

# ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT

Edited by P. Fouracre, TRL Limited

## Objectives of the paper

### Abstract

In this paper environmental impact assessment (EIA) is taken to mean the systematic examination of the likely environmental consequences of proposed projects. The results of the assessment - which are assembled in a document known as an Environmental Statement - are intended to provide decision-makers with a balanced assessment of the environmental implications of the proposed action and the alternative examined. The ES is then used by decision-makers as a contribution to the information base upon which a decision is made. The overall goal of an EIA is to achieve better developmental interventions through protecting the environment (human, physical and biotic).

EIA is just one component in the environmental planning and management of projects, in that it focuses upon consent stage. Increasingly EIA is being linked to Environmental Management Systems (ISO14001) through the use of Environmental Management Plans or Environmental Action Plans and to environmental auditing to confirm that the project conformed to the ES forecasts and requirements of the International Funding Institution.

### Key issues

- Environmental planning and management are an integral part of project planning, implementation and operation. Thus:
- International funding institutions require at least an environmental appraisal of projects prior to the granting of funds;
- Environmental issues must be addressed at the project identification stage;
- Screening is a key activity to determine whether an EIA, an environmental appraisal or no assessment is required;
- Scoping is the term given to the process of developing and selecting alternatives to the proposed action and identifying the issues to be considered in the EIA it aims to identify opportunities and constraints, determine the level of detail in the assessment; to make the EIA process efficient and to save time and money.
- The environmental impacts of rural transport development are likely to be:
- Direct effects - due to construction and operation (e.g. land take, erosion) and additional traffic (e.g. pollution)
- Indirect effects - due to transport-induced changes (e.g. health, land use, energy consumption)
- Socio-environmental effects - due, for example, to policies which favour a particular mode of transport.

### Key topic areas

- Donor requirements for the environmental screening of projects as part of the project planning process.
- Checklists for impact identification
- Environmental impacts associated with rural transport.

## 1. INTRODUCTION

*'For all the positive aspects of road projects, they may also have significant negative impacts on nearby communities and the natural environment. People and properties may be in the direct path of road works and affected in a major way. ...Disturbances to the natural environment may include soil erosion, changes to streams and underground water, and interference with animal and plant life....New roads may induce development in previously undeveloped areas, sometimes significantly affecting sensitive environments and the lifestyles of indigenous people. Roads are agents of change, and can be responsible for both benefits and damage to the existing balance between people and the environment'* (Tsunokawa and Hoban, 1997).

Environmental Impact Assessment is an integral part of the consent process for major development projects with most International Finance Institutions (IFIs) requiring applicants to submit an ES in support of applications for funds. Most IFIs have developed guidelines on what they expect of an EIA, and recipients are required to comply with these. The various guidelines are broadly similar in their content and advice, and all stress the continuing and contributory nature of environmental impact assessment with other components of project appraisal as part of a comprehensive process of project preparation implementation and operation.

This paper presents an overview of the process of EIA, and its place in the project cycle. Using the DFID guidelines (DFID, 1997) as a model, it identifies the various procedures, outputs and actions of the process. The paper also describes the use of checklists. Finally the paper looks at the types of environmental impact that might be involved in rural transport development. To begin, the paper briefly addresses the nature of donor requirements for EIA.

## 2. INTERNATIONAL FINANCE INSTITUTION REQUIREMENTS

Most of the industrialised nations have established procedures in EIA, to which project developments must conform. This framework is finding increasing application in the developing world, as national governments, spurred on by Earth Summits and evolving local concerns, create fledgling Environmental Protection Agencies and introduce their own environmental standards. This process is being encouraged by all the major multi-lateral and bi-lateral lending agencies, who have prepared guidelines for EIA, and make compliance (at least for the larger projects) with these guidelines a conditionality for lending.

In many instances, recipient nations have adopted the guidelines on EIA and environmental standards used by the principal donors.

## 3. THE ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT PROCESS

The DFID model is used to describe the typical environmental assessment activities. It is broadly similar, in approach, to other donor guidelines, though screening is less prescriptive in the sense that projects are not referenced against pre-published

categories (of size), but against a series of checklists which seek to determine the nature of the proposed development, the sensitivity/importance of the local environment, and the likely environmental effects and their scale.

Various activities are completed during the project cycle, which are identified in the Table. The main activities are described in more detail below.

