Part I

The Environmental Assessment Process
1. Assessing the environmental impact of road projects

HOW TO USE THIS CHAPTER IN THE CONTEXT OF EA AND ROAD PLANNING

<table>
<thead>
<tr>
<th>Stage in road planning</th>
<th>EA activity</th>
<th>Involvement in addition to EA team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-feasibility</td>
<td>Screening</td>
<td>Proponent</td>
</tr>
<tr>
<td></td>
<td>Scoping</td>
<td>Key regulatory</td>
</tr>
<tr>
<td></td>
<td>Consultation</td>
<td>Other government agencies</td>
</tr>
<tr>
<td>Feasibility</td>
<td>Determining baseline conditions</td>
<td>NGOs</td>
</tr>
<tr>
<td></td>
<td>Selection of preferred solution</td>
<td>Research groups</td>
</tr>
<tr>
<td>Engineering design</td>
<td>Assessment of alternative designs/methods</td>
<td>Public/community organizations</td>
</tr>
<tr>
<td>Construction</td>
<td>Development of environmental management plan</td>
<td>Advisory experts</td>
</tr>
<tr>
<td>Operation &amp; maintenance</td>
<td>Effects and compliance monitoring</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reporting</td>
<td></td>
</tr>
</tbody>
</table>

Shaded area = (A) Stages of EA covered in this chapter; (B) focus of this chapter; and (C) primary target readers.

KEY QUESTIONS ADDRESSED:

? What is environmental assessment?

? What role does EA play in the planning of a road project?

? Why should road managers and planners examine road-environment issues at both project and program levels?

? What is the difference between project-specific and strategic environmental assessment?

? How are biophysical, social, and economic impacts linked, and why is it important to consider them together?

? What factors determine the amounts of time and money allotted to environmental assessments?
1.1 THE ENVIRONMENT AND ITS ECOSYSTEMS

The word “environment” refers to our surroundings—the context within which we exist. All things, living or non-living, exist surrounded by other things, and therefore all have an environment. For humankind, the environment means, on a broad scale, the biosphere.

The biosphere is that portion of the earth-atmosphere system which supports life, and is characterized by its existence. It includes the oceans, the continental landmasses, and the lower atmosphere. The basic structural unit of the biosphere is the ecosystem. Each ecosystem occupies a space in which homogeneous conditions prevail, regardless of scale. Area can be defined in terms of a few hundred square meters or thousands of square kilometers, and depth can vary from a few centimeters (desert soil) or dozens of meters (tropical rain forest) to kilometers (oceans).

The components of the environment are inextricably linked—no component exists in total isolation, and nothing can be changed without affecting something else. Consequently, the environment cannot be assessed simply by examining its components in isolation; instead, they must be considered as parts of the whole. This concept is crucial in understanding the role which humans play in affecting their environment.

People are an integral part of the environment, and are active participants in many ecosystems. Indeed, every aspect of human interaction, be it social, economic, or physical, can be considered to affect the ecosystems of which we are a part. In other words, we affect the functioning of our environment through our daily actions. As we change the nature or intensity of our activities, the natural equilibrium of our environment must shift to accommodate these changes. Likewise, as systems change around us, and in response to us, we must accommodate them. Our actions have consequences not only for our immediate environment, but for us as well; anything we do to degrade our environment will generally affect our well-being later on.

A key characteristic of the environment is its compromise between evolution and balance. This dynamic equilibrium is a reflection of the interactions between and within ecosystems. As disturbances arise, a system is thrown off temporarily. It then begins the process of establishing a new balance, which may or may not be the same as before. The amount of time required to re-establish a dynamic equilibrium may range from minutes to tens of thousands of years, depending on the scale of the disruption and the relative fragility of the ecosystem.

Road construction and traffic operations, if undertaken without a proper understanding of the relationships inherent in environmental function, can be accompanied by serious disruptions to the environment, from which it may take a long time to regain equilibrium. In human terms, this may mean that generations must function in a debilitated environment and suffer many possible associated socio-economic hardships and financial losses.

1.2 ROADS, THE ENVIRONMENT, AND THE NEED FOR ENVIRONMENTAL ASSESSMENT

There is a growing awareness that road development has major environmental impacts. Some of the major environmental impacts of road projects include damage to sensitive ecosystems, loss of productive agricultural lands, resettlement of large numbers of people, permanent disruption of local economic activities, demographic change, accelerated urbanization, and introduction of disease.

