construction project. This will be applicable to all urban transport projects, including both the transport corridors as well as the public transit terminals. The following details should be provided:

1. Data on the existing flora and fauna in the study area, along with its classification as per Schedule given in the Wild Life Protection Act, 1972 and in the Red Book Data and a statement clearly specifying whether the study area forms a part of an ecologically sensitive area or migratory corridor of any endangered fauna. The list of endangered and endemic species should also be given

2. If the proposed project site includes any breeding or nesting ground, details about the name of the organism/species, type of habitat and period of year in which activity takes place should be provided

3. If the proposed route requires cutting of trees, then the information should be provided for number of trees to be cut, their species and whether it also involves any protected or endangered species

4. Location of national park, sanctuary, and biosphere reserve, tiger reserve, elephant reserve and wildlife migratory routes within aerial distance of 10 km on either side of proposed alignment should be furnished

5. Information on dependence of ethnic minorities on minor forest products should also be furnished

The secondary data pertaining to natural environment may be collected from the state department of environment and forests. For field observations, expert consultancy services may be availed by the project proponent, in agreement with the SEAC. However, this may be discussed and decided upon at the stage of scoping itself. Annexure IV enlists the methods of establishing baseline attributes for biological environment as recommended by MoEF.

Socio-economic, Cultural and Public Health Environment

Changes are likely to occur in land uses due to the implementation of urban transport projects/ activities. These may be the direct changes owing to the activities, which are part of the project or may be induced changes in terms of complimentary activities like offices, shopping malls, etc. that come up in the proximity of the transport infrastructure developed. Changes are also likely to occur in the character of the existing and new built environment due to the provision of infrastructure; e.g., in terms of increased FAR/ FSI.

In case of transport projects in urban areas, there is also a likelihood of impacts on built heritage/ archaeological assets in terms of sites, structures and features of historic significance and value.

There may also be impacts on access to infrastructure and to employment or education opportunities; impacts on physical health e.g. traffic related accidents, growth in walking and cycling rates, generation of wastes, etc. and other temporary impacts due to construction activities during project implementation like traffic diversions and consequent time delays.

Baseline data on all these aspects should be collected in order to establish the impacts of the project on built environment, built heritage & archaeology, public welfare, health & well-being. The data required for preparation of Resettlement & Rehabilitation Plan of the effected population as per the government norms should be also be collected, if applicable as per the scoping exercise. For relevant primary data to be collected through surveys, etc., expert consultancy services may be availed by the project proponent, in agreement with the SEAC. However, this may be discussed and decided upon at the stage of scoping itself.


General Considerations

Once information needs are identified, baseline environmental information may be assembled through the collection and analysis of existing data, by carrying out specific field studies, and/or input from consultations. Before embarking on an extensive and costly field studies program, maximum effort should be directed at secondary data collection. A lot of information may also be available from the pre-feasibility study conducted for the project. Primary studies should generally be done to fill in the data gaps and/or provide more timely or focused information. These should be reflected at the time of the scoping exercise and should be done with due approval of SEAC. Expert consultancy services may be availed by the project proponent in agreement with the SEAC for any primary studies.

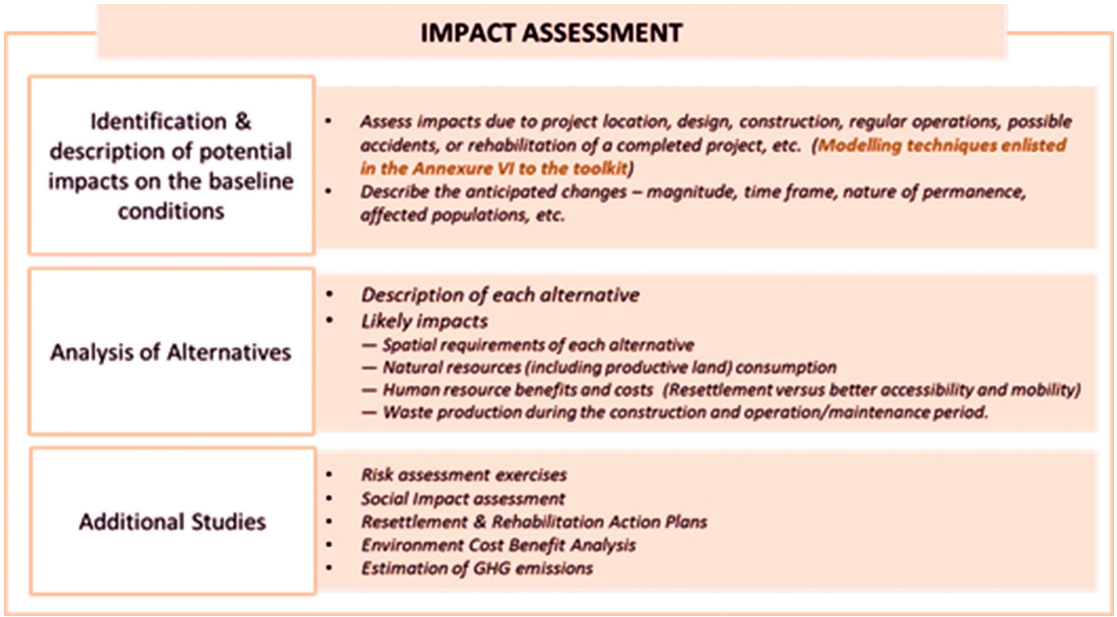
Proper data management is also important. Data collected during baseline studies is either numerical data or spatial data. Computer-based database management systems or geographic information systems should be used effectively for this purpose. All the data referred from secondary sources should be properly sourced.

3.3.3 Step 3: Impact Assessment

This section focuses on detailing out the methodology for assessing the impacts of an urban transport project during the construction and operation stages. This would primarily entail environmental impacts of urban transport projects as discussed in the earlier sections.

It was found from the literature review and review of case studies that assessment of environmental impacts of urban transport projects typically involves 1) identifying and assessing positive and negative impacts of the project on the environment and 2) identifying mitigation & monitoring measures to manage these impacts in the pre-project and post-project scenarios. The impacts on natural and social environment are assessed for micro-level parameters identified for air quality, drainage, soil, noise, land use, etc. as identified during the scoping exercise based on Form 1 (Annexure II), for different stages of project planning and implementation. Accordingly, the mitigation measures are recommended in the form of an Environmental Management Action Plan (EMAP) to minimize the negative impacts.

Figure 3.3 Step 3: Assessing impacts of urban transport projects



The EIA notification, 2006 (as amended in 2009) defines the approach to be followed for assessment of impacts as part of the EIA study. EIA of urban transport projects will have to follow the same approach. A step-by-step description is as follows (Figure 3.3).

Identification and description of potential impacts

Identification and description of potential impacts on the baseline conditions due to project location, project design, project construction, regular operations, possible accidents or rehabilitation of a completed project, etc. is required as the first step. The anticipated changes need to be described in terms of their magnitude, time frame, nature of permanence, positive or negative, affected populations, etc. Key components as established in the baseline may be assessed to understand the impact on natural and social environment. The following discussion gives an outline of the parameters that may be predicted and assessed for each of the key components. It also highlights the methodology and models that may be used in the process. It is acknowledged that the modelling exercises listed may require expert consultancy services in a number of cases owing to their specialised and technical nature and it may not be in the capacity of the project proponent to carry them out themselves. The project proponent (or the responsible local public agency) may hire consultants for the purpose; however, this may be done in agreement with the SEAC with due proposition at the stage of scoping itself.

1. Air quality

For assessing impacts on air quality, changes in levels of criteria pollutants like sulphur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO), hydro-carbons (HC), particulate matter, ground level ozone (O3), dust and other sources of air pollution may be predicted based on CPCB air quality monitoring data by using various practiced models. Annexure VI enlists some of these typical models employed to predict emissions and increase in pollutants load in atmosphere as per CPCB Guidelines. The likely impacts may be assessed in comparison with the National Ambient Air Quality Standards (see Annexure V).

It is likely that the immediate surroundings may have a greater impact. Impacts on the existing sensitive areas in the surroundings such as hospitals, schools, notified sanctuaries etc. up to 500 meters should be especially addressed. Also, apart from the impacts on air quality during project implementation phase, it is also important to predict and assess the emissions that will take place during the operation phase due to the operations of the rolling stock.

2. Ambient noise

The change in ambient noise as a result of activities during and after implementation of plans/ projects is a likely impact especially in case of transport plans/ projects. Noise levels should be monitored with the help of calibrated Sound Level Meter for 24 - hour duration as per CPCB norms and prediction of noise levels should be done by using mathematical modelling (see Annexure VI) at different representative monitoring stations. The predicted levels should be assessed in comparison to the existing noise levels. Also, there are standards of noise levels set by the CPCB/ Ministry of Environment and Forest (MoEF) (1989). These standards should be the benchmark for comparison with the noise levels estimated during and after the implementation of project.

3. Water quality

Change in concentration of carbonates, bicarbonates, pH, , Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolved Solids (TDS), Chlorides, Nitrates, Sulphates, Total nitrogen, Total Phosphate, Oils and Grease, Dissolved Oxygen (DO), etc. from the baseline levels can be assessed in


comparison to Central Pollution Control Board (CPCB) and Central Ground Water Board (CWGB) standards for water quality. Techniques typically used for modelling and assessment of water quality are described in Annexure VI. Expert consultancy services may be availed by the project proponent for this assessment.

4. Soil quality & mineral resources

The criteria to be assessed for impacts on soil quality include pH, electrical conductivity, sand (%), silt (%), clay (%), texture, moisture retention capacity (%), infiltration rate (mm/hour), bulk density (gm/cc), porosity (%), organic matter (%), nitrogen (mg/1000g), potassium (mg/1000g), phosphorous (mg/1000g), sulphates and sodium sulphates. They have to be monitored seasonally/ annually for the entire project area (using methods discussed in Annexure IV) during the study period and changes need to be predicted and assessed in comparison to the baseline scenario. The various methods recommended by MoEF that may be employed for this are enlisted in Annexure VI.

5. Natural environment & biodiversity

Removal of trees from site and removal of habitats and fauna for project implementation can be indicators to assess likely impacts on natural environment and biodiversity caused by implementation of transport plans/ projects in urban areas. Annexure VI enlists methods to assess the impacts on natural environment and biodiversity. Expert consultancy services may be availed by the project proponent for this assessment, in agreement with the SEAC.

6. Land and built environment

Changes are likely to occur in land uses due to the implementation of urban transport projects. Impact on the land use pattern should be assessed especially in case of transport corridors where changes in the character of the existing and new built environment due to the provision of infrastructure are also likely to occur e.g., in terms of increased FAR/ FSI. GIS- based techniques can be effectively used for building future scenarios to assess impacts on land and built environment.

7. Built heritage & archaeology

Impacts on built heritage/ archaeological assets should be assessed in terms of likely damage to the site/ structures/ features or in any other activity that may cause deterioration of the historical asset or its vicinity resulting in decrease in its structural, aesthetic or heritage value.

8. Public welfare, health & well being

This will involve an analysis of positive and negative impacts on livelihoods due to displacement of human settlements/population from the proposed site or due to loss of properties, community areas and impacts due to increased access to employment opportunities and other amenities. This will also include an assessment of impacts on public health and well-being due to generation of wastes, noise, pollution in the area, and increase/decrease in incidence of certain diseases, morbidity and mortality rates. Normative methods, intuitive forecasting techniques, etc. (see Annexure VI)) may be used by the project proponent/ consultant to predict the impacts on public welfare, health and well-being.

Analysis of Alternatives

It may be possible to avoid some of the identified negative impacts through alternative route alignments, technology, etc. Therefore, it is important that the impact assessment exercise includes this as an important step. The need for consideration of alternative solutions/ alignments/ technologies may be highlighted by

the project proponent or SEAC at the scoping stage. In case this analysis is carried out: 1) a description of each alternative and 2) an assessment of positive and negative impacts of each of the alternatives as discussed above should also be presented as part of the EIA report. In describing the project and its alternatives, the following four key characteristics of each of the proposed alternatives should also be determined in addition to the comparative analysis based on the parameters discussed above (MoEF, 2010):

- Spatial requirements of each alternative
- Natural resources (including productive land) consumption
- Human resource benefits and costs (such as resettlement versus better mobility and accessibility)
- Waste production during the construction and operation/maintenance periods

Additional Studies

Apart from the typical ToR for EIA of urban transport projects, specific issues as applicable to individual projects may be found by the project proponent or the SEAC during the scoping stage, or after completion of the public consultations. These may be important from environmental point of view and, therefore, the EIA and EMP report will need to address them. In such cases, typically, they are pursued as additional studies to the EIA. These may include:

- Risk assessment exercises
- Social Impact Assessment
- Resettlement & Rehabilitation Action Plans
- Environmental Cost Benefit Analysis
- Estimation of greenhouse gas (GHG) emissions (Box 3.3)

It is acknowledged that it may not be in the capacity of the project proponent (ULB or any other relevant local public authority) to carry out the EIA study and the additional studies, as may be required. The proponent may hire expert consultancy services for this purpose in agreement with the SEAC with due proposition at the stage of scoping itself.


Box 3.3 Estimating GHG emissions

One of the likely impacts of urban transport projects will be in the form of GHG emissions from movement of vehicles and machinery use during construction phase and due to the emissions from rolling stock in the operation phase. Due to these reasons and the fact that transport sector is one of the major contributors to the GHG emissions, it is recommended that estimation of impact on GHG emissions should be included as one of the parameters in the EIA exercise for integrating climate change mitigation measures in the process of development of urban transport infrastructure.

In the recent past, various guidelines and models have been developed and are in practice to estimate GHG emissions from transport sector. The Global Environmental Facility (GEF) – UNEP's Manual for Calculating Greenhouse Gas Benefits of Transportation Projects is one such best practice and showcases the methodology and associated data requirements for calculating GHG impacts of transport projects

The Manual has been designed to encourage high quality project design while contributing to reduction of GHG emissions at a global scale. The model suggested by the Manual – Transportation Emissions Evaluation Model for Projects (TEEMP) can yield result in the following areas:

1. Direct CO_2 emission increase/reductions as a result of the project due to vehicle fuel efficiency, GHG intensity of the fuel used, amount of transport activity, mode of transport chosen and amount of capacity used.
2. Direct post-project emission increase/reductions that continue beyond the timeframe of scheduled monitoring as a result of risk mitigation facilities, revolving funds and other mechanisms that may continue to operate after project ends.
3. Indirect impacts resulting in GHG reductions due to replication catalysed by the project as a result of capacity building, innovative approaches, removal of market barriers, etc. Apart from this, the model also estimates significant local co-benefits by the project in terms of public health, travel time and economic growth.

The TEEMP models can be applied to transportation projects in the following five categories:

1. Transportation efficiency projects (clean vehicles/ fuels)
2. Public transportation projects (Bus/ Rail)
3. Non-motorized transportation (NMT) projects
4. Transportation demand management (TDM) projects
5. Comprehensive regional transport initiatives

The methodology of TEEMP involves first, an estimation of baseline emissions of the scenario without the project and then a comparison of these baseline emissions with the estimated change in GHG emission caused on implementation of the project due to direct impacts, direct post-project impacts and indirect impacts as discussed above. For this purpose, the project proponent is required to collect data on 1) the lifetime of the project based on technology, existing project site conditions and assumptions; 2) baseline scenario in terms of growth trends of transport, technologies, mode shares, carbon intensity and fuel economy of vehicles, etc. with 'no project'; and 3) emission factors for technologies in the baseline as well as alternate scenario. The CO_2 emission reductions are reported for cumulative impacts over the lifetime of the project in terms of metric tons of CO_2 equivalents.

The manual notes that no single, general purpose methodology can be used to quantify impacts on GHG emissions for all transport projects. Also, it is recommended that the estimations should incorporate as much local data as possible. However, in case of non-availability of data, conservative default values provided in the Manual may be used.

3.3.4 Step 4: Strategies to avoid/reduce impacts

As per the EIA Notification, 2006 (as amended in 2009), any EIA exercise is followed by preparation of an Environmental Management Action Plan (EMAP) aimed at mitigating the impacts of the project. The EMAP suggests an action plan which includes steps to be taken in the a) Pre-construction b) Construction and c) Operational stages of the project to minimize the environmental impacts and also proposes a mechanism for monitoring the significant environmental impacts. Preparation and implementation of the EMAP is the responsibility of the project proponent. Typically, an EMAP will suggest strategies to mitigate the negative environmental impacts and also a program and methods for monitoring and follow up assessment of the urban transport project being implemented.

The usual mitigation mechanism applied in practice involves the following steps (MoEF, 2010; ADB, 2003):

- **Prevent/ Avoid** adverse environmental impacts
- **Minimize** and control adverse environmental impacts

Preventive measures are generally applicable at the level of project planning/ designing. Choosing the most optimum site location, alignment, technology options, etc. can go a long way to prevent adverse environmental impacts. For example, an urban transport corridor passing through or in the vicinity of an ecologically sensitive area like a notified forest, national park/ bird sanctuary, wetland, etc. or a built heritage/ archaeological site will have to be optimally aligned so as prevent the adverse environmental impacts as it may permanently impair the area's natural ecology, lead to adverse impacts on heritage & recreation areas and precipitate drastic changes in the project area's social and economic character.

Minimization measures typically aim to minimize adverse impacts at the stage of project implementation or construction phase. A lot of temporary and irreversible impacts may be minimized by taking appropriate measures during implementation phase. The on-site regulations (see Annexure III) like Fly Ash Rules, Use of Ground Water for Infrastructure Projects in Notified Areas, etc. are to be enforced with this objective.

Generic mitigation measures for urban transport projects

In order to identify mitigation measures to minimize adverse impacts, the nature of the impacts will have to be understood in terms of their spatial and temporal (temporary/ irreversible) nature. While a lot of on-site, temporary impacts that arise during implementation stage can be mitigated by following on-site regulations and periodic monitoring, the irreversible impacts like those on the geo-hydrology, ecology, habitats are of irreversible nature and require interventions like alternative site/ alignment or alternative technology to prevent and minimize them. Similar mitigation measures are also required in case of irreversible impacts on the built heritage structures, for resettlement and rehabilitation of habitation and livelihoods of the local community. All these should form part of the EMAP. It is also important to consider that sometimes there could be negative environmental impacts of the strategies suggested in the EMAP as well. Therefore, these strategies/ measures should also be brought within the scope of the monitoring framework being suggested as part of the EMAP as discussed in step 5 subsequently.

Few generic measures to avoid/minimize some typical expected impacts of urban transport projects have been discussed as follows. However, it may be noted that no 'one' mitigation measure will apply to all actions and in all contexts, the appropriate one(s) will need to be selected to meet the needs of the particular impacts and circumstances.


1. Air environment

The major impacts on the air environment are in terms of pollution and dust due to the increased use of vehicles in construction and operation stages and also due to use of machinery during the construction stage. Measures for mitigating air pollution and dust need to be taken up during construction and operation phases. Water sprinkling on regular basis during the entire construction period especially in the winter and summer seasons and transporting construction materials with tarpaulin coverage during the construction stages can help to reduce dust to a large extent. As soon as construction is over, the surplus earth should be utilized properly and in no case, loose earth be allowed to pile up along the alignment or near the public transit stations/ terminals. Provision of air pollution control systems in vehicles and machinery is also an important mitigation measure. Planting tall leafy vegetation between transport corridors and sensitive land uses like residential areas, medical and school facilities will also help to minimize impacts on air environment especially in the context of public health.

A number of new technologies are being developed and practiced for reducing GHG emissions caused due to consumption of energy from non- renewable sources. The regenerative breaking system being utilized by the DMRC is one such example. Clean fuels should be promoted to minimize the tail pipe emissions during operationpahse.