Stage of Project Cycle	Environmental Appraisal Activity	Output
<b>Project Development</b>		
• Identification	Preliminary review of base documentation	
• Preparation (Project Concept Note)	Screening	Environmental Screening Summary Note (ESSN)
• Design and appraisal	Environmental appraisal/EIA	Design Mitigation Measures
• Approval	Environmental Annex of project Memorandum	Environmental Monitoring Plan (EMP)
<b>Project Implementation</b>		
• Initiation/monitoring	Activate EMP	Monitoring Reports
• Operation/monitoring	Environmental monitoring	Review Reports
• Evaluation	Environmental Evaluation/Audit	Evaluation Reports

### 3.1 The EIA Process

Within EIA there are several tasks that are fundamental to the successful delivery of an EIA. EIA can be thought of as a data management process with three components. First, the appropriate information necessary for a particular decision must be identified and collated. Secondly, changes in environmental parameters resulting from the proposed project must be forecast and compared with the situation without the proposal. Finally, the actual change must be assessed and communicated to the decision makers. Figure 1 provides a schematic representation of this process.

### 3.2 Screening and Scoping

The process of screening usually involves the review of the project proposal against a checklist of projects to determine whether an EIA is a mandatory requirement. Often there is some uncertainty and an environmental assessment specialist may be required to help advise on which of the following is applied:

- Environmental Appraisal - a 'low-level' investigation which focuses on individual issues and environmental inputs to design activities

- Environmental Impact Assessment - a 'high-level' investigation which involves a multi-disciplinary, comprehensive and detailed study of proposed development, and the environment within which it is to be developed.
- Environmental Audit - is similar in scope to an EIA, but it is applied to existing projects rather than new developments.

The Screening Process results in the production of the Environmental Screening Summary Note (ESSN), which should contain the following information:

- Brief project description
- Environmental issues apparent at screening (scope of environmental impacts, risks and/or benefits).
- Significance of environmental impacts, risks and/or benefits and likely mitigation measures required.
- Environmental investigation proposed (Environmental Appraisal, EIA, Environmental Audit, etc.) and/or any other special information required
- Other issues
- Actions to be taken (and by whom)

Allied to the screening process is scoping which commences early in the project cycle, so that it can be influential in project design and provide the platform for continuing dialogue on the environmental constraints and opportunities. The specific objectives of the process are:

- To enhance the environmental benefits of the proposed project or programme.
- To ensure compliance with relevant UK, EC and local legislation, as well as commitment to Multilateral Environmental Agreements, international best practice and DFID's own objectives set out in the White Paper (DFID, 1997).
- To consider the alternatives to the proposal that should be examined;
- To identify any significant adverse environmental effects, and identify action (possibly further studies)
- To provide for public consultation and input to the identification of issues to be examined;
- To define the data assembly needs and field survey activities;
- To determine the predictive techniques and environmental objectives that are to be employed;
- To provide a timetable for undertaking the EIA alongside the project design process.

### **3.3 Impact Identification**

The process of impact identification is based upon an appreciation of how the proposed project might interact with its receiving environment. As such, this requires an appreciation of what are considered to be the valued environmental and community resources within the vicinity of the proposal. A projection is then required of the future state of these resources without the proposed project. From this a series of environmental design objectives can be established to aid both the EIA and project design process.

---

The manner in which the proposal interacts with the future environmental setting must be examined in terms of its construction, operational and decommissioning phase taking into account of any important maintenance activities. A wealth of checklists and guidance documentation exists on the broad effect that different types of project may cause. Such aids are no more than this and there is no substitute for an expert understanding of the potential interactions between the project and its environment. The public should be involved in this process.

### **3.4 Impact Prediction**

Once potential impacts are identified, the project design should be examined to attempt to minimise those which are adverse and maximise those that are beneficial. Once optimised, the process continues with the forecasting of the effects in the following terms:

- Magnitude;
- The affected feature/resource/population;
- Action causing the effect;
- Timescale and duration of the effect;
- Level of uncertainty in the forecast;
- Proposed mitigation/enhancement measures
- Significance.

The effects must be recorded in terms of whether they are short term, long term, direct, indirect, synergistic, cumulative, increase or reduce with time. This is generally undertaken with the use of expert opinion and is to be presented in a transparent way stating all the assumptions employed.