Since environmental impacts from road development are quite common, such projects usually call for comprehensive environmental assessment studies, carried out by EA professionals (both specialists and generalists) who support the main engineering team. Substantial time and effort is often required to identify potential impacts and options for minimizing them (Sections 3.1 and 3.2), to consult with various groups who have an interest in the project (Chapter 5), and to develop and implement mitigation plans (Sections 4.5 and 4.6). In addition, contract clauses (see Section 18.3) covering work procedures and staff training need to be prepared, and work processes in

---

1 Here and throughout this handbook, the term environment shall be assumed to encompass both bio-physical and socio-economic components, unless specified otherwise.

2 Based on the 1995 World Bank survey of large development projects funded by the Bank.
relation to roadside communities, flora, and fauna given considerable attention.

In order to conduct EAs successfully, road agency staff need to understand the assessment process and must coordinate it with road planning, design, and construction activities, allowing sufficient lead time and funds for the necessary additional steps (see Chapters 3 and 4).

It is essential that road agency staff be able to
- recognize potential environmental concerns;
- know when to call in specialist experts;
- know how to specify and manage their work; and
- know how to implement mitigation plans and environmental contract clauses.

New skills may have to be developed to meet the demands of the EA process. This is especially true in the area of consultation with affected residents, interested members of the public, government departments, and other organizations (known collectively as the stakeholders). While road agencies are generally quite responsive to the concerns of these stakeholders on engineering issues, the dialogue on environmental matters often needs to be expanded to include a broader range of topics. Agency staff involved in the consultation process must be equipped to address varying institutional and cultural needs and differences (see Chapters 2, 13 and 14).

Projects limited to road rehabilitation, maintenance, minor construction, as well as to traffic management and regulation, generally involve lesser environmental concerns. These situations do not call for full-scale EAs (see Section 3.5), but do require impact identification, mitigation, and a certain amount of compliance monitoring and documentation.

1.3 NEW, EXISTING, RURAL, AND URBAN PROJECT SETTINGS

In relation to the impacts they generate, road projects are commonly placed into one of five categories:

i) new;

ii) existing (rehabilitation/upgrade);

iii) rural;

iv) urban; and

v) mixed.

1.3.1 New versus existing project types

When planning and executing EAs for new road and road rehabilitation projects, proponents need to be aware that the impacts associated with these two project types are significantly different. Box 1.1 presents these differences in terms of a set of generalized EA steps, defined according to the two project types. The key difference is that, for new projects, the focus is on preventing impacts, whereas for existing or upgrade projects, the focus is on rehabilitating and mitigating further impacts.

1.3.2 Rural versus urban project types

It is also important to distinguish between projects proposed for mainly rural settings versus those planned for predominantly urbanized areas. Road developments in these two environments present significantly different problems.

In the rural setting, the key impacts usually revolve around removal of productive agricultural lands and the opening up of previously inaccessible, or marginally accessible, territory to in-migration and large-scale resource harvesting. Introduction of new sources of noise is often an issue in rural settings where ambient noise levels are typically low. Furthermore, because rural life is so closely integrated with the biophysical aspects of the environment, issues such as water quality and biodiversity conservation deserve special consideration.

In the urban setting, where population densities are higher and the connection to the biophysical environment is less significant, the dominant impacts have to do with displacement of people and their homes, general neighborhood disruption, local airshed contamination, and noise. In those urban areas where the mode of travel is dominated by the non-motorized vehicle, access and movement restrictions become major factors to consider when planning facilities for motorized vehicles.

3 This is not road planning terminology, but is included here to help identify the likely general magnitude of impacts.
Consultation is important for both urban and rural locations. It enables road project proponents to identify potential impacts as well as local sources of information and knowledge, to highlight community concerns about the effects of road changes on lifestyles and welfare, and to encourage participation in the development of workable solutions (see Sections 4.2.3 and 4.4.2).

Although the methods discussed here may be applicable to urban projects as well, the major focus of this handbook is on rural and inter-urban road projects. The more complex urban issues deserve a separate volume and will not be dealt with extensively here.

1.3.3 The “mixed” rural-urban project

In reality, most rural projects are actually a mixture of rural and urban sections, since rural roads do not simply stop in the countryside but traverse, or end in, urban areas. If the urban areas at the ends of the road, as well as any urban areas traversed by the road, are in fact an integral part of the project, they should be included in any EA. For various practical reasons, however, urban areas are often excluded from projects. This applies particularly to the terminus. Later, they may find that those traffic problems which result from a larger capacity road feeding into a lower capacity urban arterial (congestion, safety, restricted access, etc.) are forcing remedial actions that are far costlier than early preventive measures would have been, provided they had been based on a thorough examination of these urban nodes. There are many cases where it is desirable to include all urban sections in a road project through which a road passes and in which it ends.