2. Ambient Noise

Avoiding the alignment of transport corridors and transit stations/ terminals in noise sensitive areas is an important mitigation option. Also, provision of noise barriers in such areas can also mitigate the noise levels to a large extent. The selection of type and thickness of the noise barrier, etc. can be done according to the predicted model outputs. During the construction stage, stationary machines and equipment should be provided with acoustic enclosures and silencers.

3. Water Environment

For water environment, it is important to understand the impacts of the proposed urban transport project on geo-hydrology and surface hydrology. It is important that the alignment of networks/ corridors and location of transit stations/ terminals is sited after due consideration of the ground water aquifers, surface water bodies, wetlands, channel capacities and existing flood ways. In dry areas, drainage system can designed to retain/ recharge water.

4. Land Environment

While selecting the alignment of networks/ corridors and location of transit stations/ terminals, attention must be paid to avoid areas prone to landslides, soil erosion, subsidence, fertile agricultural lands, etc. In case of flood prone areas and/or areas with very flat slopes, hydrological surveys have to be conducted before alignment finalization. In hilly areas, specific geological studies should be conducted to avoid locations vulnerable to landslides. Drainage improvements to avoid water logging and flooding due to disturbance of natural drainage pattern should be considered.

5. Biological Environment

Identification of sensitive natural environments done as part of the baseline and impact assessment exercise should be taken into consideration to suggest alternative alignment and siting of urban transport infrastructure. Where required, conservation plan for conservation and protection of flora and fauna, wetlands, wildlife migratory species and medicinal plants should be prepared as addendum to the Environmental Management Plan. Tree plantation plan to compensate the trees cut for project

implementation should be prepared as per the government norms. Possibility of tree transplantation should also be examined.

6. Built Environment

The impacts on the built environment will be essentially in terms of impacts on land uses, impacts on FAR/ FSI and impacts on built heritage structures (historical/ archaeological assets). Sensitive land uses like residential areas, medical and school facilities should be preferably avoided while aligning and siting of urban transport infrastructure. Changes are also likely to occur in the character of the existing and new built environment due to the provision of infrastructure e.g., in terms of increased FAR/ FSI. Therefore, it is important that densities and FAR/ FSI are regulated in the vicinity as per the threshold/ carrying capacity. Similarly, built heritage structures also need to be taken into consideration while aligning/ siting of urban transport infrastructure.

7. Socio – economic and Health Environment

The mitigation measures for impacts on socio-economic and public health environment are essentially in terms of Resettlement and Rehabilitation plan for displaced population and provision of road safety measures. The morbidity/ mortality due to public health impacts can be mitigated to a large extent by enforcing measures and regulating impacts on air, water and ambient noise.

3.3.5 Step 5: Monitoring and Evaluation

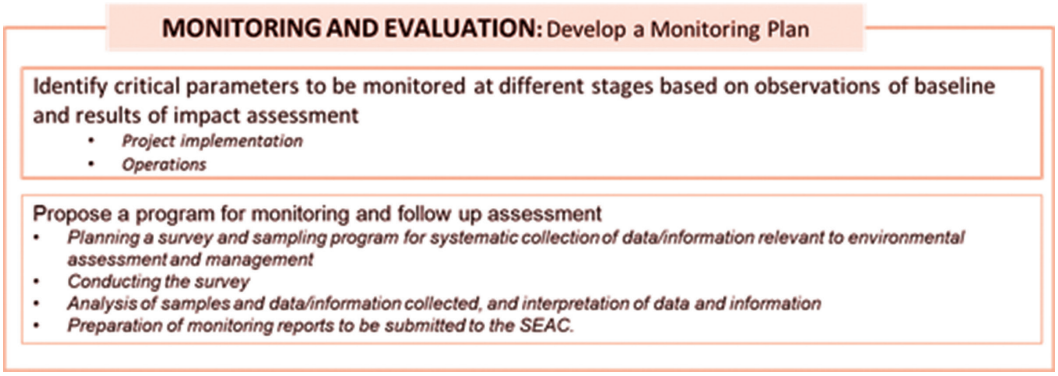
An environmental monitoring program is crucial to the EIA exercise as it helps the project to proceed according to the "planning and programming cycle, confirm and resolve uncertainties, detect unexpected situations that have not been previously envisaged, and suggest remedial measures" (Partidário, 2007).

The project proponent has to prepare an environmental monitoring program as part of the EMAP report. This would involve (ADB, 2003):

- Planning a survey and sampling program for systematic collection of data/information relevant to environmental assessment and management
- Conducting the survey
- Analysis of samples and data/information collected, and interpretation of data and information
- Preparation of monitoring reports to be submitted to the SEAC.

Environmental monitoring normally starts at the construction stage to compare the changes that have been brought about in the baseline conditions. It continues through project operation stage to detect changes in the key environmental quality parameters, which can be attributed to the project. This becomes especially important in case of urban transport projects due to the continuous activities that take place in the operation stage. Also, in case of urban transport projects, there is typically an increase in the project affected population in the operation stage as there is induced development as a result of the added transport infrastructure and increased accessibility. As discussed earlier, the impacts of the strategies/ measures suggested in the EMAP are also to be monitored to assess negative outcomes, if any. The results of the monitoring program are used to evaluate the extent, severity and trends of the environmental impacts against the predicted impacts; performance of the mitigation measures; and compliance with pertinent rules and regulations.


Figure 3.4: Step 5: Monitoring and evaluation of environmental impacts of urban transport projects



Methodology

The typical methodology for environmental monitoring and evaluation has been depicted in Figure 3.4. At this stage, the parameters identified during the scoping exercise for which the baseline establishment and impact assessment has been carried out, are to be monitored. The same techniques employed to collect the baseline information can be used for the purpose of monitoring at these stages as well (see Annexure IV). An effective environmental monitoring plan should take into account the following considerations.

- It should have a realistic & relevant sampling program so that spatial and temporal changes can be effectively monitored.
- The survey and sampling program should be custom-designed to focus on data/information relevant to the parameter being monitored. The relevant parameters identified in Step 2 may be applied for this purpose. The locations and period for monitoring should be relevant to the monitoring parameter and should be reported (see Annexure IV).
- The databases should be regularly updated and managed to reflect the actual changes that have taken place as compared to the baseline scenario and predicted impacts.
- The monitoring program should include follow up action so that appropriate measures can be taken in the event of adverse monitoring results or trends.
- The monitoring and evaluation mechanism should include means of public engagement and inputs from third parties/ experts for sustainability of the plan/ project and to effectively mitigate adverse impacts.

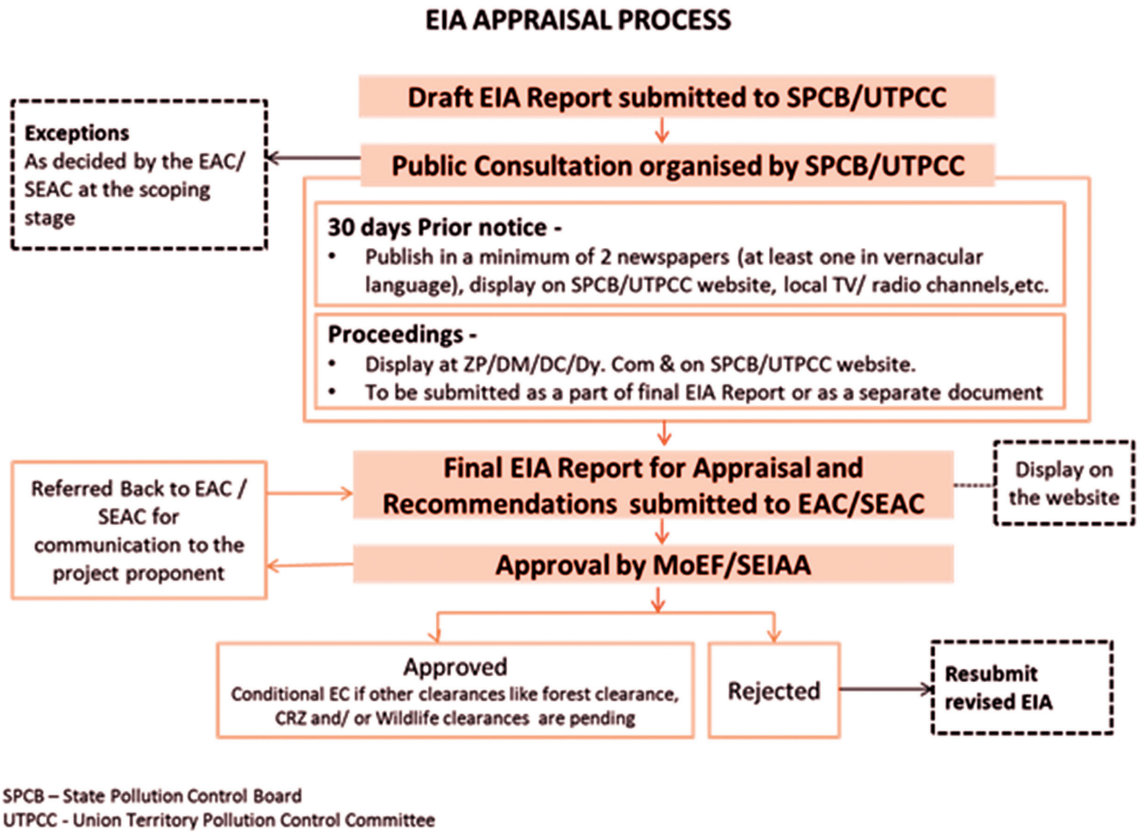
3.3.6 Appraisal process

Once the Draft EIA report has been prepared by the project proponent, it is to be submitted to State Pollution Control Board (SPCB) or the Union Territory Pollution Control Committee (UTPCC) in case of Union Territories, who are the nodal agencies for organizing the public consultations for the EIA studies (process for consultation outlined in Annexure VIII). Expansion projects, which do not require any further land acquisition, projects that concern national defense or are of some other strategic importance may not be subject to the public consultation process, based on the discretion of the EAC/ SEAC at the time of approval of ToR. Typically, project affected local community including representatives of residents' welfare associations, local associations of shopkeepers, local NGOs, etc. should also be invited apart from the

experts in the field. As per the provisions of the notification, a prior notice of 30 days should be issued by the SPCB/ UTPCC to inform the stakeholders about the Public Consultation. This should necessarily be published in a minimum of 2 newspapers with atleast 1 in vernacular language and should be displayed on the website of the SPCB, UTPCC. Apart from this other media like local cable channels, FM radio, etc. may also be utilized.

Once the consultations are concluded, the project proponent has to make necessary/ required changes in the EIA report and also recommend appropriate changes in the project DPR, if any, as per the feedback received in the consultation. The Final EIA report is then submitted by the project proponent to the EAC/ SEAC. The proceedings of the consultation also have to be documented and submitted by the proponent as an addendum to the report. The EAC/ SEAC appraises the document and may refer back to the project proponent for any clarifications/ modifications in the report. The Final report after appraisal is displayed on the website and forwarded to the State level Environment Impact Assessment Authority (SEIAA) or the MoEF (in case of category 'A' projects) for approval. 'Approval' from the SEIAA/ MoEF may be 'conditional' until other clearances like CRZ, forest or wildlife are still pending. The approval of the project is communicated back to the project proponent and displayed on the website of the SEIAA/ MoEF.

Figure 3.5: Appraisal process



SPCB – State Pollution Control Board
UTPCC - Union Territory Pollution Control Committee


3.4 Performance Checklist for EIA

Table 3.3 presents the checklist of the activities that need to be carried out by the concerned project proponent for EIA for urban transport projects. In most cases, the project proponent would hire an expert consultant to for this purpose. The following performance checklist will help the proponent to assess whether all activities have been conducted by the consultant in the right manner as prescribed in this Toolkit.

Table 3.3 Performance checklist for EIA

No.	Step by step activities to be conducted for an EIA study	Yes	No
	Was the project applied for a screening process to state level appraisal committee (SEAC)? *(Form 1/Form 1A to be submitted along with a project brief and proposed ToR)*		
	Was a detailed baseline prepared for the EIA study? *(Table 8 and Box 5)*		
	Were the likely impacts on environment assessed using modeling techniques recommended by MOEF? *(Refer Annexure IV for recommended techniques and models)*		
	Were any additional studies carried out?		
	Was an environmental management action plan (EMAP) prepared?		
	Did the EMAP include a monitoring and follow up assessment plan?		
	Did the draft EIA report include the EMAP? *(Refer Box 4 for a sample Table of Contents for a typical EIA study report)*		
	Was the draft EIA report submitted to the SPCB/UTPCC?		
	Was public consultation conducted by SPCB/UTPCC?		
	Was a 30 days prior notice given for conducting pubic consultation?		
	Were the proceedings of the consultation documented and submitted along with the final EIA report (as a part of the report or a separate document)?		
	Were necessary changes/modifications suggested in the public consultation process addressed in the final EIA report?		
	Was the final EIA report submitted for appraisal to EAC/SEAC?		
	Was the final EIA report sent to MOEF/SEIAA for approval?		
	Was the report referred back to EAC/SEAC with recommendations? If yes, were the recommendations incorporated?		
	Was the approval given on a conditional basis? If yes, were the conditions subsequently fulfilled by the proponent/consultants?		
	Is there any need for any other clearances (forest, wildlife, CRZ, or others)? If yes, were they applied for?		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Chapter 4

Literature Review

4.1 Case Studies

In this chapter, case studies of SEA/ EIA exercises conducted for transport/urban transport sector have been discussed in order to understand the basic framework used for conducting SEA or EIA. A variety of projects have been studied, covering plans/ projects on BRTS, MRTS, expressway and HSR development, to have a broad understanding of the application of the concept of environmental analysis. This will enable the user to understand how the concepts of SEA and EIA are applied to urban transport plans, programs, and projects globally. The lessons from these case studies have been highlighted in terms of the framework and methodology for conducting a SEA or EIA exercise, data requirements, and comprehensiveness of solutions to reduce/minimize environmental impacts.

4.1.1 SEA of Provisional Local Transport Plan for Surrey 2006/07 – 2010/11, UK

Project Description

The Transport Act 2000 requires local transport authorities in England (except those located within Greater London), to produce and implement a Local Transport Plan (LTP). The purpose of the Provisional Surrey Local Transport Plan is to set out a long-term strategy for transport in the county, and to provide details of the Program of schemes (infrastructure projects and initiatives designed to change behaviour) that will be delivered over its lifetime (SCC, 2006).

Rationale for SEA

The rationale for the strategic environmental assessment of the Provisional Surrey Local Transport Plan is twofold (SCC, 2006).

- One, the Local Highway Authority (Surrey County Council) has to satisfy the requirements of European and UK law, which stipulate that the environment be taken into account during the development of plans and programmes.
- Secondly, SEA can enhance the overall quality and integrity of plans, by offering a systematic and robust critique of the proposals under consideration.

The SEA report looks at the extent to which the Plan might give rise to risks and opportunities that could have implications for the environment.

- Basic framework for SEA

The strategic environmental assessment was applied to the following three elements of the Plan –

- the objectives,
- the strategic alternatives, and
- the implementation plan

Methodology

In order to understand the kind of impacts taking place, a criterion-based method of strategic environmental assessment was used to identify and examine the risks and opportunities for the environment associated with the Plan. These criteria were identified under some generic aspects relating to topics typically identified as important for environmental sustainability by policy. Each aspect was then given a score based on its sensitivity depending on the scale of change that might be observed in its respective criteria at the county level as a direct consequence of the activities expected to take place within the lifetime of the Plan. The cumulative scores gave an indication of the scale of impact on an aspect and also helped to prioritize mitigation measures. Table 4.1 gives an understanding of the criteria used for impact assessment of the Plan.

Table 4.1: Impact Assessment criteria for SEA of Provisional Local Transport Plan for Surrey

Aspect	Criteria used	Sensitivity
Air Quality	Changes in air quality in terms of levels of sulphur dioxide (SO2), nitrogen dioxide (NO2), particulate matter (PM10), ground level ozone (O3), dust and other sources of air pollution.	High
Climate Change	Emission of greenhouse gases in relation to the generation of energy by conventional and alternative means; the use of energy for heating, lighting, power and transportation; and steps being considered to address and respond to the impacts of climate change.	High
Built environment	Changes to the quality and character of the built environment in both existing and new developments (e.g. standards of design in new infrastructure, high standards of accessibility, etc.).	High
Welfare, health & well being	Changes to the welfare, health or well-being of the local population. This may include access to key services (e.g. schools, hospitals, workplaces, shops, etc.), and to employment or education opportunities, or impacts on physical health (e.g. traffic related accidents, growth in walking and cycling rates).	High
Water Resources	Changes to the biological and chemical quality of surface waters and ground waters, and the use and management of water resources.	Moderate
Land, soil & mineral resources	Changes in land use (e.g. prioritisation of brownfield sites, the capacity to make land available for different categories of development, etc.), the safeguarding of soil quality (e.g. best and most versatile agricultural land), and the safeguarding of mineral resources.	Moderate


Aspect	Criteria used	Sensitivity
Materials efficiency & waste	Changes in the generation of wastes, the recovery, reuse and recycling of materials and the management of waste disposal.	Moderate
Historic environment & archaeology	Changes to the historic environment in terms of archaeological assets (both known and unknown) and sites, structures and features of historic significance and value (e.g. sites and buildings that have been designated as being of local, regional, national, European or international importance on the grounds of their intrinsic historic value).	Moderate
Natural environment & biodiversity	Changes to the natural environment in terms of plants, animals and geological assets (e.g. sites and species that have been designated as being of local, regional, national, European or international importance on the grounds of their scientific and intrinsic value), and biodiversity in terms of habitats and species covered by biodiversity action plans.	Moderate
Landscape	Changes to the character and integrity of the landscape (e.g. areas designated at local, regional or national level as warranting protection on the grounds of their natural beauty).	Moderate

Mitigation of impacts and Monitoring

Four strategic alternatives were developed and evaluated for the Provisional Surrey LTP to mitigate the impacts of the Plan. These were as follows:

1. Smarter Choices – The strategy in this alternative focussed on promoting 'soft' or behavioural measures designed to influence travel behaviour, with minimum physical improvements to the transport infrastructure.
2. Enhanced Infrastructure – In this alternative, the strategy for the LTP would be to concentrate on improving and further developing the existing transport infrastructure.
3. The Balanced Approach - The strategy for the LTP would be to achieve a balance in meeting the need for physical improvements to existing transport infrastructure and implementing measures designed to influence travel behaviour
4. Business as Usual (a benchmarking scenario)

Recommendations were fed back to the LTP team of Surrey County Council.

The SEA report also proposed a monitoring plan; in which a set of indictors were identified for each aspect which reflected the risks and opportunities reported. The purpose of the proposed indicators was to enable the Surrey County Council LTP team to monitor and record the nature and extent of the impacts and effects that actually arise from the delivery of the Plan.

Observations

The considerations highlighted in Environmental Report were taken into account in the delivery of the Plan and the Surrey Transport Plan strategies were also modified accordingly, to minimise the adverse impacts of the Plan. It may be observed here that the SEA exercise incorporated a vast array of assessment

parameters and adopted a very comprehensive yet broad methodology to assessment of the LTP. A similar approach would be recommended for environmental assessment of urban transport plans/ polices at city level in India.

4.1.2 SEA of High Speed Rail Network, Portugal

Project Description

In November 2003, Portugal approved the layout of the future high-speed rail network in the country. This is eventually planned to become a component of the Trans-European Transport Network (TEN-T).

The plan is comprised of three priority links - Lisbon-Madrid, Lisbon-Oporto, and Oporto-Vigo axes with a total length of about 650 km and an investment of around € 8 billion (Coutinho et. al, 2005). On completion, a large number of Portugal's major cities and the two most important border connections will be linked by high-speed rail.