### **3.5 Mitigation and Enhancement**

Environmental mitigation can often result in reduced project costs and lower community costs when incorporated as a fundamental part of project design rather than as an add-on exercise. Often simple design changes such as the type of bridging strategy or the time of year that major earth moving activities take place can have a dramatic effect upon improving environmental performance. The mitigation and enhancement measures identified should be capable of being delivered in a cost effective manner and be fully justified. Mitigation measures that have not been thought through generally don't happen.

### **3.6 Reporting**

The purpose of the exercise is to improve the project design prior to its submission for consent and then to report the findings to the decision makers and the affected public in a manner that they can understand. An EIS is not a long academic thesis on the effects of a proposal, but is to be focused upon the key issues that the decision maker should appreciate.

While guidance exists on the content of Environmental Statement from the various IFIs, as a minimum, the EIS should report the following:

- Environmental objectives and policy context;

- 
- Existing environmental situation
  - Future do minimum situation
  - A description of the project
  - An assessment of the effects of the project
  - An environmental action plan or management plan
  - A summary of the effects and recommendations

A summary of the EIS is often required for communication with the general public.

### **3.7 Environmental Management Plan (EMP)**

As well as providing an input to design and appraisal, environmental issues are incorporated into the implementation phase of the project cycle. An Environmental Management Plan (EMP) should be prepared, which sets out the actions for monitoring and evaluation of the project during implementation or construction and operation. This should form a fundamental part of the project specifications. Its content will include:

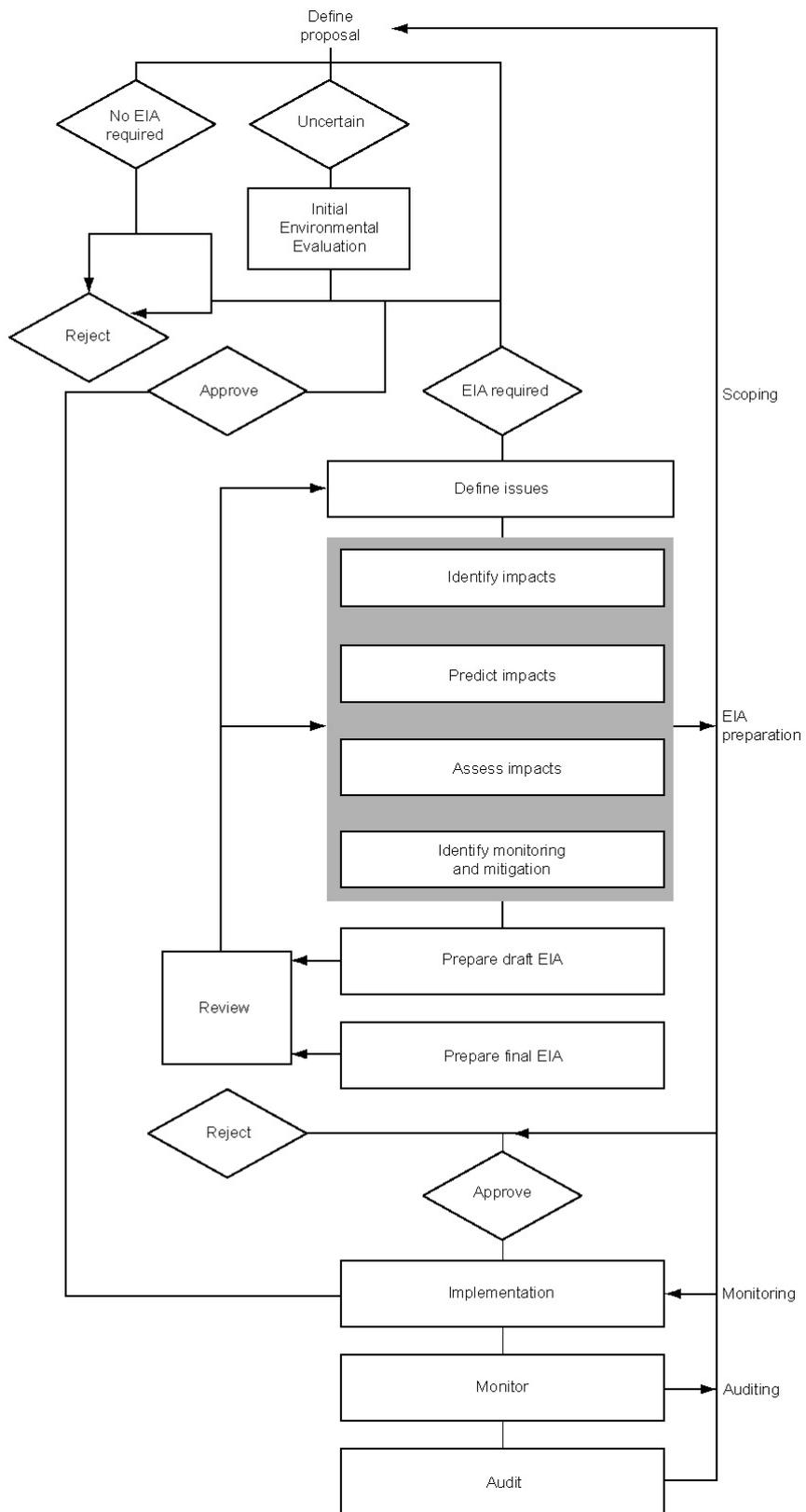
- Mitigation measures to minimise adverse impacts
- Measures to enhance environmental benefits
- Identified risks and uncertainties
- Institutional support required for effective monitoring
- Monitoring and auditing programme details
- Environmental legislation and standards which apply
- Resources, funds, contractual and management arrangements