1.4 THE ENVIRONMENTAL ASSESSMENT (EA)

In this handbook, a full environmental assessment (which normally yields an environmental impact statement or “EIS”) consists of a rigorous study that involves a thorough documentation of existing conditions, an identification of impacts, and a comparative examination of impacts arising from the road project alternatives. A growing number of development planners and managers now recognize that EA is an ex-
cellent preventive planning tool, provided that it is implemented early in the project development sequence (Figure 1.1).

EAs generally have three objectives:

i) to present to managers and decision-makers a clear assessment of potential impacts which a project (or a strategic level initiative) may have on overall environmental quality;

ii) to apply to a project (or a strategic level initiative) a methodology which assesses and predicts impacts and provides a) the means for impact prevention and mitigation, b) the enhancement of project benefits, and c) the minimization of long-term impacts; and

iii) to provide a specific forum in which consultation is systematically undertaken in a manner that allows stakeholders to have direct input to the environmental management process.

Three of the most important steps in EA are screening, scoping, and analysis of alternatives. The screening stage provides a preliminary evaluation of the magnitude of potential impacts and determines whether further study—such as a full EA—is needed. The scoping stage should indicate clear spatial and temporal boundaries for the EA. The analysis of alternatives should yield a well-informed decision on the transport solution (see Section 3.2.4) and the optimal project design, based on consultation with stakeholders and experts, as well as a careful technical examination of each alternative (see Chapter 4).

These three steps must integrate biophysical, social, and economic considerations in order to set the stage for an EA which weaves together actual cause-and-effect interactions between the natural and the social environment, thus leading to a more holistic outcome. Unfortunately, this is not always the case, since regulations and practitioners offer conflicting messages on how EAs should be approached (see Box 1.2).

1.4.1 EA and road project development

From an engineering or planning perspective, project development generally follows a well-defined process which includes pre-feasibility and feasibility studies, preliminary design, detailed design, and construction. This is followed by operation and maintenance of the completed project. Depending on the nature of the project, consultation with various government agencies, the public, or both, may be an essential component during several of the early stages of the process. It is important to synchronize environmental studies with the project development process. Ideally, the EA and project development processes should be conducted in tandem. The EA document should be completed by the feasibility stage of the engineering work, and the implementation of the mitigation plan should be tied.

---

Note: The diagram in Figure 1.1 illustrates the synchronization of the EA and project development processes. It shows the environmental assessment period, the implementation of EA specifications, and the environmental assessment processes. This diagram is presented here to illustrate that project development is not really cyclical, but rather a well-defined beginning and end. New projects enter the process at the concept stage and leave after effects and monitoring have been completed.
BOX 1.2
ENVIRONMENTAL VERSUS SOCIAL ASSESSMENT

EAs continue to suffer from the practice whereby managers and practitioners segregate the biophysical and social environment in actuality, even though regulations and legislation proclaim that the two are integral to one and the same environment. Consequently, the correct legal definitions exist, but they are applied incorrectly. Analysis of EA guidelines for many jurisdictions reveals that while their EA tables of contents include sections on the social components, these social components are treated separately from the EA; sometimes they even appear in a totally separate document under the Social Impact Assessment (SIA) heading. Moreover, terms of reference for EA projects are frequently prepared separately as “environmental TORs” and “social impact TORs.” As long as this dichotomy is maintained, a true ecosystem approach to EA will not be possible.

In closely with the design, construction, and operation phases (Figure 1.1).

Increasingly, environmental assessments are required by national and international law as well as other regulations. An environmental assessment should therefore be considered and provided for from the outset in the budget of all road projects.

1.4.2 Types of EA

There are at least five types of EAs now being undertaken around the world. They can be grouped as follows:

*Traditional project-specific EAs*
  i) project specific EA;
  ii) programmatic EA;
  iii) summary environmental evaluation; and
  iv) regional EA.

*Strategic EAs*
  v) sectoral EA.

While the majority of EAs completed are project-specific, the past few years have seen EAs extended to address sector-level planning, programs, and policies (such as the ones dealing with development and environment in a strategic way). An example of a sectoral EA would be the assessment of the effects resulting from a province-wide road rehabilitation program. The project-specific EA, the regional EA, and the sectoral EA are the focus of this handbook, since they are most pertinent to road projects.