Rationale for SEA

Portugal transposed the European Union (EU) Directive 2001/42/EC concerning Strategic Environmental Assessment (SEA) of plans and programmes in 2007 and thus at the time of planning for HSR network is was not necessarily required. However, HSR is a major strategic investment that could bring strong socio-economic and other environmental impacts. Therefore, the promoters of the high –speed rail network in the country felt that it was required to conduct a study that should follow the guidelines of the Directive concerning the content and structure of the environmental report. This was done to identify the potential impacts due to the project and hence, plan the project more effectively (Coutinho et. al, 2005).

Figure 4.1: HSR network alternatives, Portugal;

Source: Coutinho et. al, 2005


Basic framework for SEA

This SEA exercise was conducted in accordance with the European Union (EU) Directive 2001/42/EC on the "assessment of the effects of certain plans and programmes on the environment" The Directive lays down a minimum environmental assessment framework which defines the broad principles of the environmental assessment system and leaves the procedural details to each Member States taking into account the principle of subsidiarity. However, it is important to refer the necessary procedures which correspond to the different steps of the SEA process, defined as follows: screening, scoping, environmental report, decision making and monitoring (Coutinho et. al, 2005).

The framework of the SEA comprised of:

- Integration of environmental & sustainability objectives, through the use of key performance indicators for impact assessment and monitoring;
- Scoping to determine constraints and/or opportunities of the project ;
- Providing a context for future project proposals;
- Follow-up of the plan performance through a matrix (balance scorecard) against each objective.

Methodology

The SEA exercise involved developing and comparing two layout alternatives for the HSR network at the plan level; the so called TT plan and T plan alternatives. Within this context, the SEA focused on the identification of the principal environmental and territorial effects resulted by the adoption either of the alternatives. This was as follows:

The 1st step involved identification of the externalities associated with the plan and an estimate of the external costs and benefits of the transport modal shift caused by the operation of the network. These externalities also accounted for the objectives specified through the European Environment Agency's (EEA) Transport and Environmental Reporting Mechanism (TERM) set of indicators.

In the 2nd step, the characteristics of the territory that will be crossed by the HSR network were analysed and potential impacts of the network and location of the stations on the development of the region, especially the cities, served by HSR were assessed. This analysis was supported by GIS mapping techniques.

From the outcome of the above two, a cumulative impact of HSR was assessed.

Mitigation of impacts and Monitoring

The evaluation concluded that both alternatives contribute to a reduction of costs, improving the environmental performance of the transport sector. Only noise and urban effects had an increase of external costs. The most significant reduction is noted in accidents, due to the expected modal shift and consequently the reduction of accidents.

To fulfil the environmental objectives and sustainability targets, the following mitigation measures were identified (Coutinho et. al, 2005):

- Measures of railway design: to overcome constrains and raise opportunities in the vulnerable areas and urban centres;
- Measures for integration with the planning process at the municipality level: these measures are associated with urban expansion and need for infrastructure development in the area under the HSR influence zone.

For follow-up assessment and monitoring of the environmental effects, the key performance indicators identified while impact assessment were organized to make a balance score card. The balance scorecard is divided into each level of Project implementation phase: the project implementation by itself, relation with external activities and operations; for which the indicators would be monitored against the environmental & sustainability objectives identified earlier.

Observations

In this case, the SEA exercise was used as a decision-making tool and to plan the network by developing alternate scenarios and assessing principal effects resulted by the adoption either of the alternatives. Since the Plan for HSR was a macro-level proposal going beyond the limits of one city and connecting several cities, the environmental assessment was carried out at a very broad scale. Accordingly, the methodology and data used for the assessment were not very intensive. A city level SEA exercise would need to be more detailed in comparison; although the approach demonstrated here is a good example to understand what the assessment of alternative alignments would entail.

4.1.3 SEA of Expressway Network Plan of Hunan Province, China

Project Description

A long-term (2005–2030) plan for the expressway network of Hunan province, a central-southern province in China, was prepared under China's provincial level expressway infrastructure (PLEI) network plan. The proposed expressway network includes five north– south vertical axes and seven east–west horizontal axes. The total length of the network is 5615 km (Figure 4.2; Zhou and Sheate, 2011).

Rationale for SEA

Chapter 2 of the EIA Law of China is exclusively for SEA implementation and application. According to its provisions, the PLEI network plan falls into the 'special plan' category and since the political level of decision-making authority is higher than 'municipal (with district) and above', therefore, a formal SEA should apply. It was under this requirement that the SEA exercise was carried out (Zhou and Sheate, 2011). However, implementation of the project had already started by the time the SEA exercise was completed.


Figure 4.2: Expressway network of Hunan Province, China

Source: Zhou and Sheate, 2011

Basic framework for SEA

The SEA exercise considered impacts due to – a) Project location, b) Construction and c) Operation of the network plan. The SEA report included the following components:

1. Description of the existing environment – establishing the baseline
2. Scoping – Based on existing environmental issues, identifying:
    - Assessment indicators
    - Assessment objectives
3. Prediction and assessment of environmental impacts
4. Comparison and selection of alternatives
5. Mitigation and monitoring measures

Methodology

In order to understand the kind of impacts taking place, some of the parameters were estimated in the pre-project and post-project scenario through projections, based on existing situation and overlay mapping of

assessment indicators for scenario building. However, this impact assessment was very generic in nature and there was no detailed assessment or quantification carried out for specific indicators.

This process was also substantiated through public participation, which basically included officials from various governments, specialists from academic institutions, and also comments & suggestions that were taken from general public while project planning.

Mitigation of impacts and Monitoring

Because no impact was properly predicted and assessed, therefore no specific mitigation measures for any significant impact were developed, assessed and recommended. The measures documented are very general suggestions and common practical guidelines.

The SEA report has a dedicated section addressing monitoring measures. A monitoring plan for air pollutants, noise and water pollutants has been suggested but it does not mention who will provide the resources to make the planned monitoring activities function properly.

Observations

This impact assessment was very generic in nature and there was no detailed assessment or quantification carried out for specific indicators. As a result, no impact was properly predicted and assessed; therefore no specific mitigation measures for any significant impact were developed, assessed or recommended. The measures documented are very general suggestions and common practical guidelines. Also, there was no substantial outcome of the SEA exercise as implementation of the project had already started by the time it was completed

4.1.4 SEA of Gujarat State Highways Program

Project Description

Gujarat State Highways Program was a Gujarat government initiative which aimed at the improvement of the state highways including three major components namely, road improvement (widening or strengthening), periodic maintenance (asphalt overlays) and institutional development. The project was financed by a World Bank loan. Under this project, 818 km of roads out of the total of 1500 kms of state highways (Figure 4.3) were selected for improvement with the available budget and an Environmental team was formed to undertake the Strategic environmental Assessment (SEA) for the Program.

Rationale

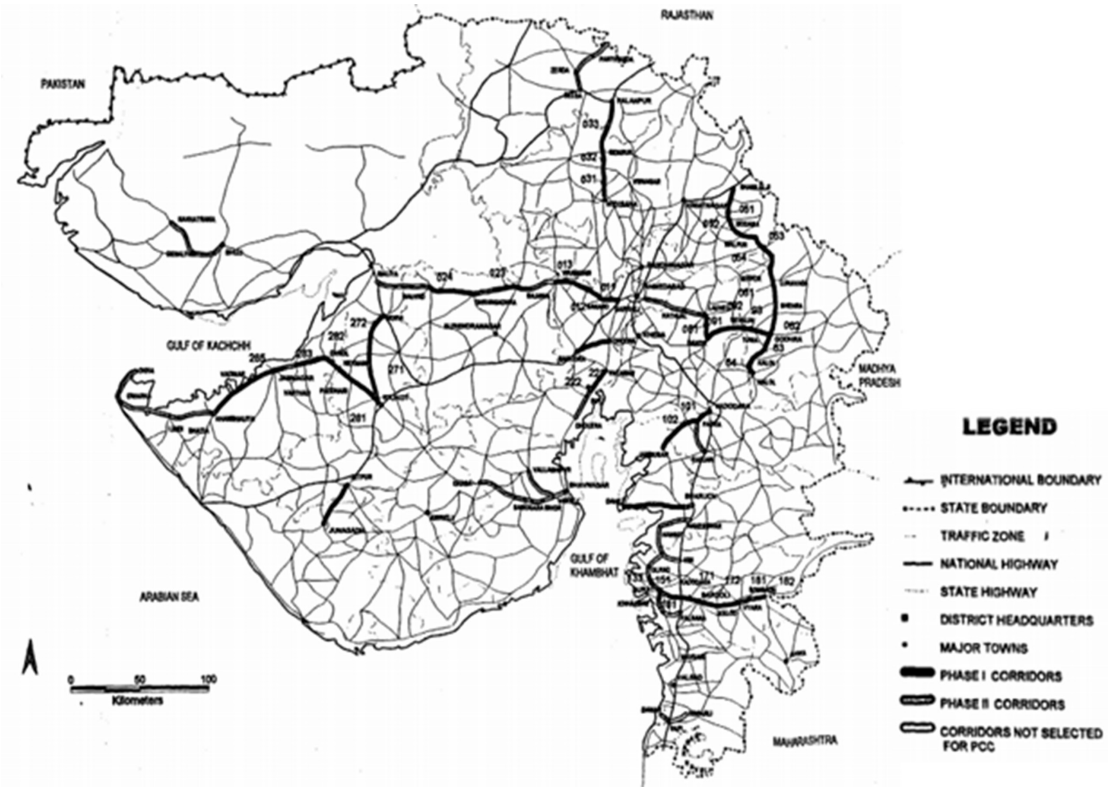
An SEA was considered important to assess the likely impacts of the proposed program on both the natural and social components in an integrated manner. The main focus of the SEA exercise was to present an environmental screening of the project corridors and classify them as high, medium or low based on the likely impact levels. This led to the phasing of the project corridors which was done due to the limited budget available with the government. Government of Gujarat realized the need for a practical plan which could help in mitigating and monitoring the negative impacts due to construction activities as well as the future operation of these roads. As the outcome of the study, an Environmental Management Plan was prepared along with a Resettlement Action Plan (RAP) to serve as guiding documents to the Gujarat Roads and Building Department as they initiated work on the different road sections. SEA was seen important to plan the project in a way that there were minimum negative impacts on the environment.


Basic Framework

The SEA exercise considered the impacts on both the natural and social environment due to the construction and operations of the road corridors. The assessment was done for the following components.

Natural Environment	Social Environment
• Climate (Wind, Temperature and rainfall)	• Demographic profile of districts
• Air Quality	• Socio-economic profiles
• Noise	• Vulnerable Groups
• Water resources (Surface and Ground)	• Land-use and development
• Minerals (types of soils)	• Archeological and cultural property
• Flora	
• Fauna	

Figure 4.3: Highways identified under the Gujarat State Highways Program



Methodology

Detailed information was collected on the natural and social environmental features along the corridor of impact (full 1500 km) and added on the strip maps of the road corridors. Other social, bio physical and

cultural elements within the right of way were also plotted on the maps. The data collected included the number of residential and business units potentially affected by the project corridors and adjacent land uses, trees and vegetation water crossings, wetlands, wells, archaeological and cultural assets (Table 4.2). Following the creation of a strip map database, proper digital drawings were prepared for the corridors.

Data Collection:

Data was collected in two stages. In the first stage, state wide data describing the setting along the corridors was collected using secondary sources followed by additional data updates in the next stage through field surveys.

Mitigation of impacts and monitoring

The likely impacts were categorised into short term or long term impacts and were predicted to be mostly direct with relatively few indirect effects. Mitigation measures or actions were recommended to be taken up during the construction as well as operation phases of the project. Preventive or mitigation actions were suggested in order to minimise the likely impacts on air, water resources, wind erosion, flora and fauna in the project areas.

Table 4.2 Impact Assessment parameters for SEA of Gujarat State Highways Program

Areas Studies/ Surveys	Parameters
Air Quality	Air pollution levels: Six parameters: Carbon Monoxide (CO), Hydrocarbons (HC), oxides of Nitrogen (NOx), Sulphur Dioxide (SO2), Suspended Particulate Matter (SPM). Climate and Wind data Traffic Volume (daily volume and composition of traffic)
Noise	Equivalent noise level at different locations (traffic as well as surrounding activities)
Water Quality	Surface Water: type and number of wetlands within or along road corridors and type and number of water crossings. Characteristics of major rivers and water quality data were obtained from secondary sources. Ground Water: location of aquifer recharge zones, depth of ground water table, level of water table, and the groundwater development (i.e. extraction) zones.
Flora and Fauna	Number of protected areas i.e. National Park, Sanctuaries and reserved forests influenced by the project corridor, Species, size and density of trees, green tunnels; bio-diversity data on flora and fauna; and, rare and endangered species.
Soil Conditions	Erosion potential and condition of existing pits and quarries, to be used for road construction
Social Environment	Demography, socio-economic, land use and development and Vulnerable Groups(VG)
Cultural Heritage	Sites of archaeological, heritage and cultural significance.


Environmental Management Action Plan (EMAP)

An EMAP was prepared which listed the various mitigation measures in the construction and operation phases of the project along with the monitoring requirements and the implementing agencies for each measure.

A Resettlement Action Plan was also prepared as a part of this exercise in order to compensate for the losses (in the form of land, livelihood, structures or other assets, community property resources etc.) bore by the people affected under this project activity during construction or operations. The project affected individuals/ households/communities were entitled to certain compensation points as per the plan.

Observations

Two corridors (bypasses) were identified for new construction and were classified as high impact category projects. All other corridors except the two bypasses to be constructed were classified as medium or low impact category projects. SEA brought forward that these corridors had a very minimal impact on both the natural as well as social environment and can be easily managed through the measures suggested in the EMAP.

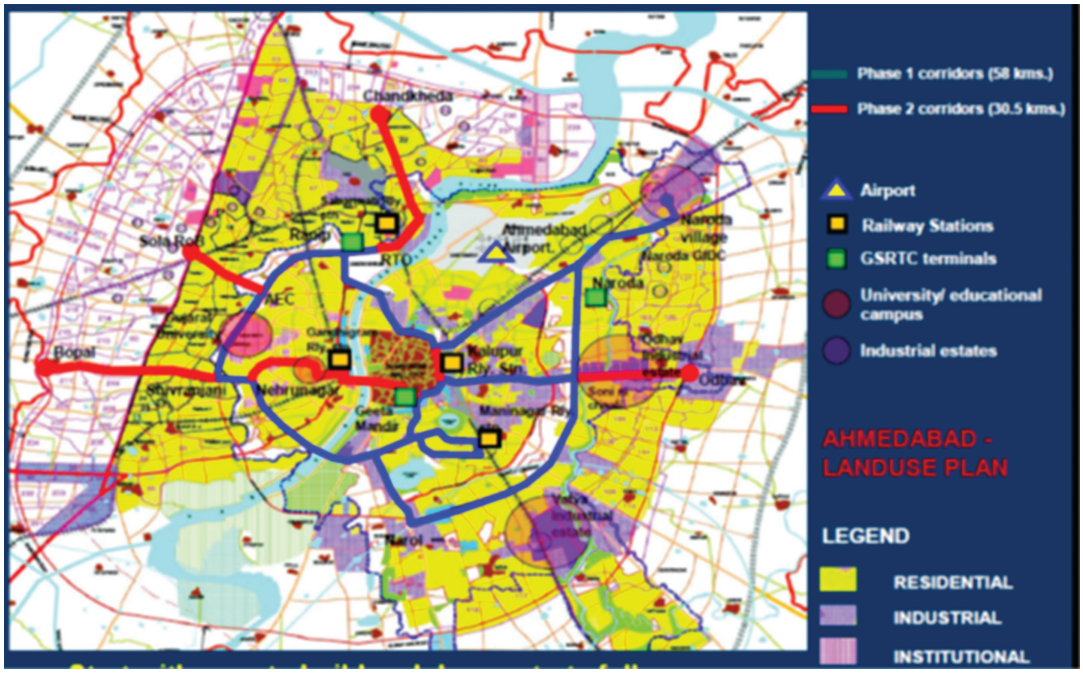
4.1.5 EIA of Ahmedabad BRTS

Project Description

With an aim to improve its mobility infrastructure, Ahmedabad conceived the idea of having a BRTS. In 2007, Ahmedabad Municipal Corporation formed a Special Purpose Vehicle (SPV) – Ahmedabad Janmarg Limited (AJL), an autonomous body, headed by the Municipal Commissioner of Ahmedabad and comprising representatives from the state government and urban transport experts – to implement the BRTS in the city. The regular operations of Janmarg started in October 2009 - the operational corridors covering a length of 58 km (Figure 4.4).

Janmarg is based on the concept of an integrated multi-modal transport system. With a system comprising of main and feeder lines that connect the key origin and destination points, the system aims to increase the accessibility to work and education centres. The project has been developed as a public-private partnership venture.

Figure 4.4: Network Plan of BRTS Ahmedabad;



Source: http://ahmedabadbrts.com/Resources.html

Rationale for EIA

Although conducting an EIA is not a statutory requirement for BRTS projects, the exercise was conducted in case of Janmarg in an attempt to address environmental issues arising as a result of the development and also for better decision-making at planning & design level. This EIA exercise was done for the Phase I of the project covering a length of 58km (Figure 4.4; CEPT, 2006).

Basic framework for EIA

The EIA exercise considered impacts on the following during – a) the Planning and design stage, b) Construction stage and c) Operational stage of the project:

1. **Natural environment**

- Climate
- Physiography
- Drainage
- Impacts on soil
- Impacts on water resources
- Air quality
- Ambient noise
- Impacts on flora


2. Social environment

- General impacts like increase in land prices, loss of utilities, public health and safety, etc.
- Other specific impacts

Methodology

In order to understand the kind of impacts taking place, some of the parameters were estimated in the pre-project and post-project scenario using specific quantification methodologies as discussed in Table 4.3.