### **3.8 Environmental Audit/Evaluation**

When the project is in existence, then an environmental audit may be required in order to satisfy IFIs that it is operating to an appropriate environmental standard. The audit seeks to confirm the operational practices and to highlight any deviation from the accepted norm.

An environmental evaluation is increasingly undertaken to confirm that the performance of the project, once constructed and operational, conforms to the specification and environmental performance standards specified as part of the consent or funding arrangements. Frequently, the environmental evaluation seeks to examine the EMP and review the monitoring data in order to reveal aspects where improved practice is possible and where future EIAs can be enhanced.

**Figure 1: Flow diagram showing the main components of an EIA system**



## 4. CHECKLISTS

DFID use two sets of checklists to help in the process of environmental appraisal. As part of the Screening Process, checklists are available which cover environmental features, development features, potential adverse and beneficial impacts, and impact characterisation. At the project approval stage, checklists are available to decision makers to determine the nature and scale of potential environmental constraints and opportunities, and the extent to which these have been adequately addressed in project design. Examples of the content of the checklists are shown in the Table.

<p><b>Screening Checklists</b></p> <ul style="list-style-type: none"> <li>• <b>Environmental Features</b> Areas containing rare or endangered species National parks, nature reserves, Etc. Habitats providing important resources for vulnerable groups Moist or dry tropical and sub-tropical forest</li> <li>• <b>Development Features</b> Important policy changes likely to affect the environment Major changes in land tenure or use Substantial changes in water use Large infrastructure projects</li> <li>• <b>Potential adverse and beneficial effects</b> Livelihoods Culture Land management Water quality and quantity Local air quality Global impacts Conservation</li> <li>• <b>Impact characterisation</b> Is the impact beneficial, benign or harmful? What is the scale and intensity of impact? Are effects irreversible? Are the effects due to construction and/or operations? Are the effects likely to be politically or socially controversial? Will there be different effects on different members of society? What are the timescales of impact?</li> </ul>
<p><b>Checklists for Policy Approvers and Decision-makers</b></p> <ul style="list-style-type: none"> <li>• <b>Project setting</b> Have underlying causes of environmental damage been considered? Would these underlying causes be better addressed by other means?</li> <li>• <b>Impact identification</b> Is there any effect on environmentally sensitive or important areas? Have the environmental and social risks been evaluated? Have indirect effects been addressed?</li> <li>• <b>Mitigation measures</b> What mitigation measures are proposed? What measures will be taken to enhance environmental benefits? What consultation was there with concerned stakeholders?</li> <li>• <b>Procedures</b> Have appropriate guidelines been followed? Have the beneficial and adverse environmental effects been integrated into the economic analysis? Have the appropriate authorities been consulted?</li> <li>• <b>Implementation</b> Do local institutions need strengthening in order to effect the environmental measures? Who will monitor the environmental impact? Have environmental measures been costed, and funds allocated?</li> </ul>

## 5. ENVIRONMENTAL IMPACT OF RURAL TRANSPORT DEVELOPMENT

The Asian Development Bank (1993) provides a useful listing and brief description of the main environmental problems commonly associated with rural roads projects. These are:

- Encroachment into precious ecological resources, including forests and swamps.
- Encroachment into historical areas and cultural monuments.
- Impairment of fisheries, aquatic ecology and other beneficial water uses, due to changes in surface hydrology.
- Erosion and silt runoff from exposed areas, which may also cause impairment of downstream water quality and damage to land values.
- Dust nuisances caused by both the road usage and during construction.