1.5 ENVIRONMENTAL ASSESSMENT AT THE INDIVIDUAL PROJECT LEVEL.

1.5.1 The project-specific environmental assessment (EA)

The project-specific environmental assessment (EA) is the most common form of EA, and there is considerable experience with its execution. Ideally, EAs should focus on identifying potential impacts on the local and immediate environment within the context of a region or sector. However, they are nearly always carried out in isolation, with little regard for what is happening beyond the project site and without considering existing future plans for the region. Clearly, there is room for improvement in this area. As part of the project scoping exercise, measures such as assessing the cumulative impact of multiple activities, and reviewing existing and planned developments in the region, are both desirable and necessary.

Project-specific EA allows road agencies to:

- familiarize themselves with the environmental status of the proposed site and anticipate any environmental impacts that may arise from the road project;
- highlight likely design problems, thus permitting the agency to make early changes and avoid costly delays at a later stage; and
- integrate the project into the existing environment.

1.5.2 The programmatic or class EAs

Another project-level assessment type is variously known as the programmatic,\(^6\) categorical,

---

\(^6\) For an in-depth discussion of these types of EAs and an extensive bibliography, see World Bank, 1996(b).

\(^7\) While the experience base is extensive, practitioners continue to make the same mistakes; lessons learned are rarely recorded and “effects monitoring” is not undertaken. The International EIA Network is now being established. One of its objectives is to build a library of EIA case studies and make it available to all practitioners. Contacts are listed in the section entitled “Other sources of information” at the end of this handbook.

\(^8\) As used by the United States Environmental Protection Agency.
or class-9 EA. Class EAs have been developed for consideration of groups of projects which are similar in type, scope, and scale, and whose impacts are generally well understood. Examples include sewage treatment facilities, road maintenance and rehabilitation projects, and small bridge construction. The class EA steps applied to a project within a given group consist of a prescribed methodology which includes specific criteria, standards, and mitigation options known to be useful for the group or class of similar projects. For a class EA, mitigative measures are selected from a predefined list of measures that are proven to be effective, and then tailored to the specific project. As long as the projects fall within the definition of the class,10 the methodology can be undertaken with little involvement on the part of the regulatory agency (e.g. a Ministry of Environment and Planning). The reason for this is that the guidelines used to specify the EA steps for the class undergo their own full EA and become a methodology sanctioned by the regulators and other stakeholders (through consultation sessions). Class EAs can save considerable time and money but, at the same time, are self-policing, thus placing the onus on the proponent to adhere to the specifications. The document arising from a class EA is often referred to as an Environmental Study Report, as opposed to an EIS.

1.5.3 Summary or initial environmental evaluation (SEE/IEE)

In many cases, a more limited environmental analysis is appropriate. This type of study, referred to either as an SEE or IEE, focuses on specific impacts and their mitigation.11 The results of this type of study can take a variety of forms, but they are sometimes presented as a self-standing mitigation plan or an environmental management plan. The screening, scoping, and consultation tasks are normally used to decide if an SEE or IEE is appropriate for a given project.

1.5.4 The regional EA (REA)

Regional EAs12 are used to assess environmental effects relating to the broad spatial context of a proposed project. The main objective of the REA is to assess the cumulative and other potential effects that all projects (present and future) proposed for a geographic area or administrative region might have on the environment (see Box 1.3 for a definition of "region"). Examples of these areas might include a coastal zone, a forest region, a watershed, a municipality, a county or a province.

---

9 As applied by the Canadian Environmental Protection Agency.
10 The definition of a class includes a description of a set of criteria which qualify a project for inclusion in the class. These criteria generally deal with capacity, volume output, area coverage, or type of activity.
11 While SEEs and IEEs are often the only EA analyses applied, their function is also to determine what additional EA work needs to be done. SEEs and IEEs can be the initial work preceding a more detailed EA.

---

12 See also World Bank, 1996a.
understood regional context, emphasizing the interrelated nature of the environment.

1.6 ENVIRONMENTAL ASSESSMENT AT THE STRATEGIC LEVEL

Strategic EAs are formalized and systematic procedures for establishing environmental impacts, which may arise from broad actions such as new policies, national and regional development plans, or major program initiatives. They help to inject environmental considerations and actions into decision-making, above and beyond the project level.