Table 4.3: Methodology used in EIA of Ahmedabad BRTS

Impacts on	Methodology
Climate	Change in daytime temperature on the road surface due to loss of shade trees was measured
Water resources	Change in concentration of carbonates, bicarbonates, Cl, NO3, SO4, F, Ca, Na, Hardness and pH levels from the baseline levels was assessed
Air quality	Ambient air quality baseline data from the Gujarat Pollution Control Board (GPCB) and Central Pollution Control Board(CPCB) was collected and the change in concentration of CO, HC, NOX, SOX, SPM and Pb (lead) was measured.
Ambient noise	There are standards of noise levels set by CPCB/ Ministry of Environment and Forest (MoEF) (1989). These standards were compared with the noise levels estimated after the implementation of project.
Flora	Removal of trees before construction

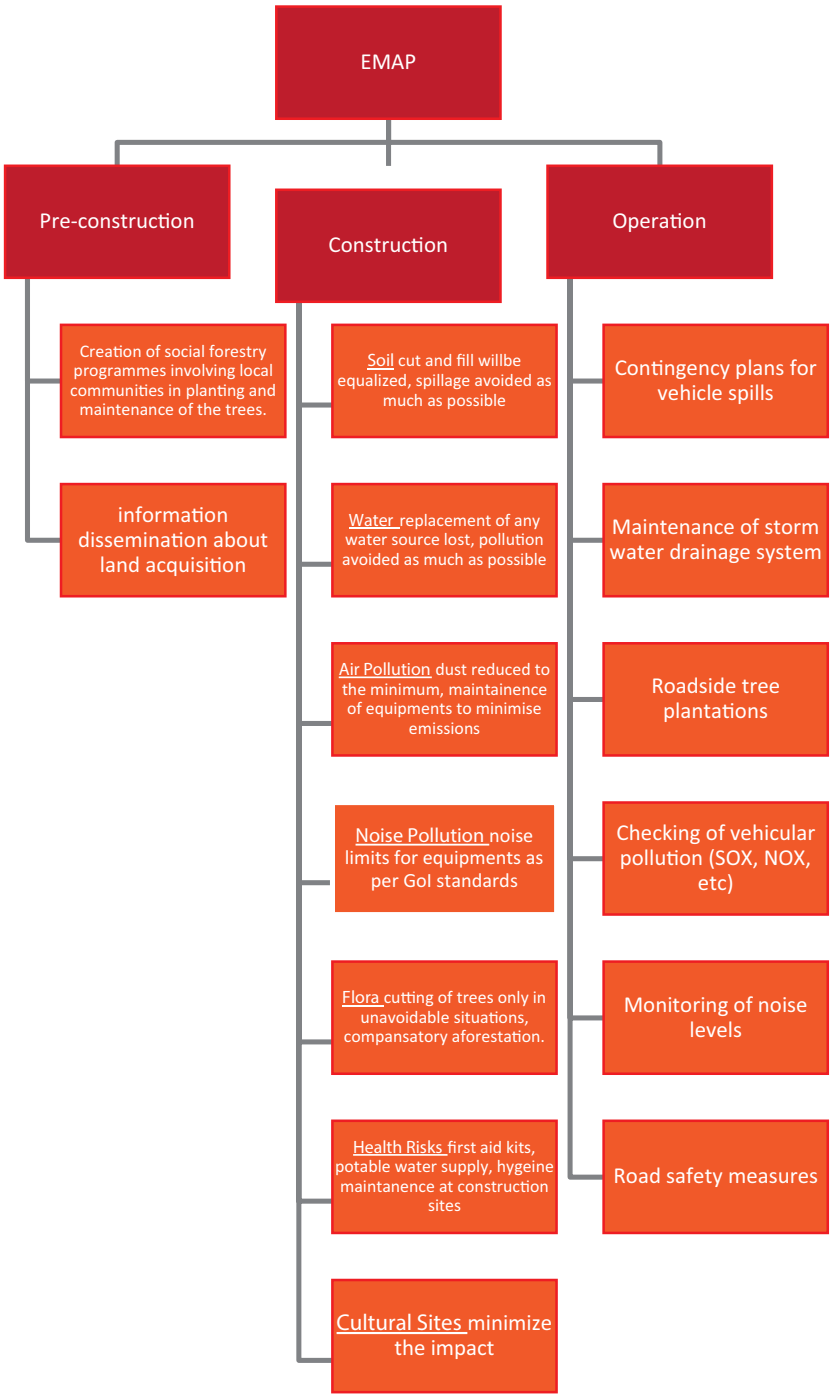
Based on the results of the above estimates and other assessments, a number of impacts were identified by the EIA report; which included impacts on climate, physiography, drainage, soil, water resources, air quality, ambient noise, flora, public health & safety, access to utilities, land values, etc. .

Mitigation of impacts - Environmental Management Action Plan (EMAP)

Typically, any EIA exercise is followed by an Environmental Management Action Plan (EMAP) to mitigate the impacts of the development project. The EIA report of Janmarg has proposed an EMAP to tackle the identified impacts shown in Figure 4.5. These include steps to be taken in the a) Pre-construction b) Construction and c) Operational stages of the project to minimise the environmental impacts.

Observations

Figure 4.5: Proposed EMAP for Ahmedabad BRTS




The EIA report proposed an EMAP to tackle the identified impacts. These include steps to be taken in the a) Pre-construction b) Construction and c) Operational stages of the project. This review was done based on the executive summary of the EIA report, therefore it difficult to give a detailed insight on the methodology and the data collected for the study. However, the adopted approach is in line with the requirements of the EIA Notification to a large extent and may be replicable for environmental assessment of BRTS, if the assessment parameters are adapted to the context of Indian cities.

4.1.6. EIA of Delhi Metro (Central Secretariat to Badarpur)

Project Description

Central Secretariat is an interchange station on the Yellow Line, which connects Jahangirpuri in North Delhi to HUDA City Centre in Gurgaon via Rajiv Chowk and South Delhi. The 20.16km long Central Secretariat – Badarpur section passes through important residential and work centres like Lajpat Nagar, East of Kailash, Nehru Place, Sarita Vihar, etc (Figure 4.6; DMRC, 2007). This corridor is also important because this section will eventually be extended up to Faridabad which is growing very fast in terms of population and industrialization and requires a high capacity public transport link to connect main activity areas of Delhi.

Rationale for EIA

As per the EIA Notification 2006 (amended in 2009), new, expansion or modernization of any activity falling within the eight categories of developmental and industrial activities shall be undertaken in any part of India only after it has been accorded environmental clearance by the MoEF in accordance with the procedures specified in the notification. Since urban transportation projects such as the Delhi Metro are not included in the Schedule of the notification, hence conducting an EIA or carrying out Public Hearing are not mandatory. However, this EIA was done to identify the potential impacts due to the project and hence, plan the project more effectively (DMRC, 2007).

Basic framework for EIA

The EIA exercise considered impacts on the following due to – a) Project location, b) Construction and c) Operation of the project:

3. **Natural environment**
    - Air quality
    - Noise
    - Water environment
    - Soil
    - Flora/ green cover
4. **Social environment**
    - Socio – Economic component
    - Land use pattern along the proposed corridors

Figure 4.6: Delhi Metro Central Secretariat - Badarpur Corridor;

Source: DMRC, 2007

Methodology

In order to understand the kind of impacts taking place, some of the parameters were estimated in the pre-project and post-project scenario using specific quantification methodologies as discussed in Table 4.4.

Table 4.4: Methodology used in EIA of Delhi Metro

Impacts on	Methodology
Water resources	The parameters for monitoring were pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolved Solids (TDS), Chlorides, Nitrates, Sulphates, Total nitrogen, Total Phosphate, Oils and Grease, The monitoring points were ground and surface waters if any. The ground water sampling was carried out in the Metro corridor.
Air quality	The total consumption of diesel for earth excavation and transportation machinery was worked out per day. Based on the emission factor for the various parameters like SPM, SO2, NOX etc, prediction of pollution load was made.
Ambient noise	The measurements were carried out with the help of a calibrated Sound Level Meter for 24 - hour duration at each sampling site.
Soil	Soil erosion rates, slope stability of land faces, water sediments load, effectiveness of soil conservation measures, changes in soil texture and structure were proposed to be monitored at frequent intervals.


Based on the results of the above estimates and other assessments, a number of impacts were identified by the EIA report. The identified positive impacts have been enlisted below.

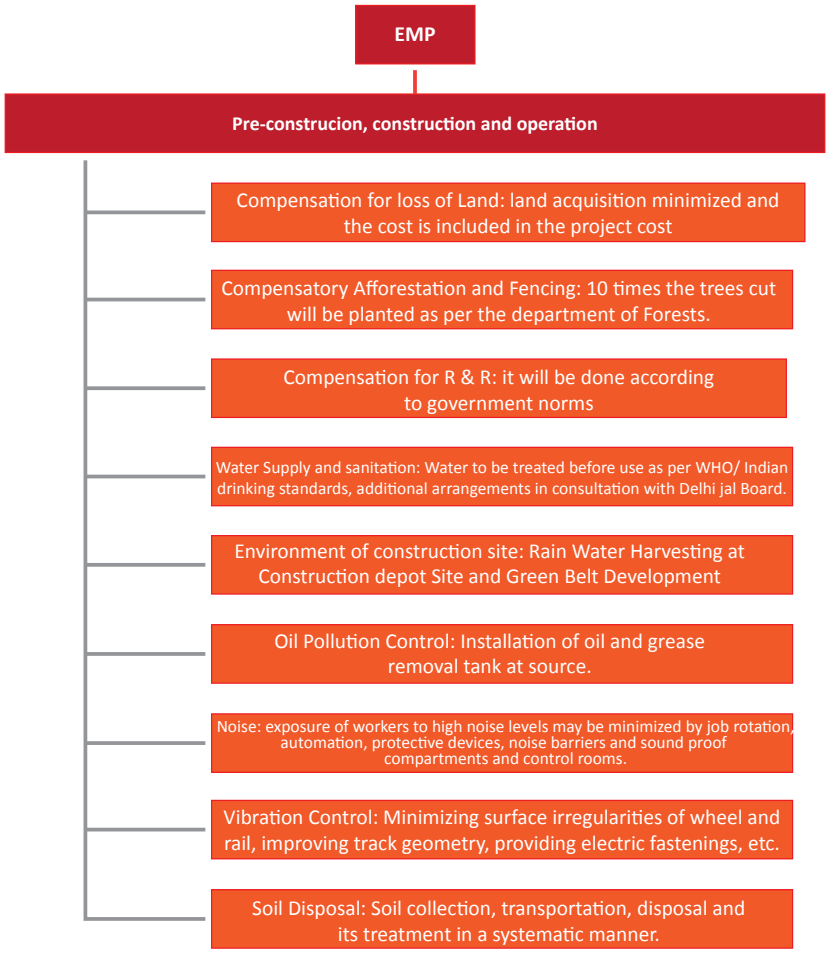
- Reduced travel time resulting in increased accessibility
- Safe and comfortable mode of transportation
- Reduced traffic resulting in reduced congestion on roads due to the probable shifting of significant proportion of private vehicles to the metro
- Reduced fuel consumption from the transport sector resulting in precious foreign exchange
- Reduction in vehicular emission loads resulting in improved air quality of the region
- Reduction in road accidents resulting in reduced death and injury during road accidents
- Increased job/employment opportunities (direct and indirect)
- Sense of pride to the city and country having a world-class facility

Environmental Management Action Plan (EMAP)

Typically, any EIA exercise is followed by an Environmental Management Action Plan (EMAP) to mitigate the impacts of the development project. The EIA of Delhi Metro has proposed an EMAP to tackle the identified impacts. These include steps to be taken in the a) Construction b) Construction and c) Operational stages of the project to minimise the environmental impacts (Figure 4.7).

Observations

Figure 4.7: Proposed EMAP for Delhi Metro Corridor



The EMAP suggested measures to tackle the identified impacts. These include steps to be taken in the a) Construction b) Construction and c) Operational stages of the project. This review was done based on the executive summary of the EIA report, therefore it difficult to give a detailed insight on the methodology and the data collected for the study. However, the adopted approach is in line with the requirements of the EIA Notification to a large extent and may be replicable for environmental assessment of rail-based MRTS, if the assessment parameters are adapted to the context of Indian cities.

4.1.7. EIA of the Safir-Hadramout Road project (Republic of Yemen)

Project Description

An EIA study was carried out for a proposed road in the Republic of Yemen that will transverse the central part of the country and also serves as a shorter route connecting Eastern Governorate with the capital Sana'a. The 311 km long road project passes through certain areas of historical and archaeological importance. To assess the base conditions of the site and evaluate the direct and indirect potential effects of the project on the biophysical, ecological, social and cultural environment (considering the conservation of archaeological and historical sites), an EIA study was suggested and funded by the World Bank. It was


carried out by a private consultancy company in conjunction with Yemeni experts. The EIA exercise resulted in the realignment of certain segments in order to minimise the evaluated impacts on the nearby heritage structures. Also as an outcome, a follow up monitoring plan for mitigation and management actions during the construction and operation of the project was also prepared.

Rationale for EIA

The EIA was suggested by World Bank due to the proximity of the prehistoric and archaeological sites to the proposed road corridor. Certain activities can have serious adverse effects on monuments or structures of prehistoric or archaeological significance located nearby. In lieu of this, an EIA was undertaken to identify, avoid or minimise the likely impacts of the project activity and hence, plan the project in a more effective manner.

Basic framework for EIA

The EIA exercise mainly took into consideration the impacts of the road construction activity on the following:

- Physical environment
- (including geology, surface and ground water hydrology and quality, heavy rains and flash floods, recharge areas, soil salinity, wind conditions, temperature etc.).
- Biological environment
- (Ecologically sensitive areas, wildlife habitats and their migration routes, significant grazing fields and water sources).
- Socio and cultural environment
- (Population distribution, community structure, tribal people, land tenure, existing settlements, infrastructure and services, public health and employment).
- Archaeological and historical sites of significance

  (Prehistoric and historic remains, artefacts, monuments such as tombs etc.)

Methodology

The EIA was carried out in three stages:

Pre field stage: This stage primarily included data collection, discussion with various Government Authorities and Ministries, review of relevant literature and identification of data gaps. It also involved preparation of a base map along with thematic maps at smaller scales on the basis of available maps and secondary information including satellite and aerial photographs.

Field stage: This stage involved visual assessment along the stretch of the entire proposed road corridor along with local inquiries to meet the critical data gaps and also understand and identify the likely environmental and social impacts in the project area due to road construction. The proposed stretch was divided into homogeneous segments, each of which were analysed in detail to assess the current environmental conditions, evaluate likely impacts and also identify actions for mitigation.

Post field stage: Documenting the results of the first two stages leading to finalisation of the environmental assessment report was done in this stage. An Environmental Management and Monitoring Plan for mitigating negative impacts are identified.

Various studies were undertaken to assess the likely impacts of the project activity which have been enlisted in Table 4.5.

Table 4.5: Impact Assessment parameters for EIA of the Safir-Hadramout Road project

Studies/ Surveys to assess impacts on	Methodology
Desertification/Land Degradation	Due to the hot and arid desert character of the project area, Desertification was assessed and evaluated using some parameters: movement of sand in broad terms; deflation of fine material – increase in coarse material; degradation of marginal lands –removal of top soil and grass cover; enlargement of rock outcrops or bare areas to indicate degrees of erosion; decreasing or disappearance of vegetative cover; rise and fall of water tables; and the practice of cutting trees.
Geology and hydrogeology	Resource inventory preparation was undertaken for major resources namely, water, soils and minerals, agriculture, livestock animal husbandry, flora and fauna, oil and energy along with physical and social infrastructure and linkages and communication systems in order to understand the biophysical, socio-economic and cultural environment in the regional perspective. It was then analysed to determine the environmental status and the settlement systems.
Social and cultural dynamism	Information about the profiles of the social organisation and cultural patterns of the major nomadic, seminomadic and other settled social groups and their spatial distribution in the project area was collected through secondary data sources (published and unpublished), as well as surveys (selective questionnaires and interviews), and personal observations. A study was also undertaken to assess the social perspective on development which would help in assessing the possible anticipated clustering of people and activities and hence, the requirements of the social and economic infrastructure along the proposed road project. Accordingly, measures to address the environmental impacts were formulated.
Institutional study	Organograms of the National and Governmental administration were studied to understand the powers and responsibilities of the different departments, laws regarding right to land property, access to water, land use controls etc. Also due consideration was given to the views of the government on developmental prospects and the work done by the area authorities. This led to the formulation of the imperatives of the Environmental Management Plan and tasks of the monitoring unit.
Segmentation of road alignment for impact assessment	Environment quality assessment was done for each of the 22 segments of the proposed road which was further reviewed against the regional environmental setting. At the same time, mitigation actions/measures were also identified to reduce or minimize the negative impacts of the project activity which further helped in the preparation of the Environmental Management and Monitoring Plan.


Studies/ Surveys to assess impacts on	Methodology
Prehistoric/archaeology resource study	This study involved four stages as discussed below: **Pre field stage**: Comprehensive literature review of various published and unpublished documents referring to the prehistoric and archaeological significance of the project area. **Field stage**: A Comprehensive field survey of the project corridor was done to identify and locate prehistoric and archaeological sites using topographic maps and Global Positioning System (GPS) unit. To ensure consistency in data collection, a standard form for all the sites to record and report information. Artefacts were collected, properly labelled and sent to laboratories for further analysis. **Site Testing**: This stage involved limited site testing at several sites which was implemented to address site significance through certain parameters like site integrity and presence of in situ cultural materials of regional, local and academic research importance. **Data analysis/report preparation**: This stage involved analysis of the collected artefacts and preparation of a report. A statement of significance along with findings at each site level was prepared and incorporated in the report. The report also included the expected impacts from the proposed activity on the sites and recommended actions.

Detailed assessment of the above surveys and studies identified a number of positive as well as negative impacts. The identified positive impacts have been enlisted below:

- Local employment generation
- Additional consumption of local produce.
- Enhancement of local skills (technology transfer)
- Improved access and security.
- Increase in social interaction between communities.
- Taking over camp buildings and associated facilities as maintenance depots, community centres or growth nucleus.

Several negative impacts associated with road construction were identified but these were temporary impacts confined to certain locations and hence, could be mitigated without any difficulty. Different actions were identified for the conservation of the identified prehistoric/archaeological sites. The measures included actions like no action at all, avoid quarrying, protection by fencing, re-alignment of the road, monitoring during construction and also preparation of maps for further information before road construction were recommended.

At the same time, actions were also recommended to enhance positive social impacts resulting from the project activity in terms of creation of job opportunities and reduction of fragmentation between the local groups.

Environmental Management Action Plan (EMAP)

An Environmental Management Action Plan (EMAP) was prepared as a result of the EIA exercise in order to mitigate the negative impacts. A mitigation management panel was recommended to monitor and guide the implementation of the mitigation measures in all the stages namely, pre-construction, construction and post construction projects.

Mainly measures related to prehistory and archaeology, dune stabilisation and combating desertification, monitoring the behaviour of exploited aquifer, development of public facilities along road towards enhancing the positive impacts, development of shelter belts, roadside orchards, and administration of landuse control have been identified and actions are suggested to be taken by the concerned departments.

Observations

The EIA study helped in redesigning and re-aligning the proposed road so as to protect the identified areas of archaeological and prehistoric nature. Different mitigation actions were identified to conserve the identified sites along with actions to enhance the positive social impacts resulting from the proposed construction especially in terms of creation of job opportunities.

4.2 Lessons learnt

This chapter summarizes the findings of the literature review.

Importance of carrying out SEA/ EIA of urban transport plans/ projects

The literature review primarily gives an understanding of the application of the concept of SEA/ EIA for transport/ urban transport plans and projects. The first thing that comes up is the importance of carrying out an environmental assessment at the strategic level. SEA introduces environmental considerations into decision making early and hence allows decision makers to focus on the environmental effects of strategic choices, before specific projects are considered. Thus, SEA can help to consider a broader range of alternative proposals and mitigation measures. Moreover, SEA allows for the consideration of cumulative and broad scale (i.e., regional and global) environmental effects. In some of the case studies, SEA was used as an effective decision-making tool and to plan the network by developing alternate scenarios and assessing principal effects resulted by the adoption either of the alternatives. In context of urban transport sector, SEA can be conducted to understand the broad impact of strategies suggested in city development plans, transport/mobility plans/ studies, etc. and address the possible adverse environmental impacts at an early stage and also facilitate decision making at the strategic level. Similarly, quite a number of large scale urban transport projects are coming up or are being implemented in metros and medium sized-cities in the country. Also, there are a number of urban transport projects which are identified under the context of the city development plans, transport/mobility plans. It is important that they should also undergo a prior environmental assessment in form of EIA in order to prevent/ minimize adverse environmental impacts that they may have.

The literature review also helps in understanding the differences and similarities in the approach for conducting environmental analysis at different scales in terms of the scope/ coverage (framework), methodology and data requirements. This may further be understood as follows.

Framework for SEA/ EIA

All the case studies involved 1) identifying and assessing positive and negative impacts of the project/ plan on the environment and 2) mitigation & monitoring measures to manage these impacts.

However, there were some differences in the framework owing to the different scales and time-frames to which these concepts are applied. Since EIA is conducted at project level, the impacts may be more of local in nature – at site or area level. So the impacts were assessed for micro-level parameters like air quality, drainage, soil, noise, land use, etc. for different stages of project planning and implementation. Accordingly, the mitigation measures were recommended in the form of an Environmental Management Action Plan (EMAP) to minimize the negative impacts.