Of these, erosion is thought to have the major environmental impact. *'Construction in the rainy season, or improper construction methods which leave soils exposed unnecessarily, can cause significant erosion. Improper drainage from roads in areas of high precipitation can ruin roads and have adverse impacts on adjacent lands, most pronounced in steep areas. Even in low rainfall areas, if the drainage system is improperly designed, a short but intense rain can erode large swathes downslope of the drainage ditches. Large-scale destruction can also occur through slips and landslides in steep areas. Damaging to land and vegetation resources, erosion also causes serious sedimentation and siltation problems in nearby surface waters. With their greater potential for causing environmental problems, roads built in steep humid zones will require higher standards and costs than roads on plains.'* (The World Bank, 1991.)

Mitigation measures to control erosion can be included in the designs (e.g. appropriate drainage channels and culverts) as well as in the implementation (e.g. quickly establishing vegetation on exposed slopes). The method of implementation may also contribute to reduced environmental damage; thus labour-based operations may be better deployed (as opposed to heavy machinery) due to the greater precision and sensitivity of application that is possible (McCormick, 1990).

Some schemes may present positive environmental effects, which can help in justification. As an example, a benefit of the construction of an all-weather road in the Mongolian steppeland was the associated reduction in the amount of 'off-road' travel by vehicles. The latter was encouraging the proliferation of multiple-tracks across the steppe which was considered to be causing serious environmental damage (Hearn, 1999).

The indirect environmental impacts of rural transport development are much less easy to predict, because they are likely to be of a long-term nature. Changes in land-use may result from the greater accessibility due to improved roads and services. Roads which have been used to 'open up' the tropical rain forests of Brazil, have encouraged the development of settled farming communities, but at the expense of the indigenous peoples' livelihoods, and at the expense of the natural ecology. In the same way, roads constructed to give logging companies greater access to the African rain forests may have had a similar damaging impact.

## 6. CONCLUSION

It is clear that the environmental impacts of projects and policies are no longer considered as inconsequential or secondary to decision-making for development. EIA is now recognised as an integral part of the project cycle, and donor-funded transport projects will invariably require that environmental issues are properly addressed using this or a related technique. The identification at an early stage of environmental impacts contributes not only to project appraisal, but also project design, which incorporates necessary mitigation, and counter measures. Equally important, as part of the EIA, is the development of an Environmental Management Plan (incorporating a monitoring scheme), by which the project implementation can be tracked against planned benchmarks and expectations, with appropriate design changes being considered where warranted. Donor project evaluations now include an examination of the environmental outcomes, and compare actual performance with plans.

In this context, not only must the planning for environmental impacts be robust, but the proposed countermeasures must be soundly conceived and properly effected. As with any such development, this requires the identification and commitment of resources for the project life-span. In developing economies, these resources may be difficult to sustain, given that they are not obviously 'productively' used (in the sense of providing a clear and measurable return on investment). However, the evidence of environmental damage caused by such short-sighted approaches is now too overwhelming to be ignored. Clearly, EIA's should be provided for from the outset in the budget of all road projects, and environmental assessment units in road agencies of developing countries advocated as standard practice.

### KEY REFERENCES

AfDB (1992). Environmental assessment guidelines. Abidjan: African Development Bank.

AsDB (1993). Environmental guidelines for selected infrastructural projects. Office of the Environment. Manila: Asian Development Bank.

DFID (1999). Environmental Guide. London: Department for International Development (DFID).

OECD (1994). Impact environmental assessment of roads. Paris: Organisation for Economic Co-operation and Development.

TRL (1997). Principles of low cost road engineering in mountainous regions. TRL Overseas Road Note 16. Crowthorne: Transport Research Laboratory.

Tsunokawa K and C Hoban (1997). Roads and the environment - a handbook. World Bank Technical Paper No. 376. Washington, D.C: World Bank

World Bank (1991). Environmental assessment sourcebook. Volume II, Sectoral Guidelines. World Bank Technical Paper No. 40. Washington, D.C: World Bank