Goodland and Tillman (1996) identify six types of strategic EAs:

i) Sectoral EAs (SEA);
ii) EAs of programs and policies;
iii) EAs of structural adjustment projects;
iv) EAs of privatization initiatives;
v) EAs of international treaties; and
vi) EAs of national budgets.

1.6.1 The Sectoral EA (SEA)

Of the six strategic EA types, only the SEA is addressed in this handbook. It is the most relevant in the context of road development. The main objective of the SEA is to assess macro-scale development alternatives and, through this process, formulate sound environmentally-based advice on appropriate and sustainable development goals. The SEA highlights the benefits and costs of undertaking sector-wide action by comparing one strategy with another.

In the context of roads, an SEA might address a sector-wide investment in a relatively large geographic area, such as a province or state, integrating environmental concepts and strategies into the transportation planning process. This would require an analysis not only of infrastructure but also of land use (see Box 1.4), road user charges, land development and emissions legislation, as well as other policies that can influence transport choices.

SEAs are also useful in identifying macro-level information gaps that need to be filled if informed and environmentally acceptable decisions about sector-wide development are to be made.

SEAs rank projects within the sector in terms of their environmental strengths (including the biophysical, social, and economic components), and likely assessment, mitigation and monitoring needs. SEAs should rely heavily on consultation with stakeholders to build ownership in any proposed mitigation strategy.

SEAs should have four key outputs:

i) an assessment of policy, legal and administrative conditions in terms of completeness and appropriateness with regard to the sectoral initiatives proposed;
ii) an institutional strengthening plan based on the examination of the capacity of key regulatory agencies’ ability to set guidelines, enforce standards, manage an EA, review EA results, and act as environmental opinion-shapers for senior decision-makers;
iii) an analysis of alternative investment options, as opposed to project designs (alignments); and
iv) recommendations for sector-wide regulatory changes as possible mitigative measures; one example of this would be requiring the use of unleaded gasoline to reduce lead contamination.

In the transportation sector (and not only there), SEA is sometimes applied in situations where a transportation mode is fixed but various road sub-projects need to be assessed. In this situation, the SEA is used to prioritize the sub-projects in terms of impacts, benefits, and EA requirements. This “modified” SEA pro-

---

BOX 1.4
COORDINATION OF TRANSPORT AND LAND USE PLANNING

Land use planning issues are usually considered an element of project planning and included in project environmental assessments. However, only a few countries have developed land use plans and policies for use at national and regional levels, that is to say, outside urban areas. Regional comprehensive land use plans, where they exist, provide an important information base for road environmental studies. Conversely, a road or transport planning issue can sometimes be a catalyst for initiating a comprehensive land use plan for the region concerned.

BOX 1.5
SUGGESTED APPROACH TO SECTORAL EA: WORLD BANK ASIA REGION

Experience in the road sector, particularly in rural areas, has spurred development of informal procedures for sectoral EA in the Bank's Asia region to ensure consideration of all possible impacts on the environment. According to the informal procedures, this form of sectoral EA should contain:

- a screening process designed to identify sub-projects having potentially significant issues that would need to be addressed in a sub-project EA;
- a general assessment of the kinds of impact that might be associated with the different types of rural road sub-projects; and
- a sectoral environmental action plan to eliminate, minimize or mitigate the impacts resulting from sub-projects identified as not requiring full EAs and provide general guidelines for long-term monitoring.

Two categories are used in environmental screening of sub-projects:

i) sub-projects that may create a few minor and easily recognizable environmental problems, but no significant ones; and

ii) sub-projects with potentially adverse impacts on environmentally sensitive areas, defined as zones of significant human habitation; ecologically important areas such as wetlands and primary forests; archeological, historical, and cultural sites; and terrain with slope greater than 50%.

The second category of sub-projects usually requires project-specific EAs, while the first category is addressed primarily through the sectoral EA in the form of general impact assessments, sectoral action plans, and codes of engineering practice for environmentally sustainable road developments. These codes apply to both categories of sub-projects and cover such issues as construction practices, site selection, resettlement and compensation, as well as public consultation or participation.


14 In the World Bank (1996b) review of EAs, completed between 1992 and 1995, it was concluded that EAs accounted for 0.06% to 0.45% of the total project cost (as opposed to project preparation cost). Examples: Bombay STP: $310,000 (0.11%); Yemen Road Project: $250,000 (0.27%).
1.8 REFERENCES AND BIBLIOGRAPHY