On the other hand, in case of SEA, the environmental analysis is done at strategic/ perspective planning level, so it becomes imperative to evaluate the objectives of the plan as well. Moreover, assessment of alternate future scenarios to choose the most optimum approach and follow-up assessment & monitoring are also an inevitable part of the exercise. The case studies on SEA reflect these considerations. The Table 6 summarises the findings from review of case studies.

Table 4.6: Findings of review of case studies

Aspect	SEA	EIA
Framework	The general framework followed in the SEA case studies included: 1. **Assessment of Objectives** on environmental and sustainability criteria 2. **Scoping** – identifying externalities and opportunities 3. **Prediction and Assessment of alternative scenarios** 4. **Mitigation of Impacts** 5. **Monitoring and follow up assessment**	The EIA exercise considered impacts on the following during – a) the Planning and design stage, b) Construction stage and c) Operational stage of the project: **1. Natural environment** – Climate, physiography, drainage, impacts on soil, impacts on water resources and their quality, air quality, ambient noise, impacts on flora/ green cover, etc. **2. Social environment** – impacts on land prices, land use pattern, loss of utilities, public health and safety, etc.
Methodology	• A criterion-based method was used to identify and examine the risks and opportunities. The criteria were projected and then overlayed to predict the cumulative impacts on environment. Public participation was also involved in the process. • *Should present alternative scenarios and help in rapid assessment of their likely impacts to enable pro-environment decision making before specific projects are considered*	• Parameters relating to environment were quantified in the pre-project and post-project scenarios to understand the impacts. • Public hearing is an important part of the exercise • *Should essentially follow the provisions of the EIA Notification, 2006 (as amended in 2009 and 2011)*
Data	*Should be in simple format and easily available to city authorities*	• Detailed data requirement in view of the intensive assessment needed. • *Should be in simple format and easily available to city authorities*

It is also important that the assessment parameters that are identified for the SEA/ EIA of urban transport plans and projects are relevant to the scope and impacts that are specific to the issues of urban areas; e.g., impacts on built environment, impacts on public health due to noise and vibrations, etc.

Methodology for conducting SEA/ EIA

All case studies, both for SEA and EIA, identified some parameters or criteria to assess the impacts. In case of EIA, these parameters/ criteria were quantified in the pre-project and post-project scenarios to assess the impacts. On the other hand, in case of SEA, they were used to build and compare alternate future scenarios to examine the risks and opportunities. Some form of public participation was also involved in the process. However, it was found to be very rudimentary and limited.

It may be noted here that the methodology that is adopted conducting EIA of urban transport projects should essentially be in line with the principles of the Environment (Protection) Act, 1986 and the statutory requirements of the EIA Notification, 2006 (as amended in 2009 and 2011). The methodology for SEA should present alternative scenarios of the urban transport policies/ strategies and help in rapid assessment of their likely impacts to enable pro-environment decision making before specific projects are considered.

Data

It is important that the data required for establishing environmental baseline and assessment in simple format and easily available at the city level in order to carry out the exercise effectively and in a time bound manner. A more detailed discussion on data requirements would entail subsequently, in the discussion on establishing the baseline.

Annexures

Annexure I

Annexure I Schedule-I: Projects requiring Environmental Clearance as per EIA Notification, 2006

(1)	(2)	(3)	(4)	(5)
		Category with threshold limit		**Conditions if any**
Project or Activity				
		A	**B**	
1	**Mining, extraction of natural resources and power generation (for a specified production capacity)**			
1(a)	(i) Mining of minerals (ii) Slurry pipelines (coal lignite and other ores) passing through national parks/ sanctuaries/ coral reefs, ecologically sensitive areas.	≥50 ha of mining lease area in respect on non-coal mine lease. > 150 ha of mining lease area in respect of coal mine lease. Asbestos mining irrespective of mining area. All Projects.	< 50 ha ≥ 5 ha of mining lease area in respect of non-coal mine lease. < 150 ha > 5 ha of mining lease area in respect of coal mine lease.	General Condition shall apply Note: (i) Prior Environmental Clearance is as well required at the stage of renewal of mine lease for which application should be made up to one year prior to date of renewal. (ii) Mineral prospecting is exempted
1(b)	Offshore and onshore oil and gas exploration, development & production	All projects		**Note** Exploration Surveys (not involving drilling) are exempted provided the concession areas have got previous clearance for physical survey
1(c)	River Valley Projects	(i) ≥ 50 MW hydroelectric power generation; (ii) ≥ 10,000 ha. of culturable command area	(i) < 50 MW ≥ 2 5 MW hydroelectric power generation; (ii) < 1 0, 0 00 ha . of culturable command area	"General Condition shall apply. Note: Irrigation Project not involving submergence or inter- state domain shall be appraised by the SEIAA as Category 'B' Projects.";

(1)	(2)	(3)	(4)	(5)
1(d)	Thermal Power Plants	"> 500 MW (coal/lignite/naphtha & gas based); > 50 MW (Pet coke, diesel and all other fuels including refinery residual oil waste except biomass); > 20 MW (based on biomass or non-hazardous municipal solid waste as fuel);	< 500 MW (coal/ lignite/naphtha & gas based); <50MW > 5MW (Pet coke, diesel and all other Fuels including refinery residual oil waste except biomass); < 20 MW > 15MW (based on biomass or non-hazardous municipal solid waste as fuel);	General Condition shall apply. Note: i) Power plants up to 15 MW based on biomass and using auxiliary fuel such as coal/ lignite / Petroleum products up to 15% are exempt. ii) Power plants up to 15 MW, based on non-hazardous municipal waste and using auxiliary fuel such as coal / lignite/ petroleum products up to 15% are exempt. iii) Power plants using waste heat boiler without any auxiliary fuel are exempt."
1(e)	Nuclear power projects and processing	All projects		
1(c)	RiverValley projects			
1(d)	Thermal Power Plants	"> 500 MW (coal/lignite/naphtha & gas based); > 50 MW (Pet coke, diesel and all other fuels including refinery residual oil waste except biomass); > 20 MW (based on biomass or non-hazardous municipal solid waste as fuel);	< 500 MW (coal/ lignite/naphtha & gas based); <50MW > 5MW (Pet coke, diesel and all other Fuels including refinery residual oil waste except biomass); < 20 MW > 15MW (based on biomass or non-hazardous municipal solid waste as fuel);	General Condition shall apply. Note: i) Power plants up to 15 MW based on biomass and using auxiliary fuel such as coal/ lignite / Petroleum products up to 15% are exempt. ii) Power plants up to 15 MW, based on non-hazardous municipal waste and using auxiliary fuel such as coal / lignite/ petroleum products up to 15% are exempt. iii) Power plants using waste heat boiler without any auxiliary fuel are exempt."
1(e)	Nuclear power projects and processing	All projects		


(1)	(2)	(3)	(4)	(5)
1(c)	RiverValley projects			
3 (b)	Cement plants	> 1.0 million < 1.0 million tonnes/annum production capacity	<1.0 million tonnes/ annum production capacity. All Stand-alone grinding units	General Condition shall apply
4	**Materials Processing**			
4(a)	Petroleum refining industry	All projects		
4(b)	Coke oven plants	≥2,50,000 tonnes/annum	<2,50,000 & ≥25,000 tonnes/annum	" General Conditions shall apply",
4(c)	Asbestos milling and asbestos based products	All projects		
4(d)	Chlor-alkali industry	≥300 TPD production capacity or a unit located outside the notified industrial area/ estate	"(i) All Projects irrespective of the size, if it is located in a Notified Industrial Area/Estate. (ii) <300 tonnes per day (TPD) and located outside a Notified Industrial Area/Estate.";	"General as well as Specific Condition shall apply No new Mercury Cell based plant will be permitted and existing units converting to membrane cell technology are exempted from this notification;
4(e)	Soda ash Industry	All projects	-	-
4(f)	Leather/skin/hide processing industry	New projects outside the industrial area or expansion of existing units outside the industrial area	All new or expansion of projects located within a notified industrial area/ estate	"General as well as specific condition shall apply."
5	**Manufacturing/Fabrication**			
5(a)	Chemical fertilizers	"All projects except Single Super Phosphate."	"Single Super Phosphate";	-
5(b)	Pesticides industry and pesticide specific intermediates (excl-uding formulations)	All units producing technical grade pesticides		
5(c)	Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/ or reforming to aromatics)	All projects		
5(d)	Handmade fibres manufacturing	Rayon	Others	General Condition shall apply

(1)	(2)	(3)	(4)	(5)
5(e)	Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)	Located outside the notified industrial area/ estate	Located in a notified industrial area/ estate	"General as well as specific conditions shall apply."
5(f)	Synthetic organic chemicals industry (dyes & dye interm-ediates; bulk drugs and intermediates excluding drug form-ulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	Located outside the notified industrial area/ estate	Located in a notified industrial area/ estate	"General and specific conditions shall apply."
5(g)	Distilleries	(i) All Molasses based distilleries (ii) All Cane juice/ non-molasses based distilleries ≥30 KLD	All Cane juice/ non- molasses based distilleries <30KLD	General Condition shall apply
5(h)	Integrated paint industry	-	All projects	General Condition shall apply
5(i)	Pulp & paper industry excluding manufacturing of paper from waste paper and manufacture of paper from ready pulp without bleaching	Pulp manufacturing and Pulp & Paper manufacturing industry -	Paper manufacturing Industry without pulp manufacturing	General Condition shall apply
5(j)	Sugar Industry	-	> 5000 tcd cane crushing capacity	General Condition shall apply
6	**Service Sectors**			
6(a)	Oil & gas transp-ortation pipe line (crude and refinery/ petrochemical products), passing through national parks/sanctuaries/ coral reefs /ecolo-gically sensitive areas including LNG Terminal	All projects -		


(1)	(2)	(3)	(4)	(5)
6(b)	Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of schedule 2 & 3 of MSIHC Rules 1989 amended 2000)		All projects	General Condition shall apply
7	**Physical Infrastructure including Environmental Services**			
7(a)	Air ports	"All projects including airstrips, which are for commercial use."		"Note: Air strips, which do not involve bunkering/ refueling facility and or Air Traffic Control, are exempted."
7(b)	All ship breaking yards including ship breaking units	All projects		
7(c)	Industrial estates/ parks/ complexes/ areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes.	If at least one industry in the proposed industrial estate falls under the Category A, entire industrial area shall be treated as category A, irrespective of the area. Industrial estates with area greater than 500 ha. and housing at least one Category B industry.	Industrial estates housing at least one Category B industry and area <500 ha. Industrial estates of area > 500 ha. and not housing any industry belonging to Category A or B.	"General as well as specific conditions shall apply. Note: 1. Industrial Estate of area below 500 ha and not housing any industry of Category 'A' or 'B' does not require clearance. 2. If the area is less then 500 ha but contains building and construction projects > 20,000 Sq mtr. and or development area more than 50 ha it will be treated as activity listed at serial no. 8(a) or 8(b) in the Schedule, as the case may be."
7(d)	Common hazardous waste treatment, storage and disposal facilities (TSDFs)	All integrated facilities having incineration & landfill or incineration alone	All facilities having land fill only	General Condition shall apply

(1)	(2)	(3)	(4)	(5)
7(e)	"Ports, harbours, break waters, dredging."	> 5 million T PA of cargo handling capacity (excluding fishing harbours)	< 5 million TPA of cargo handling capacity and/ or ports/ harbours ≥ 10,000 TPA of fish handling capacity	"General Condition shall apply. Note: 1. Capital dredging inside and outside the ports or harbours and channels are included; 2. Maintenance dredging is exempt provided it formed part of the original proposed for which Environment Management Plan (EMP) was prepared and environmental clearance obtained."
7(f)	Highways	i) New National High ways; and ii) Expansion of National Highways greater than 30 KM, involving additional right of way greater than 20 m involving land acquisition and passing through more than one State.	" (i) All New State Highway Projects" (ii) State Highway expansion projects in hilly terrain (above 1,000 m AMSL) and or ecologically sensitive areas."	"General Condition shall apply. Note: Highways include expressways."
7(g)	Aerial ropeways	(i) All Projects located at altitude of 1,000 mtr. and above (ii) All Projects located in notified ecologically sensitive areas."	"All projects except those covered in column (3)."	General Condition shall apply
7(h)	Common Effluent Treatment Plants (CETPs)		All projects	General Condition shall apply
7(i)	Common Municipal Solid Waste Management Facility (CMSWMF)		All projects	General Condition shall apply
8	**Building/Construction projects/Area Development projects and Townships**			
8(a)	Building and Construction projects		≥20000 sq.mtrs and < 1,50,000 sq.mtrs. of built-up area#	The built up area for the purpose of this Notification is defined as "the built up or covered area on all the floors put together including basement(s) and other service
8(b)	Townships and Area Development projects.		Covering an area ≥ 50 ha and or built up area ≥1,50,000 sq.mtrs ++	++All project sunder Item 8(b) shall be appraised as Category B1


Note:-

General Condition (GC):

Any project or activity specified in Category 'B' will be treated as Category 'A', if located in whole or in part within 10 km from the boundary of: (i) Protected Areas notified under the Wild Life (Protection) Act, 1972; (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time; (iii) Eco-sensitive areas, as notified under section 3 of the Environment (Protection) Act, 1986, such as Mahabaleshwar, Pancgani, Matheran, Panchmarhi, Dhanu, Doon valley, and (iv) inter-State boundaries and international boundaries:

Provided that the required regarding distance of 10 km of the inter-State boundaries can be reduced or completely done away with by an agreement between the respective States or U.Ts sharing the common boundary in case the activity does not fall within 10 kilometers of the areas mentioned at item (i),(ii) and (iii) above."

Specific Condition (SC):

If any Industrial Estate/Complex / Export processing Zones /Special Economic Zones/Biotech Parks / Leather Complex with homogeneous type of industries such as Items 4(d), 4(f), 5(e), 5(f), or those Industrial estates with pre -defined set of activities (not necessarily homogeneous, obtains prior environmental clearance, individual industries including proposed industrial housing within such estates /complexes will not be required to take prior environmental clearance, so long as the Terms and Conditions for the industrial estate/complex are complied with (Such estates/complexes must have a clearly identified management with the legal responsibility of ensuring adherence to the Terms and Conditions of prior environmental clearance, who may be held responsible for violation of the same throughout the life of the complex/estate).

Annexure II

(I) Basic Information

No.	Item	Details
	Name of the project/s	
	S.No. in the schedule	
	Proposed capacity /area/length/tonnage to be handled/command area/ lease area/number of wells to be drilled.	
	New/Expansion/Modernization	
	Existing Capacity/Area etc.	
	Category of Project i.e. 'A' or 'B'	
	Does it attract the general condition? If yes, please specify.	
	Does it attract the specific condition? If yes, please specify.	
	Location Plot/Survey/Khasra No. Village Tehsil District State	
	Nearest railway station/airport along with distance in kms.	
	Nearest Town, city, district Headquarters along with distance in kms.	
	Village Panchayats, Zilla Parishad, Municipal Corporation, Local body (complete postal addresses with telephone nos. to be given)	
	Name of the applicant	
	Registered Address	
	Address for correspondence: Name Designation (Owner/Partner /CEO) Pin code E-mail Telephone No. Fax No.	


No.	Item	Details
	Details of Alternative Sites examined, if any. Location of these sites should be shown on a topo sheet.	Village-District-State 1 2 3
	Interlinked Projects	
	Whether separate application of interlinked project has been submitted?	
	If yes, date of submission	
	If no, reason	
	Whether the proposal involves approval/clearance under: if yes, details of the same and their status to be given. The Forest (Conservation) Act, 1980? i. The Wildlife (Protection) Act, 1972? ii. The C.R.Z. Notification, 1991?	
22.	Whether there is any Government Order/Policy relevant /relating to the site?	
23	Forest land involved (hectares)	
24.	Whether there is any litigation pending against the project and/or land in which the project is propose to be set up? a) Name of the Court b) Case No. c) Orders/directions of the Court, if any and its relevance with the proposed project.	

ii. Activity

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)		
1.2	Clearance of existing land, vegetation and buildings?		
1.3	Creation of new land uses?		
1.4	Pre-construction investigations e.g. bore houses, soil testing?		
1.5	Construction works?		

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.6	Demolition works?		
1.7	Temporary sites used for construction works or housing of construction workers?		
1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations		
1.9	Underground works including mining or tunneling?		
1.10	Reclamation works?		
1.11	Dredging?		
1.12	Offshore structures?		
1.13	Production and manufacturing processes?		
1.14	Facilities for storage of goods or materials?		
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?		
1.16	Facilities for long term housing of operational workers?		
1.17	New road, rail or sea traffic during construction or operation?		
1.18	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?		
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?		
1.20	New or diverted transmission lines or pipelines?		
1.21	Impoundment, damming, cumnverting, realignment or other changes to the hydrology of watercourses or aquifers?		
1.22	Stream crossings?		
1.23	Abstraction or transfers of water form ground or surface waters?		
1.24	Changes in water bodies or the land surface affecting drainage or run-off?		
1.25	Transport of personnel or materials for construction, operation or decommissioning?		
1.26	Long-term dismantling or decommissioning or restoration works?		
1.27	Ongoing activity during decommissioning which could have an impact on the environment?		
1.28	Influx of people to an area in either temporarily or permanently?		
1.29	Introduction of alien species?		
1.30	Loss of native species or genetic diversity?		
1.31	Any other actions?		


2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):

S.No.	Information/checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)		
2.2	Water (expected source & competing users) unit: KLD		
2.3	Minerals (MT)		
2.4	Construction material – stone, aggregates, sand / soil (expected source – MT)		
2.5	Forests and timber (source – MT)		
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)		
2.7	Any other natural resources (use appropriate standard units)		

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)		
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)		
3.3	Affect the welfare of people e.g. by changing living conditions?		
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,		
3.5	Any other causes		

4. Production of solid wastes during construction or operation or decommissioning (MT/month)

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes		
4.2	Municipal waste (domestic and or commercial wastes)		
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)		
4.4	Other industrial process wastes		
4.5	Surplus product		
4.6	Sewage sludge or other sludge from effluent treatment		
4.7	Construction or demolition wastes		
4.8	Redundant machinery or equipment		
4.9	Contaminated soils or other materials		
4.10	Agricultural waste		
4.11	Other solid wastes		

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources		
5.2	Emissions from production processes		
5.3	Emissions from materials handling including storage or transport		
5.4	Emissions from construction activities including plant and equipment		
5.5	Dust or odours from handling of materials including construction materials, sewage and waste		
5.6	Emissions from incineration of waste		
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)		
5.8	Emissions from any other sources		


6. Generation of Noise and Vibration, and Emissions of Light and Heat:

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers		
6.2	From industrial or similar processes		
6.3	From construction or demolition		
6.4	From blasting or piling		
6.5	From construction or operational traffic		
6.6	From lighting or cooling systems		
6.7	From any other sources		

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials		
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)		
7.3	By deposition of pollutants emitted to air into the land or into water		
7.4	From any other sources		
7.5	Is there a risk of long term build-up of pollutants in the environment from these sources?		

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment

S. No	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances		
8.2	From any other causes		
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?		

9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
9.1	Lead to development of supporting. lities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: • Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) • housing development • extractive industries • supply industries • other		
9.2	Lead to after-use of the site, which could havean impact on the environment		
9.3	Set a precedent for later developments		
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects		


(iii) Environmental Sensitivity

S. No	Areas	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary
1	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value		
2	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests		
3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration		
4	Inland, coastal, marine or underground waters		
5	State, National boundaries		
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas		
7	Defence installations		
8	Densely populated or built-up area		
9	Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)		
10	Areas containing important, high quality or scarce resources (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)		
11	Areas already subjected to pollution or environmental damage. (those where existing legal environmental standards are exceeded)		
12	Areas susceptible to natural hazard which could cause the project to present environmental problems.....(earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions)		

(IV).Proposed Terms of Reference for EIA studies:

"I hereby given undertaking that the data and information given in the application and enclosures are true to the best of my knowledge and belief and I am aware that if any part of the data and information submitted is found to be false or misleading at any stage, the project will be rejected and clearance give, if any to the project will be revoked at our risk and cost.

Date: _____

Place: _____

Signature of the applicant with Name and Full Address

(Project Proponent /Authorised Signatory

Note:

1. The projects involving clearance under Coastal Regulation Zone Notification, 1991 shall submit with the application a C.R.Z map duly demarcated by one of the authorized agencies, showing the project activities, w.r.t. C.R.Z (at the stage of TOR) and the recommendations of the State Coastal Zone Management Authority (at the state of EC). Simultaneous action shall also be taken to obtain the requisite clearance under the provisions of the C.R.Z Notification, 1991 for the activities to be located in the CRZ.

2. The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden thereon (at the state of EC)."

3. All correspondence with the Ministry of Environment & Forests including submission of application for TOS/Environmental Clearance, subsequent clarifications, as may be required from time to time, participation the EAC Meeting on behalf of the project proponent shall be made by the authorized signatory only. The authorized signatory should also submit a document in support of his claim of being an authorized signatory for the specific project."


Annexure II: Form 1 A

(only for construction projects listed under item 8 of the Schedule)

CHECK LIST OF ENVIRONMENTAL IMPACTS

(Project proponents are required to provide full information and wherever necessary attach explanatory notes with the Form and submit along with proposed environmental management plan & monitoring Program)

1. LAND ENVIRONMENT

(Attach panoramic view of the project site and the vicinity)

1.1. Will the existing landuse get significantly altered from the project that is not consistent with the surroundings? (Proposed landuse must conform to the approved Master Plan /Development Plan of the area. Change of landuse if any and the statutory approval from the competent authority be submitted). Attach Maps of (i) site location, (ii) surrounding features of the proposed site (within 500 meters) and (iii) the site (indicating levels & contours) to appropriate scales. If not available attach only conceptual plans.

1.2. List out all the major project requirements in terms of the land area, built up area, water consumption, power requirement, connectivity, community facilities, parking needs etc.

1.3. What are the likely impacts of the proposed activity on the existing facilities adjacent to the proposed site? (Such as open spaces, community facilities, details of the existing landuse, disturbance to the local ecology).

1.4. Will there be any significant land disturbance resulting in erosion, subsidence & instability? (Details of soil type, slope analysis, vulnerability to subsidence, seismicity etc may be given).

1.5. Will the proposal involve alteration of natural drainage systems? (Give details on a contour map showing the natural drainage near the proposed project site)

1.6. What are the quantities of earthwork involved in the construction activity-cutting, filling, reclamation etc. (Give details of the quantities of earthwork involved, transport of fill materials from outside the site etc.)

1.7. Give details regarding water supply, waste handling etc. during the construction period.

1.8. Will the low lying areas & wetlands get altered? (Provide details of how low lying and wetlands are getting modified from the proposed activity)

1.9. Whether construction debris & waste during construction cause health hazard? (Give quantities of various types of wastes generated during construction including the construction labour and the means of disposal)

2. WATER ENVIRONMENT

2.1. Give the total quantity of water requirement for the proposed project with the breakup of requirements for various uses. How will the water requirement met? State the sources & quantities and furnish a water balance statement.

2.2. What is the capacity (dependable flow or yield) of the proposed source of water?

2.3. What is the quality of water required, in case, the supply is not from a municipal source? (Provide physical, chemical, biological characteristics with class of water quality)

2.4. How much of the water requirement can be met from the recycling of treated wastewater? (Give the details of quantities, sources and usage)

2.5. Will there be diversion of water from other users? (Please assess the impacts of the project on other existing uses and quantities of consumption)

2.6. What is the incremental pollution load from wastewater generated from the proposed activity? (Give details of the quantities and composition of wastewater generated from the proposed activity)

2.7. Give details of the water requirements met from water harvesting? Furnish details of the facilities created.

2.8. What would be the impact of the land use changes occurring due to the proposed project on the runoff characteristics (quantitative as well as qualitative) of the area in the post construction phase on a long term basis? Would it aggravate the problems of flooding or water logging in any way?

2.9. What are the impacts of the proposal on the ground water? (Will there be tapping of ground water; give the details of ground water table, recharging capacity, and approvals obtained from competent authority, if any)

2.10. What precautions/measures are taken to prevent the run-off from construction activities polluting land & aquifers? (Give details of quantities and the measures taken to avoid the adverse impacts)

2.11. How is the storm water from within the site managed?(State the provisions made to avoid flooding of the area, details of the drainage facilities provided along with a site layout indication contour levels)

2.12. Will the deployment of construction labourers particularly in the peak period lead to unsanitary conditions around the project site (Justify with proper explanation)

2.13. What on-site facilities are provided for the collection, treatment & safe disposal of sewage? (Give details of the quantities of wastewater generation, treatment capacities with technology & facilities for recycling and disposal)

2.14. Give details of dual plumbing system if treated waste used is used for flushing of toilets or any other use.

3. VEGETATION

3.1. Is there any threat of the project to the biodiversity? (Give a description of the local ecosystem with it's unique features, if any)

3.2. Will the construction involve extensive clearing or modification of vegetation? (Provide a detailed account of the trees & vegetation affected by the project)

3.3. What are the measures proposed to be taken to minimize the likely impacts on important site features (Give details of proposal for tree plantation, landscaping, creation of water bodies etc. along with a layout plan to an appropriate scale)


4. FAUNA

4.1. Is there likely to be any displacement of fauna- both terrestrial and aquatic or creation of barriers for their movement? Provide the details.

4.2. Any direct or indirect impacts on the avifauna of the area? Provide details.

4.3. Prescribe measures such as corridors, fish ladders etc. to mitigate adverse impacts on fauna

5. AIR ENVIRONMENT

5.1. Will the project increase atmospheric concentration of gases & result in heat islands?

(Give details of background air quality levels with predicted values based on dispersion models taking into account the increased traffic generation as a result of the proposed constructions)

5.2. What are the impacts on generation of dust, smoke, odorous fumes or other hazardous gases? Give details in relation to all the meteorological parameters.

5.3. Will the proposal create shortage of parking space for vehicles? Furnish details of the present level of transport infrastructure and measures proposed for improvement including the traffic management at the entry & exit to the project site.

5.4. Provide details of the movement patterns with internal roads, bicycle tracks, pedestrian pathways, footpaths etc., with areas under each category.

5.5. Will there be significant increase in traffic noise & vibrations? Give details of the sources and the measures proposed for mitigation of the above.

5.6. What will be the impact of DG sets & other equipment on noise levels & vibration in & ambient air quality around the project site? Provide details.

6. AESTHETICS

6.1. Will the proposed constructions in any way result in the obstruction of a view, scenic amenity or landscapes? Are these considerations taken into account by the proponents?

6.2. Will there be any adverse impacts from new constructions on the existing structures? What are the considerations taken into account?

6.3. Whether there are any local considerations of urban form & urban design influencing the design criteria? They may be explicitly spelt out.

6.4. Are there any anthropological or archaeological sites or artefacts nearby? State if any other significant features in the vicinity of the proposed site have been considered.

7. SOCIO-ECONOMIC ASPECTS

7.1. Will the proposal result in any changes to the demographic structure of local population? Provide the details.

7.2. Give details of the existing social infrastructure around the proposed project.

7.3. Will the project cause adverse effects on local communities, disturbance to sacred sites or other cultural values? What are the safeguards proposed?

8. BUILDING MATERIALS

8.1. May involve the use of building materials with high-embodied energy. Are the construction materials produced with energy efficient processes? (Give details of energy conservation measures in the selection of building materials and their energy efficiency)

8.2. Transport and handling of materials during construction may result in pollution, noise & public nuisance. What measures are taken to minimize the impacts?

8.3. Are recycled materials used in roads and structures? State the extent of savings achieved?

8.4. Give details of the methods of collection, segregation & disposal of the garbage generated during the operation phases of the project.

9. ENERGY CONSERVATION

9.1. Give details of the power requirements, source of supply, backup source etc. What is the energy consumption assumed per square foot of built-up area? How have you tried to minimize energy consumption?

9.2. What type of, and capacity of, power back-up to you plan to provide?

9.3. What are the characteristics of the glass you plan to use? Provide specifications of its characteristics related to both short wave and long wave radiation?

9.4. What passive solar architectural features are being used in the building? Illustrate the applications made in the proposed project.

9.5. Does the layout of streets & buildings maximise the potential for solar energy devices?

Have you considered the use of street lighting, emergency lighting and solar hot water systems for use in the building complex? Substantiate with details.

9.6. Is shading effectively used to reduce cooling/heating loads? What principles have been used to maximize the shading of Walls on the East and the West and the Roof? How much energy saving has been effected?

9.7. Do the structures use energy-efficient space conditioning, lighting and mechanical systems? Provide technical details. Provide details of the transformers and motor efficiencies, lighting intensity and air-conditioning load assumptions? Are you using CFC and HCFC free chillers? Provide specifications.

9.8. What are the likely effects of the building activity in altering the micro-climates? Provide a self-assessment on the likely impacts of the proposed construction on creation of heat island & inversion effects?

9.9. What are the thermal characteristics of the building envelope? (a) roof; (b) external walls; and (c) fenestration? Give details of the material used and the U-values or the R values of the individual components.


9.10. What precautions & safety measures are proposed against fire hazards? Furnish details of emergency plans.

9.11. If you are using glass as wall material provides details and specifications including emissivity and thermal characteristics.

9.12. What is the rate of air infiltration into the building? Provide details of how you are mitigating the effects of infiltration.

9.13. To what extent the non-conventional energy technologies are utilised in the overall energy consumption? Provide details of the renewable energy technologies used.

10. Environment Management Plan

The Environment Management Plan would consist of all mitigation measures for each item wise activity to be undertaken during the construction, operation and the entire life cycle to minimize adverse environmental impacts as a result of the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It will state the steps to be taken in case of emergency such as accidents at the site including fire.

Annexure III: Pre Requisite Clearances

Coastal Regulation Zone (CRZ) (1991)

India has a vast coastline which is facing continuing pressures from increasing population and the increasing anthropogenic activities along the coastline. MoEF with the intention of protecting the coastal ecosystems and habitats issued CRZ notification in 1991 under the EPA 1986 including Environment (Protection) Rules 1986.

The CRZ notification completely prohibits various developmental activities (including road construction, expansion of roads, modification in existing structure and repairing or new developmental activity) in some areas and is permitted in certain cases (CRZ II and CRZ III) with prior approval from the concerned authorities or if it has been included in the CZMP of that area/state, which has already been approved by the MoEF. The notification imposes restrictions for new and up-gradation/modification of existing road projects and a "CRZ Clearance" has to be undertaken from MoEF even if Environmental Clearance is not required as per the provisions of Revised EIA Notification of 2006. EAC of MoEF for Infrastructure and other misc. projects is the nodal agency for considering and recommending CRZ Clearance for any road/ highway project provided that the project comes under the purview of the notification.

Forest Clearance

The Forest (Conservation) Act, 1980

Environmental Appraisal Committees are mostly reluctant to provide EIA clearance unless justified by technical and other reasons. The existing guidelines for the existing roads passing through the forest areas/ land only permits black topping and any up-gradation comprising road widening or proposal for further acquisition of adjoining land will require forest clearance as per the specified procedure.

Under the Forest (Conservation) Act, 1980 the project proponent seeks approval of the proposal from the State Government and other authorities and then followed by the central government - MoEF or any other authority depending upon the area of the forest land proposed to be acquired by the project proponent. The final clearance is provided only if it is approved by the Supreme Court empowered monitoring committee.

Forest Clearance cases related to Liner Plantations.

MoEF issued new revised guidelines for applicability of Forest (Conservation) Act, 1980 on liner plantations for widening/ modernization of existing roads. Various Government Departments like Railways, Irrigation, PWD, etc. has acquired land for specific purposes (like laying of roads, railway lines and canals) and was planted up with trees. Certain such areas were notified as protected forests for management purposes and would require from the Central Government under the Act. The regional offices, while issuing the approval sets up a condition that for every tree cut at least two trees should be planted as a provision for compensatory afforestation. The decision by the regional authorities have to be done within a done period of 30n days of the receipt of fully completed application, failing which the Central Government/State may proceed with the widening/modernization under intimation to the local State Forest Department and Central Government. On the other hand, the areas which have not been notified as protected forests will not attract the provisions of widening or expansion or re-alignment.


Wildlife Clearance

As per the Wildlife (Protection) Act, 1972 any developmental activity within the framework of EIA notification of September 2006, requires a 'Wildlife Clearance' if it is proposed to be located in or within 10 km of any 'Wildlife Sanctuary or National Park'. In the context of roads/highway projects, all proposed new road projects as well as up-gradation of road projects acquiring additional land is discouraged. Further, permission for up-gradation within existing Right of Way (ROW) is granted under special circumstances where there is no other alternative is feasible due to techno-economical or any other reasons.

Moreover, as per the General conditions specified under the EIA Notification of September 2006, if any new or up gradation of National or Highway road project [Category 7(f) of the notification] passes within 10 km of the boundary of protected areas notified under the Wildlife (Protection) Act (1972), the project will be treated as category 'A' Project and will be appraised by the MoEF at Central level which will also include conducting 'Public Hearing' as per the specified procedure.

On – site regulations

Fly Ash Rules

Further no person or agency involved in the construction of roads (including highways and flyovers) is permitted to use the borrow material excavated from the right of way of the road for the construction of road embankments. The guidelines or specifications issued by the Indian Road Congress (IRC) as contained in IRC specification No. SP: 58 of 2001 regarding use of fly ash shall be followed. All construction of road embankments will use fly ash, or municipal inert, unless the cost of fly ash of municipal inert deliver at the construction site is more than 25% higher than the equivalent quantity of soil extracted from other than the right of way for embankment use. In those cases, such soil may be used or else designated technical authorities of IRC certify that use of fly ash or municipal inert at the location for the intended purpose is technically infeasible, then for the top and side covers, soil other than soil extracted from the 'right of way' may be used.

Use of Ground Water for Infrastructure Projects in Notified Areas

Water is a scarce resource. For any road/highway construction project in the notified (critical) areas requiring ground water usage, the project proponent has to take prior permission from Central Ground Water Board (CGWA) or any other authorised agency. The designated authority may accord approval/permission for the withdrawal and use of ground water for construction activity, while specifying mandatory provision of Rain Water Harvesting (RWH) by the project proponent.

Other applicable Environmental Legislations/ Acts/ Regulations

S.No.	Legislations	Applicability	Related To
1	Air (Prevention and control of Pollution) Act (1981)	Construction & Operation Phase	Compliance to NAAQS
2	Water 9Prevention and control of Pollution) Act (1974)	Construction & Operation Phase	Prevention / Regulation of pollution of surface water bodies and underground water
3	Water (Prevention and Control of Pollution) Cess Act (1977) (Including amendments in 1992 & 2003)	Construction & Operation Phase	An act to provide for the operation and maintenance and to regulate the working of metro railway in the metropolitan city of Delhi

S.No.	Legislations	Applicability	Related To
4	The Delhi Metro Railway (Operation & Maintenance)Act, 2002	Construction & Operation Phase	An Act to provide for the operation and maintenance and to regulate the working of metro railway in the metropolitan city of Delhi
5	Environment (Protection)Act (986), including Environment Protection Rules (1986)	Construction & Operational Phase	"Umbrella Act' compliance of all notifications, rules and schedules issued under this act.
5.1	EIA Notification (September 14th, 2006)	Not Applicable	Metro Corridor doesn't come under preview of EIA Notification 14th Sep. 2006, & Dec. 1st 2009.
5.2	Costal Regulation Zone (CRZ) Notification (1991) (applicable in Coastal Areas, Estuaries etc.)	Pre-construction &Construction Phase	For projects coming under the influence area of coastal Regulation zone (1991) e.g. Mumbai, Chennai etc.
5.3	Noise Pollution (Regulations and control) Rules (2000)	Construction & Operation Phase	Use of heavy machinery and other equipment
5.4	Hazardous Waste (Management and Handling, Transboundary Movement Rules (1008) (as Amended)	Construction & Operation Phase	Storage of paints and HSD etc. to be used during construction phase.
5.5	Municipal solid Waste (Management & Handling)Rules (2000)	Construction Phase	Applicable for waste generated during construction and household waste generated at construction/workers camps.
5.6	Noise Limits for Generators Run on diesel (Rule No. 94)	Construction & Operation Phase	Limits the noise generated from the DG Sets during construction and Operation Phase
5.7	Fly Ash Rules for Utilization for coal or Lignite based Thermal Power Plant (2009)	Construction Phase	Compulsory use of fly Ash if project are lying within the vicinity of Thermal Power Plant
5.8	CGWA Guidelines under EPA (1986) for Ground Water abstraction	Construction & Operation Phase	Regulates/prohibits extraction of groundwater from notified critical/over exploited/dark area. Compulsory Rain Water Harvesting
6.	State Town Planning Acts	Construction Phase	Land use, Building Byelaws
7	Delhi Urban Art Commission act (1973) (for Delhi Only)	Construction Phase	Preservation, Development and maintaining the aesthetic quality of urban and environmental design within Delhi.
8.	National Resettlement and Rehabilitation Policy (NRRP) 2007	Pre-Construction Phase	R&R issues arising due to land/property acquisition
9	Petroleum Act with rules (2000)	Construction & Operation Phase	Usage, storage of Petroleum and Petroleum products
10	Forest (conservation) Act (1980) including forest (conservation)Rules (2003)	Construction Phase	Prohibition/regulation of any developmental activity in any declared protected/reserved forest.
11	Wildlife (Protection) Act (1974)	Construction Phase	Prohibition/regulation of any developmental activity in any declared wildlife conserved area
12	Delhi (Preservation) of Trees Act (1994) (For Delhi Only)	Pre-Construction Phase	Guidelines/Prohibition/related to cutting of tree(s) in Delhi


S.No.	Legislations	Applicability	Related To
13	Land Acquisition Act (1894) and its amendments	Pre-Construction Phase	Guidelines/procedures/compensation for acquiring land for public purpose
14	The Ancient Monuments (Preservation)Act (1904)	Pre-Constr-uction Phase & Construction Phase	Regulation/Prohibition of construction near declared protected monument(s)
15	NBC Code of India (2005)	Construction Phase	Various aspects related to construction
16	Endangered species Habitat Assessment Guidelines	Pre-Constr-uction & Construction Phase	
17	Disability Act (1995)	Operational Phase	Take special measures/establishments for benefit of persons with disabilities.
18	Motor Vehicle Act (MVA) (1988) including Central Motor Vehicles rules (1989) with amendments	Construction Phase	For vehicles used for construction activities
19	Ancient Monuments & archae-ological sites & Remains act (1958)	Pre-Construction Phase	If the proposed corridor is close to monument declared protected under the act.

Annexure IV

Annexure IV Methods of Monitoring and Establishing Baseline Environmental Attributes

Attributes	Sampling		Measurement Method	Remarks
A. Air Environment	**Network**	**Frequency**		
Meteorological • Wind speed • Wind direction • Dry bulb temperature • Wet bulb temperature • Relative humidity • Rainfall • Solar radiation • Cloud cover • Environmental Lapse Rate	Minimum 1 site in the project impact area	1 hourly continuous	Mechanical/ automatic weather station Rain gauge As per IMD specifications Mini Sonde/SODAR	IS 5182 Part 1-20 Site specific primary data is essential Secondary data from IMD, New Delhi CPCB guidelines
Pollutants				**Monitoring Network**
• SPM	10 to 15 locations in the project impact area	24 hourly twice a week (National Ambient Air Quality Standards, CPCB Notification dated 11th April, 1994)	Gravimetric (High-Volume)	• Minimum 2 locations in upwind side, more sites in downwind side / impact zone • All the sensitive receptors need to be covered
• RPM			Gravimetric (High-Volume with Cyclone)	
• SO_2			EPA Modified West & Gaeke method	**Measurement Methods**
• NO_x			Arsenite modified Jacob & Hochheiser	As per CPCB standards for NAQM, 1994
• CO		8 hourly twice a week	NDIR technique	
• H_2S*		24 hourly twice a week	Methylene-blue	
• NH_3*			Nesslers method	
• HC*			Infra Red analyser	
• Fluoride*			Specific Ion meter	
• Pb*				

*Project Specific

Note: For Rapid Environmental Impact Assessment one complete season data except monsoon is adequate while the comprehensive Environmental Impact Assessment Resources coverage of three seasons


Attributes	Sampling		Measurement Method	Remarks
B. Noise	**Network**	**Frequency**		
• Hourly equivalent noise levels	Identified study area	Once in each season	Instrument : Noise level meter	IS:4954-1968 as adopted by CPCB
• Hourly equivalent noise levels	Inplant (1.5 metre from machinery)	Once	Instrument : Noise level meter	CPCB/OSHA
• Hourly equivalent noise levels	Highways	Once in each season	Instrument : Noise level meter	CPCB/IS:4954-1968
• Peak particle velocity	150-200m from blast site	Once	PPV meter	
C. Water	**Network**	**Frequency**	**Measurement Method**	**Remarks**
Parameters for water quality • pH, temp, turbidity, magnesium hardness, total alkalinity, chloride, sulphate, nitrate, fluoride, sodium, potassium, salinity • Total nitrogen, total phosphorus, DO, BOD, COD, Phenol • Heavy metals • Total coliforms, faecal coliforms • Phyto plankton • Zoo plankton	Set of grab samples during pre and post-monsoon for ground and surface water for 10 km distance	Diurnal and Season wise	Samples for water quality should be collected and analysed as per : • IS : 2488 (Part 1-5) methods for sampling and testing of Industrial effluents • Standard methods for examination of water and wastewater analysis published by American Public Health Association.	Data should be collected from relevant offices such as central water commission, state and central ground water board, Irrigation dept.

D. Land Environment				
Soil • Particle size distribution • Texture • pH • Electrical conductivity • Cation exchange capacity • Alkali metals • Sodium Absorption Ratio (SAR) • Permeability • Water holding capacity • Porosity	One surface sample from each village, (soil samples be collected as per BIS specifications)	Season wise	Collected and analysed as per soil analysis reference book, M.I.Jackson and soil analysis reference book by C.A. Black	
Land use/Landscape • Location code • Total project area • Topography • Drainage (natural) • Cultivated, forest, plantations, water bodies, roads and settlements	At least 20 points along the boundary		Global positioning system Topo sheets Satellite Imageries* (1:25,000) Satellite Imageries* (1:25,000) *Project specific	

E. Biological Environment **Aquatic** • Primary productivity • Aquatic weeds • Enumeration of phyto plankton, zoo plankton and benthos • Fisheries • Diversity indices • Trophic levels • Rare and endangered species • Marine Parks/ Sanctuaries/ closed areas /coastal regulation zone (CRZ) **Terrestrial** • Vegetation-species list, economic importance, forest produce, medicinal value • Importance value index (IVI) of trees • Fauna • Avi fauna • Rare and endangered species • Sanctuaries / National park / Biosphere reserve • Migratory routes	• Considering probable impact, sampling points and number of samples to be decided on personal judgement within 10/25 km radius from the proposed site • Samples to collect from upstream and downstream of discharge point, nearby tributaries at down stream, and also from dug wells close to activity site • For forest studies, direction of wind should be considered while selecting forests	Season wise	Standard techniques (APHA et. al. 1995, Rau and Wooten 1980) to be followed for sampling and measurement	• Seasonal sampling for aquatic biota • One season for terrestrial biota, in addition to vegetation studies during monsoon season • Preliminary assessment • Microscopic analysis of plankton and me bents, studies of macro fauna, aquatic vegetation and application of indices, viz. Shannon, similarity, dominance IVI etc. • Point quarter plot less method for terrestrial vegetation survey • Secondary data to collect from Government offices, NGOs, published literature • Plankton net • Sediment dredge • Depth sampler • Microscope • Field binocular


F. socio-economic				
• Demographic structure • Infrastructure resource base • Economic resource base • Health status : Morbidity pattern • Cultural and aesthetic attributes • Education	Socio-economic survey is based on proportionate, stratified and random sampling method	Minimum for two phases of the project	Primary data collection through questionnaire	Secondary data from census records, statistical hard books, topo sheets, health records and relevant of ficial records available with Govt. agencies

Annexure - V

Annexure V: National Ambient Air Quality Standards (NAAQS)

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and other areas`	Ecologically sensitive area (notified by Central government)	Methods of measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur dioxide (SO_2), µg/m^3	Annual*	50	20	-Improved West & Gaeke
		24 hours**	80	80	-Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), µg/m^3	Annual*	40	30	-Modified Jacob & Hochheiser (Na-Arsenite) -Chemiluminescence
		24 hours**	80	80	
3	Particulate Matter (Size less than 10m) or PM_{10} µg/m^3	Annual*	60	60	- Gravimetric - TOEM - Beta attenuation
		24 hours**	100	100	
4	Particulate Matter (Size less than 2.5m) or $PM_{2.5}$ µg/m^3	Annual*	40	40	- Gravimetric - TOEM - Beta attenuation
		24 hours**	60	60	
5	Ozone (O3) µg/m^3	8 hours**	100	100	- UV photometric - Chemiluminescence - Chemical method
		1 hour**	180	180	
6	Lead (Pb) µg/m^3	Annual*	0.50	0.50	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
		24 hours**	1.0	1.0	
7	Carbon Monoxide (CO) mg/ m^3	8 hours**	02	02	-Non Dispersive Infra Red (NDIR) spectroscopy
		1 hour**	04	04	
8	Ammonia (NH_3) µg/m^3	Annual*	100	100	- Chemiluminescence - Indophenol blue method
		24 hours**	400	400	
9	Benzene (C_6H_6) µg/m^3	Annual*	05	05	-Gas chromatography based continuous analyzer -Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) – particulate	Annual*	01	01	-Solvent extraction phase only, ng/m^3 followed by HPLC/ GC analysis
11	Arsenic (As) ng/m^3	Annual*	06	06	AAS/ICP method - after sampling on EPM 2000 or equivalent filter paper


Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and other areas`	Ecologically sensitive area (notified by Central government)	Methods of measurement
12	Nickel (Ni) ng/m^3	Annual*	20	20	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniForm 1ntervals

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note:

Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation

(Source: National Ambient Air Quality Standards, CPCB Notification dated 18th November 2009)

Ambient Standards for Noise

Area Code	Area Category	Limit in dB (A) Leq	
		Day time	Night time
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential areas	55	45
D	Silence zone	50	40

Note:

Daytime is reckoned in between 6 a.m. and 9 p.m.

Night time is reckoned in between 9 p.m. and 6 a.m.

Silence zone is defined as areas up to 100 metres around such premises as hospitals, educational institutions, and courts. The silence zones are declared by a competent authority.

Mixed categories of areas should be declared as 'one of the four above mentioned categories by the competent authority and the corresponding standards shall apply.

(Source: CPCB)

Annexure VI

Annexure VI: Methods of Impact Prediction and their Relevance

Air Environment

Model	Application	Remarks
ISCST 2	Appropriate for point, area and line sources Applicable for flat or rolling terrain Transport distance up to 50 km valid Computes for 1 hr to annual averaging periods	Can take up to 99 sources Computes concentration on 600 receptors in Cartesian or polar co-ordinate system Can take receptor elevation Requires source data, meteorological and receptor data as input.
PTMAX	Screening model applicable for a single point source Computes maximum concentration and distance of maximum concentration occurrence as a function of wind speed and stability class	Requires source characteristics No met data required Used mainly for ambient air monitoring network design
PTDIS	Screening model applicable for a single point source Computes maximum pollutant concentration and its occurrence for the prevailing meteorological conditions	Requires source characteristics Average met data (wind speed, temperature, stability class etc.) required Used mainly to see likely impact of a single source
MPTER	Appropriate for point, area and line sources Applicable for flat or rolling terrain Transport distance up to 50 km valid Computes for 1 hr to annual averaging periods Terrain adjustment is possible	Can take up to 250 sources Computes concentration at 180 receptors up to 10 km Requires source data, meteorological data and receptor co-ordinates
CTDM PLUS (Complex Terrain Dispersion Model)	Point source steady state model, can estimate hourly average concentration in isolated hills/array of hills	Can take maximum 40 stacks and computes concentration at maximum 400 receptors Does not simulate calm met conditions Hill slopes are assumed not to exceed 15 degrees Requires source, met and terrain characteristics and receptor details
UAM (Urban Air shed Model)	3-D grid type numerical simulation model Computes O_3 concentration under short term episodic conditions lasting for 1 or 2 days resulting from NOx and VOCs Appropriate for single urban area having significant O_3 problems	
RAM (Rural Air shed Model)	Steady state Gaussian plume model for computing concentration of relatively stable pollutants for 1 hr to 1 day averaging time Applicable for point and area sources in rural and urban setting	Suitable for flat terrain Transport distance less than 50 kms


Model	Application	Remarks
CRESTER	Applicable for single point source either in rural or urban setting Computes highest and second highest concentration for 1hr, 3 hr, 24 hr and annual averaging times Tabulates 50 highest concentrations for entire year for each averaging times	Can take up to 19 stacks simultaneously at a common site Unsuitable for cool and high velocity emissions Do not account for tall buildings or topographic features Computes concentration at 180 receptor, circular wing at five downwind ring distance 36 radials Require source, and met data
OCD (Offshore and coastal Dispersion Model)	It determines the impact of offshore emissions from point sources on the air quality of coastal regions It incorporates over water plume transport and dispersion as well as changes that occur as the plume crosses the shore line Most suitable for over water sources where onshore receptors are below the lowest shore height	Requires source emission data Require hourly met data at offshore and onshore locations like water surface temperature over water air temperature relative humidity etc.
FDM (Fugitive Dust Model) for Fugitive emissions estimation	Suitable for emissions from fugitive dust sources Source may be point, area or line (up to 121 source) Require particle size classification max. up to 20 sizes Computes concentrations for 1hr, 3hr, 8hr, 24hr or annual average periods	Require dust source particle sizes Source co-ordinates for area sources, source height and geographic details Can compute concentration at max. 1200 receptors Require met data (wind direction, speed, temperature, mixing height and stability class) Model do not include buoyant point sources, hence no plume rise algorithm
RTDM (Rough Terrain Diffusion Model)	Estimates GLC is complex/rough (or flat) terrain in the vicinity of one or more colocated point sources Transport distance max. up to 15 km Can be used as screening model beyond 15 km to up to 50 km Computes for 1 to 24 hr. or annual average concentrations	Can take up to 35 colocated point sources Require source data and hourly met data computes concentration at maximum 400 receptors Suitable only for non reactive gases Do not include gravitational effects or depletion mechanism such as rain / wash out, dry deposition
CDM (Climat-ological Dispersion Model)	It is a climatological steady state GPM for determining long term (seasonal or annual) arithmetic average pollutant concentration at any ground level receptor in an urban area	Suitable for point and area sources in urban region, flat terrain Valid for transport distance less than 50 kms Long term averages : one month to one year or longer

Model	Application	Remarks
PLUVUEII (Plume Visibility Model)	Applicable to assess visibility impairment due to pollutants emitted from well-defined point sources It is used to calculate visual range reduction and atmospheric discoloration caused by plumes It predicts transport, atmospheric diffusion, chemical conversion, optical effects, surface deposition of point source emissions	Require source characteristics, met data and receptor co-ordinates & elevation Require atmospheric aerosols (background & emitted) characteristics, like density, particle size Require background pollutant concentration of SO_4, NO_3, NOx, NO_2, O_3, SO_2 and deposition velocities of SO_2, NO_2 and aerosols
MESOPUFF II (Meso scale Puff Model)	It is a Gaussian, Variable trajectory, puff superposition model designed to account for spatial and temporal variations in transport, diffusion, chemical transformation and removal mechanism encountered on regional scale. Plume is modelled as a series of discrete puffs and each puff is transported independently Appropriate for point and area sources in urban areas Regional scale model.	Can model five pollutants simultaneously (SO_2, SO_4, NOx, HNO_3 and NO_3) Require source characteristics Can take 20 point sources or 5 area sources For area source location, effective height, initial puff size, emission is required Computes pollutant concentration at max. 180 discrete receptors and 1600 (40 x 40) girded receptors Require hourly surface data including cloud cover and twice a day upper air data (pressure, temp., height, wind speed, direction)

Noise Environment

Model	Application	Remarks
FHWA (Federal Highway Administration)	Noise Impact due to vehicular movement on highways	
Dhawani	For predictions of impact due to group of noise sources in the industrial complex (multiple sound sources)	Model developed at NEERI, Nagpur
Hemispherical sound wave propagation Air Port: Federal Aviation Administration EPA United States Air Force	For predictive impact due to single noise source For predicting impact of traffic on airport and rail road	

Water Environment

Name	Applications	Remarks
QUAL-II E	Wind effect is insignificant, vertical disperse effects insignificant applicable to streams Data required Deoxygenation coefficients, re-aeration coefficients for carbonaceous, nitrogenous and benthic substances, dissolved oxygen deficit	Steady state or dynamic model
	The model is found excellent to generate water quality parameters Photosynthetic and respiration rate of suspended and attached algae	


Name	Applications	Remarks
	Parameters measured up to 15 components can be simulated in any combination, e.g. ammonia, nitrite, nitrate, phosphorous, carbonaceous BOD, benthic oxygen demand, DO, coli forms, conservative substances and temperature	
DOSAG-3, USEPA : (1-D) RECEIV-II, USEPA	Water quality simulation model for streams & canal A general water quality model	Steady-state
Explore-I, USEPA	A river basin water quality model	Dynamic, simple hydrodynamics
HSPF, USEPA	Hydrologic simulation model	Dynamic, simple hydrodynamics
RECEIVE-II, USEPA	A general dynamic planning model for water quality management	
Stanford watershed model	This model simulates stream flows once historic precipitation data are supplied The major components of the hydrologic cycle are modelled including interception, surface detention, overland flow, inflow, groundwater, evapo-transpiration and routing of channel flows, temperature, TDS, DO, carbonaceous BOD coliforms, algae, zoo plankton, nitrite, nitrate, ammonia, phosphate and conservative substances can be simulated	
Hydrocomp model	Long-term meteorological and wastewater characterisation data is used to simulate stream flows and stream water quality	Time dependant (Dynamic)
Storm water Manag-ement model (SWMM)	Runoff is modelled from overland flow, through surface channels, and through sewer network both combined and separate sewers can be modelled. This model also enables to simulate water quality effects of storm water or combined sewer discharges. This model simulates run-off resulting from individual rainfall events	Time dependant
Battelle Reservoir model	Water body is divided into segments along the direction of the flow and each segment is divided into number of horizontal layers. The model is found to generate excellent simulation of temperature and good prediction of water quality parameters. The model simulates temperature, DO, total and benthic BOD, phyto plankton, zoo plankton, organic and inorganic nitrogen, phosphorous, coli form bacteria, toxic substances and hydrodynamic conditions	Two dimensional multi-segment model
TIDEP (Turbulent diffusion temper-ature model reservoirs)	Horizontal temperature homogeneity Coefficient of vertical turbulent diffusion constant for change of area with depth negligible coefficient of thermal exchange constant Data required Wind speed, air temperature, air humidity, net incoming radiation, surface water temperature, heat exchange coefficients and vertical turbulent diffusion coefficients	Steady state model
BIOLAKE	Model estimates potential fish harvest from a lake	

Name	Applications	Remarks
Estuary models/ estuarial Dynamic model	It simulates tides, currents, and discharges in shallow, vertically mixed estuaries excited by ocean tides, hydrologic influx, and wind action Tides, currents in estuary are simulated	Dynamic model
Dynamic Water Quality model	It simulates the mass transport of either conservative or non-conservative quality constituents utilising information derived from the hydrodynamic model Bay-Delta model is the Program generally used. Up to 10 independent quality parameters of either conservative or non-conservative type plus the BOD-DO coupled relationship can be handled	Dynamic model
HEC-2	To compute water surface profiles for steady, gradually : varying flow in both prismatic & non-prismatic channels	
SMS	Lake circulation, salt water intrusion, surface water profile simulation model	Surface water Modelling system - Hydrodynamic model
RMA2	To compute flow velocities and water surface elevations	Hydrodynamic analysis model
RMA4	Solves advective-diffusion equations to model up to six non-interacting constituents	Constituent transport model
SED2D-WES	Model simulates transport of sediment	Sediment transport model
HIVEL2D	Model supports sub-critical and supercritical flow analysis	A 2-dimensional hydrodynamic model
MIKE-II, DHI	Model supports simulation of flows, water quality, and sediment transport in estuaries, rivers, irrigation systems, channels & other water bodies	Professional Engineering software package

Land Environment

Name	Applications	Remarks
Digital Analysis Techniques	Provides land use / land cover distribution	
Ranking analysis for soil suitability criteria Affected micro-flora /micro-fauna	Provides suitability criteria for developmental / conservation activities	Various parameters viz. Depth, texture, slope, erosion status, geomorphology, flooding hazards, GW potential, land use etc. are used


Biological Environment

Name	Relevance		
Flora			**Remarks**
Sample plot methods	Density and relative density Density and relative dominance	Average number of individuals species per unit area Relative degree to which a species predominates a community by its sheer numbers, size, bulk or bio-mass	The quadrant sampling technique is applicable in all types of plant communities and for the study of submerged, sessile (attached at the base) or sedentary plants
	Frequency and relative frequency importance value	Plant dispersion over an area or within a community	Commonly accepted plot sizes : 0.1 m2 - mosses, lichens & other mat like plants
		Average of relative density, relative dominance and relative frequency	1 m2 - herbaceous vegetation including grasses
			10-20m2 - for shrubs and saplings up to 3m tall, and
			100 m2 - for tree communities
Transects & line intercepts methods	Cover	Ratio of total amount of line intercepted by each species and total length of the line intercept given its cover	This methods allows for rapid assessment of vegetation transition zones, and requires minimum time or equipment to establish
	Relative dominance	It is the ratio of total individuals of a species and total individuals of all species	Two or more vegetation strata can be sampled simultaneously
Plot less sampling methods	Mean point plant Mean area per plant	Mean point-plant distance Mean area per plant	Vegetation measurements are determined from points rather than being determined in an area with boundaries
	Density and relative density		Method is used in grass-land and open shrub and tree communities

Name	Relevance		
	Dominance and relative dominance		It allows more rapid and extensive sampling than the plot method
	Importance value		Point - quarter method is commonly used in woods and forests
Fauna			
Species list methods	Animal species list	List of animal communities observed directly	Animal species lists present common and scientific names of the species involved so that the faunal resources of the area are catalogued
Direct Contact methods	Animal species list	List of animal communities observed directly	This method involves collection, study and release of animals
Countindices methods (Roadside and aerial count methods)	Drive counts Temporal counts	Observation of animals by driving them past trained observers	Count indices provide estimates of animal populations and are obtained from signs, calls or trailside counts or roadside counts
	Call counts	Count of all animals passing a fixed point during some stated interval of time	These estimates, though they do not provide absolute population numbers, provide an index of the various species in an area
			Such indices allow comparisons through the seasons or between sites or habitats
Removal methods	Population size	Number of species captured	Removal methods are used to obtain population estimates of small mammals, such as, rodents through baited snap traps


Name	Relevance		
Mark recapture methods	Population size estimate (M)	Number of species originally marked (T), number of marked animals recaptured (t) and total number of animals captured during census (n) N= nT/t	It involves capturing a portion of the population and at some later date sampling the ratio of marked to total animals caught in the population

Socio-economic Environment

Relevance		
Name	**Application**	**Remarks**
Extrapolative Methods	A prediction is made that is consistent with past and present socio-economic data, e.g. a prediction based on the linear extrapolation of current trends	
Intuitive Forecasting (Delphi techniques)	Delphi technique is used to determine environmental priorities and also to make intuitive predictions through the process of achieving group consensus	Conjecture Brainstorming Heuristic programming Delphi consensus
Trend extrapolation and correlation	Predictions may be obtained by extrapolating present trends Not an accurate method of making socio-economic forecasts, because a time series cannot be interpreted or extrapolated very far into the future without some knowledge of the underlying physical, biological, and social factors	Trends breakthrough precursor events correlation and regression
Metaphors and analogies	The experience gained elsewhere is used to predict the socio-economic impacts	Growth historical simulation common-sense forecasts
Scenarios	Scenarios are common-sense forecasts of data. Each scenario is logically constructed on model of a potential future for which the degrees of confidence as to progression and outcome remain undefined	Common-sense
Dynamic modelling (Input-output model)	Model predicts net economic gain to the society after considering all inputs required for conversion of raw materials along with cost of finished product	
Normative Methods	Desired socio-economic goals are specified and an attempt is made to project the social environment backward in time to the present to examine whether existing or planned resources and environmental programmes are adequate to meet the goals	Morphological analysis technology scanning contextual mapping - functional array - graphic models Mission networks and functional arrays decision trees & relevance trees matrix methods scenarios

Annexure VII

Annexure VII: Review of Guidelines/ Manuals on Environmental analysis

In order to have an understanding of the desired components in the Toolkit on Environmental Analysis; manuals/ guidelines/ Toolkits on SEA and EIA were reviewed. A discussion is as follows.

1. Environmental Impact Assessment Guidance Manual for Highways by MoEF (GoI)

The EIA Guidance Manual for Highways was formulated as part of the Program launched by MoEF for development of sector specific EIA guidance manuals. This guidance manual aims at helping the project proponent and consultant in the preparation of EIA report for Highway projects, as per the requirement of the EIA notification 2006. It is also aimed at helping the regulatory authority while reviewing the report and the public to be aware of the related environmental issues.

This EIA guidance manual consists of twelve chapters, corresponding to the generic structure as per the EIA Notification. The components of manual are discussed in Table 7.

Components of EIA Guidance Manual for Highways

Conceptual & Procedural Guidelines	• ***Introduction*** This section gives the general information on highway projects, environmental clearance process, and identification of the project proponent, preparation of ToR, etc. • ***Project Description*** This section gives a detailed outline for points to be discussed in the chapter on Project description in the EIA report, such as, the type of project, need for the project, project location, highway alignment, utilities, implementation schedule and the estimated cost of the project. • ***Project Benefits*** This section highlights the aspects for which details of benefits have to be discussed. For example, improvement in the physical infrastructure, social infrastructure, employment potential and other tangible benefits. • ***Disclosure of Consultants Engaged***
Technical Guidelines	• ***Description of Environment*** This section gives an understanding of the baseline data to be collected in the project area and study area. • ***Anticipated Environmental Impact and Mitigation Measures*** The method of assessment of impact including studies carried out, modelling techniques adopted to assess the impact where pertinent have been discussed in this section. It also gives some generic impacts on the baseline parameters, both during the construction and operational phases and mitigation measures to be implemented by the proponent. • ***Environmental Monitoring Program*** • ***Additional Studies*** This section covers the details of the additional studies, if any, required in addition to those specified in the TOR and which are necessary to cater to more specific issues applicable to the particular project.


Technical Guidelines	• ***Environmental Cost Benefit Analysis*** This section outlines the methodology for Environmental Cost Benefit Analysis of the project, if recommended by the Expert Appraisal Committee at the scoping stage. • ***Environmental Management Plan*** This section gives guidelines on preparation of Environmental Management Plan (EMP), which include the administrative and technical setup, summary matrix of EMP, the costs involved to implement the EMP, both during the construction and operational Phases.

2. Environmental Assessment Guidelines of Asian Development Bank (ADB)

The ADB's Environment Policy mandates the consideration of environment in all aspects of ADB's operations. These guidelines were designed for use by ADB staff and its Borrowers to provide guidance on how to fulfil ADB's environmental assessment requirements. These guidelines were also prepared to guide consultants who need to know ADB's policies and procedures in preparation of an initial environmental examination (IEE) or an EIA report for a project under consideration. Guidance is also provided on more strategic tools such SEA. The components of Guidelines are discussed in Table 8.

Components of Environmental Assessment Guidelines of ADB

Conceptual & Procedural Guidelines	• *Overview of Environmental Assessment Requirements and Procedures* This section outlines the concepts of environmental analysis, rationale for conducting such an exercise, country specific environmental assessment requirement. • *Background on Nature of Environmental Impacts* • *Process of Public Consultation and Information Disclosure, Including Best Practices* • *Managing and Administering an Environmental Assessment Study* - Key Players in Environmental Assessment - Work Plan and Budget - Environmental Assessment Personnel • *Social Dimensions and Environmental Assessment* • *Cultural Heritage and Environmental Assessment* • *The Practice of Strategic Environmental Assessment* • *Guidelines on procedures for* Rapid Environmental Assessment (REA) Checklists, Content and Format for EIA, Environmental Assessment of Policy Matrix, Environmental Assessment and Review Procedures, etc.
Technical Guidelines	• *Contents for Country Specific Environmental Analysis* • *Determination of the Environment Category and Basic Environmental Assessment Requirements* • *Preparation of Environmental Management Plan (EMP)* • *Environmental Standards and Emission Levels* • *Economic Analysis in Environmental Assessment* • *Environmental Auditing*

3. A Practical Guide to the Strategic Environmental Assessment Directive, UK

This Practical Guide was prepared by the Office of the Deputy Prime Minister (ODPM), Government of UK and provides information and guidance on how to comply with the European Directive 2001/42/EC "on the assessment of the effects of certain plans and programmes on the environment", known as the Strategic Environmental Assessment or SEA Directive. The Guide is an adaptation of the Directive to UK and is intended to apply to all plans and programmes in the UK which fall within the scope of the Directive. The components of the Practical Guide are discussed in Table 9.

The Target audience of the Practical Guide include (ODPM, 2005):

- The public authorities/ agencies producing plans and programmes subject to SEA;
- The Advisory Bodies or Authorities with environmental responsibilities which are to be consulted under the Directive;
- Other government bodies, including those with roles in perspective planning or policy formulation;
- Consultants and advisers involved in undertaking SEA; and
- All those who may be affected by or have an interest in plans or programmes, public agencies, local governments, non-government organisations, businesses and developers.

Components of the Practical Guide on SEA, UK

Conceptual & Procedural Guidelines	• ***Background and Context*** This section gives a background on the objectives and requirements of SEA and the kind of project which qualify for its application. The section also discusses the regulatory context for carrying out a SEA exercise. • ***SEA and Consultation*** This section highlights the importance of consultations in the SEA process and outlines the procedure for carrying out consultations with responsible authorities and public. • ***SEA and Sustainable Development***
Technical Guidelines	• ***Stages of SEA*** This section gives step-by-step technical guidelines to carry out a SEA exercise: - Stage A: Setting the context and objectives, establishing the baseline and deciding on the scope - Stage B: Developing and refining alternatives and assessing effects - Stage C: Preparing the Environmental Report - Stage D: Consultation and decision-making - Stage E: Monitoring implementation of the plan or Program

4. Observations from the review of Guidelines/ Manuals on Environmental analysis

The review of the guidelines/ manuals was done with an objective of understanding the components of a Toolkit on SEA/ EIA. As may be observed, the guidelines were broadly divided into 2 sections:

1. Chapters explaining different concepts like SEA/ EIA, their regulatory framework & required process for conducting the study.


2. Chapters giving technical guidance on how to carry out the study, prepare the assessment report and to conduct any additional studies if required.

Table 10 gives an overview of the lessons learnt from the literature review. These findings have been taken into consideration while preparing the Toolkit on Environmental Analysis.

Findings of review of manuals/ guidelines/ Toolkits

Aspect	Findings
Components of Toolkit	**1. Conceptual & Procedural guidelines** – Explanation of concepts – Discussion on regulatory and policy context – Objectives and requirement of environmental analysis – Discussion on the required procedures for SEA/ EIA e.g. public participation, screening of projects, preparation of ToR, etc. **2. Technical Guidelines** – How to carry out SEA/ EIA? For example, establishing baseline, impact assessment, developing alternative scenarios, etc. – Guidelines for preparing the report – Guidelines for preparing EMAPs (in case of EIA) or Monitoring Plans (in case of SEA) – Guidelines for any other additional studies that may be required.

Annexure VIII

Annexure VIII: Process for Public Consultation

EIA Notification 2006 (as amended in 2009) makes public consultation a mandatory requirement for all category A and category B1 projects. However, in some cases exceptions may be made, subject to the decision of the EAC/ SEAC during the approval of ToR. Public consultation is conducted by the concerned State Pollution Control Boards (SPCBs) or the Union Territory Pollution Control Committee (UTPCC) in association with the concerned District Administration in order to address the concerns of the local communities who are likely to get affected by the developmental activities. In case of urban transport projects, until the time they are not included in the Schedule of the Notification, the process of Public Consultation may be carried out by the public agency convening the project.

As per the provisions of the notification, a prior notice for 'environmental public hearing' of development projects is to be issued by the SPCB/ UTPCC to inform the stakeholders about the Public Consultation. This should necessarily be published in a minimum of two newspapers with atleast one in vernacular language of the concerned community and should be displayed on the website of the SPCB, UTPCC. Apart from this other media like local cable channels, FM radio, etc may also be utilized.

Typically, project affected local community including representatives of residents' welfare associations, local associations of shopkeepers, local NGOs, etc. should also be invited apart from the experts in the field, and managers & policy makers.

The project proponent or the consultant must present their suggested approach, techniques to be used and limitations/ assumptions of the study in the Public consultation at the scoping stage before sending it to the EAC/ SEAC for approval. Once the draft study report has been prepared, the second stage of Public Consultation should be carried out and the outcomes of the study are to be presented to appraise the stakeholders of the potential impacts and proposed environmental management plan.

All the suggestions or comments or concerns brought out during the public consultation process are required to be addressed by the proponent and necessary changes are to be made in the report before finally sending it for appraisal to the EAC/ SEAC. The proceedings of the Public Consultation exercises are to be included as an addendum to the final study report.

Glossary

Alternative fuels: Alternative fuels are any materials or substances that can be used as fuels, other than conventional fuels (e.g. gasoline and diesel). Alternative fuels are also referred to as non-conventional or advanced fuels. These include biodiesel, bio alcohol (methanol, ethanol, butanol), chemically stored electricity (batteries and fuel cells), hydrogen, non-fossil methane, non-fossil natural gas, vegetable oil, and other biomass sources.

Baseline: Existing conditions before development against which subsequent changes can be referred.

Biological Oxygen Demand (BOD): It is a measure of the amount of oxygen that bacteria will consume while decomposing organic matter under aerobic conditions[1]. The BOD value is most commonly expressed in milligrams of oxygen consumed per liter of sample.

Bus Rapid Transit System (BRTS): Bus Rapid transit (BRT) system is a bus-based mass transit system with exclusive Right of Way for buses, pedestrians and cyclists. The system is designed to provide a high quality of service equivalent to a light rail transit (LRT) service at one third cost of a LRT project. BRT is fast, efficient, safe, and user-friendly in comparison to the traditional bus systems. Some of the key features[2] of a BRT system are:

- Exclusive right-of-way lanes
- Rapid boarding and alighting
- Free transfers between lines
- Pre-board fare collection and fare verification
- Enclosed stations that are safe and comfortable
- Clear route maps, signage, and real-time information displays
- Automatic vehicle location technology to manage vehicle movements
- Modal integration at stations and terminals
- Clean vehicle technologies
- Excellence in marketing and customer service

1 http://www.gaepd.org/Files_PDF/techguide/wpb/devwtrplan_b.pdf
2 http://www.itdp.org/documents/brtplanningguidedec04.pdf

Chemical Oxygen Demand (COD): Chemical oxygen demand (COD) does not differentiate between biologically available and inert organic matter and it is a measure of the total quantity of oxygen required to oxidize all organic material into carbon dioxide and water. COD values are always greater than BOD values, but COD measurements can be made in a few hours while BOD measurements take five days[3].

Comprehensive mobility plan (CMP): City level transport plans prepared for medium sized cities in India for development of urban transport infrastructure**.**

Congestion pricing: It refers to variable tolls, with higher prices under congested conditions and lower prices under less congested conditions, intended to reduce peak-period traffic volumes to optimal levels.

Criteria pollutants: These are commonly found air pollutants, which are generally monitored to assess the ambient air quality. Criteria pollutants identified for regular monitoring across all location in India by the Central Pollution Control Board include Sulphur dioxide, oxides of Nitrogen, Suspended particulate matter and Respirable suspended particulate matter.

EMP/EMAP: An Environmental Management Plan/ Action Plan that suggests remedial measures to mitigate and monitor the environmental impacts arising out of a development activity. It is a statutory requirement as part of the EIA study report as the EIA Notification under the EPA, 1986 of India.

Environmental Cost Benefit Analysis: It is a technique that compares the monetary value of environmental benefits with the monetary value of environmental costs in order to evaluate and prioritize issues[4].

Environmental sustainability: A state in which the demands placed on the environment can be met without reducing its capacity to allow all people to live well, now and in the future. It is a state when the rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued indefinitely[5].

Greenhouse gases (GHG): Gases that trap heat in the atmosphere and have a global warming potential are referred to as the greenhouse gases. These include Carbon dioxide, Methane, Nitrous oxide and Fluorinated gases[6].

Information and Communication Technologies (ICT): ICT refers to technologies that provide access to information through telecommunications. It is similar to Information Technology (IT), but focuses primarily on communication technologies. This includes the Internet, wireless networks, cell phones, and other communication mediums[7].

Integrated multi modal transit systems: An integrated multi-modal transit system integrates and interlinks more than one mode of transport in a manner that provides multiple modal choices to the commuter, taking care of first and last mile connectivity.

Intermediate Para Transit (IPT): An IPT system is a form of informal transport system in urban/ peri-urban areas that comes in between the formal public transport system and private/ personal transport. It is a more personalized kind of system that carries fewer passengers and is highly flexible in routing and operations.

3 http://www.gaepd.org/Files_PDF/techguide/wpb/devwtrplan_b.pdf
4 http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/0,,contentMDK:21324891~isCURL:Y~pagePK:148956~piPK:216618~theSitePK:244381,00.html
5 http://www.thwink.org/sustain/glossary/EnvironmentalSustainability.htm
6 http://www.epa.gov/climatechange/ghgemissions/gases.html
7 http://www.techterms.com/definition/ict


However, the owners/ operators are supposed to observe the traffic rules, vehicular regulations and are accountable to the public and government for inconveniences, accidents, etc.

Light Rail Transit (LRT): Light Rail Transit (LRT) is made up of modern, electricity-powered Light Rail Vehicles (LRV) that carry passengers in dedicated lanes, separated from motor vehicle traffic[8].

Mass Rapid Transit System (MRTS): It is generally a rail based a passenger transport system with a high capacity, high frequency and is grade separated from the other traffic.

Mitigation strategies: Measures to minimize or reduce the severity of environmental impacts arising out of any urban transport plan, program or project.

Mono rail systems: Monorail is a transportation system that is supported and stabilized along a single rail.

Non Motorized Transport (NMT): Also known as Active Transportation and Human Powered Transportation, it includes Walking and Bicycling, and variants such as Small-Wheeled Transport (skates, skateboards, push scooters and hand carts) and Wheelchair travel[9].

Public hearing: The process of statutory public consultation as per the EIA Notification, 2006 to receive objections/ suggestions from the project affected people (PAP) and other experts and stakeholders.

Renewable sources: Renewable sources are the natural sources of energy which can replenish over a period of time either through biological or other naturally recurring processes. These include sun, wind, etc.

Screening: The first step of the environmental assessment exercise that determines if a plan, program or project qualifies for a detailed SEA or EIA.

Sensitivity analysis: Sensitivity analysis is a technique used to determine how different values of an independent variable will impact a particular dependent variable under a given set of assumptions. By creating a given set of scenarios, the analyst can determine how changes in one variable(s) will impact the target variable[10].

Social Impact Assessment: Social impact assessment can be defined as the process of assessing or estimating, in advance, the social consequences that are likely to follow from specific policy actions or project development, particularly in the context of appropriate national, state, or provincial environmental policy legislation[11]. For more details, refer Toolkit on Social Impact Assessment and R&R Plans.

Spatial scale: A scale used for measurement in terms of space.

Sustainable mobility: It is defined as the near universal access to reliable and low carbon mobility, infrastructure and information[12].

Synergistic effects: An induced effect arising due to two or more agents, entities, factors, or substances that produces an effect greater than the sum of their individual effects[13].

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8 http://www.torontoenvironment.org/campaigns/transit/LRTfaq#whatislrt

9 http://www.vtpi.org/tdm/tdm25.htm

10 http://www.investopedia.com/terms/s/sensitivityanalysis.asp

11 http://www.hardystevenson.com/Articles/SOCIAL%20IMPACT%20ASSESSMENT%20A%20CONTRIBUTION%20TO%20THE%20STATE%20OF%20THE%20ART%20SERIES.pdf

12 http://www.wbcsd.org/work-program/sector-projects/mobility.aspx

13 http://www.businessdictionary.com/definition/synergistic-effect.html#ixzz2Qw86q4fR

Life cycle costs: Both the direct and indirect costs of the environmental impacts caused by the product in its entire life cycle.

Temporal scale: A scale used for measurement in terms of time.

Trans-boundary effects: It refers to the environmental impacts occurring at a macro or regional scale across jurisdictions as a result of an activity occurring within the one jurisdiction. However, it explicitly excludes impacts of global nature.

Transportation demand management: Transportation Demand Management (TDM), also called Travel Demand Management, aims to maximize the efficiency of the urban transport systems by discouraging unnecessary private vehicle use and promoting more effective, healthy and environment friendly modes of transport, i.e. public transport and non-motorized transport[14].

Virtual commuting: It is a concept in which people commute to places virtually by the use of technology. It does not include actual travel and allows to access things which are even at any large distances physically. For example, employees using internet to work from home, video conferencing enables people to attend conferences actually taking place at distant places, etc. Virtual commuting can be very helpful in reducing the need to travel.

14 Transportation Demand management (Training document), April 2009; Prepared by GTZ

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Toolkit on 'Environmental Analysis: Strategic Environmental Assessment and Environmental Impact Assessment'

The toolkit aims at providing guidance to the concerned city officials and consultants for conducting Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) of urban transport plans, programs and projects so as to ensure integration of environmental concerns in the process of planning, implementing and managing urban transport infrastructure and services. The toolkit will help build the capacity of city-level officials to conduct environmental assessment and appropriately choose and implement environment-friendly options for the city's transport system. The city officials would also get equipped to evaluate and monitor the work carried out by hired consultants effectively.