Implementation of Integrated Environmental Management Procedure for Low-Volume Road Projects

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Roads and transport routes by their nature are potentially intrusive to the environment. Numerous scars have been left on landscapes, many of which are still visible after a number of years. Public complaints stemming from road development and the resultant increases in traffic are escalating. Therefore, roads and related structures must be constructed to minimize negative impacts on the environment and enhance positive impacts associated with the provision of infrastructure. The incorporation of an integrated environmental management procedure during the project cycle will identify all environmental issues that can be addressed during the early stages of an assignment. In new road projects, this will allow uninterrupted construction and could prevent the costly time delays that result from disputes and actions. Incorporation of the procedure into the maintenance and operation of existing transport routes can enhance rehabilitation and management programs. The proposed procedure facilitates the identification, investigation, and reporting of key issues relevant to the circumstances of the particular project. It also includes review, monitoring, and auditing stages.

One of the primary factors affecting the economic strength of any country is a reliable and adequate transport infrastructure. One of the main components of this is roads and railways. Without these transport routes, the population cannot be economically active, agricultural and mining produce cannot reach their market places, health services become ineffective, and energy supply becomes costly and unreliable. Low volume roads provide access to communities and act as feeder routes to and from agricultural and forestry areas, mines, and tourism destinations.

Roads and their associated structures and materials often leave significant scars on the environment. This visual impact is particularly distinct owing to their linear nature. In addition, vehicles using the roads cause noise, vibration, and air pollution. However, the negative impacts caused by certain roadways are usually countered by positive impacts. For instance, the construction of an alternative route or town bypass may have a negative impact on the landscape and the local economy (reduced trade from through traffic), but it may have a positive impact on the residents of the town by decreasing the traffic, noise, and air pollution and improving safety conditions.

Environmental impact assessments are a relatively new consideration in road and transport related activities (*1*). Although numerous studies on the effects of traffic in urban areas have been undertaken (*1*), comparatively little work, other than certain specific environmental impact assessments, has been conducted on the impact caused by roads and the associated traffic on the environment. Before new roads are constructed

or existing roads are rehabilitated or upgraded, the relevant authorities must determine the impact on the biophysical and socio-economic environments. In Africa, most funding agencies will not consider the granting of loans for road development and upgrading until a thorough investigation has been concluded.

This paper summarizes some of the environmental aspects associated with road construction, discusses an integrated environmental management procedure for low volume road projects, and suggests how the roads industry can approach the next century with a greater environmental awareness.

Environmental Impacts of Roads

We have identified a number of impacts associated with the construction, maintenance, and use of roads (*1*,*2*). The list is not exhaustive, but it covers most of the major socioeconomic and biophysical considerations and includes impacts on the following:

- Physical characteristics of the site and surroundings,
- Ecological characteristics of the site and surroundings,
- Current and potential land use and landscape character,
- Cultural resources,
- Socioeconomic characteristics of the affected public,
- Adjacent and associated infrastructure services,
- Social and community services and facilities,
- The nature and level of present and future environmental pollution, and
- Health and safety.

The Status Quo

The location of roads, selection of construction materials, and design of the pavements and associated structures are largely based on traditional engineering principles. These principles are found in "text-book" or recipe guides and manuals prepared by road authorities and research organizations. Until recently, few of these manuals have included aspects concerning environmental conservation practices. However, many universities and other training institutions are now including environmental training in their engineering curriculum, and numerous articles referring to environmental considerations in road and transport projects have recently been published (*1*).

Integrated Environmental Procedure for Low-Volume Roads

Integrated environmental management procedures are designed to ensure that the environmental consequences of development proposals are understood and adequately considered in the planning process (*3*). The purpose of an integrated environmental procedure for low volume roads is to resolve or mitigate any negative impacts and to enhance the positive impacts of the development. The process can be implemented for any size of project, from upgrading a drainage structure to constructing a new road through an ecologically sensitive area. The time required to manage the process will depend on the size of the project, the amount of consultation required, and the complexity of the issues identified. The basic principles underpinning the integrated environmental management procedure require the following (*3*):

- A broad meaning to the term *environment*, encompassing both socioeconomic and biophysical components;
- An open, participatory approach in the planning of proposals;
- Consultation with interested and affected parties;
- Due consideration of alternative options;
- An attempt to ensure that the "social costs" of development proposals are outweighed by the "social benefits";
- Democratic regard for individual rights and obligations;
- The opportunity for public and specialist input in the decision-making process;
- Informed decision making;
- Accountability for information on which decisions are based and for the decisions made;
- An attempt to mitigate negative impacts and enhance positive aspects of proposals, and
- Compliance with these principles during all stages of the planning, implementation, and decommissioning phases of proposals.

An integrated environmental procedure for low-volume road projects is provided in the form of a flow chart in Figure 1.

Stage 1: Planning and Assessment of the Proposal

Proposal Development

Central to the notion of an integrated environmental management procedure for low-volume roads is the notion that its underlying principles should direct the

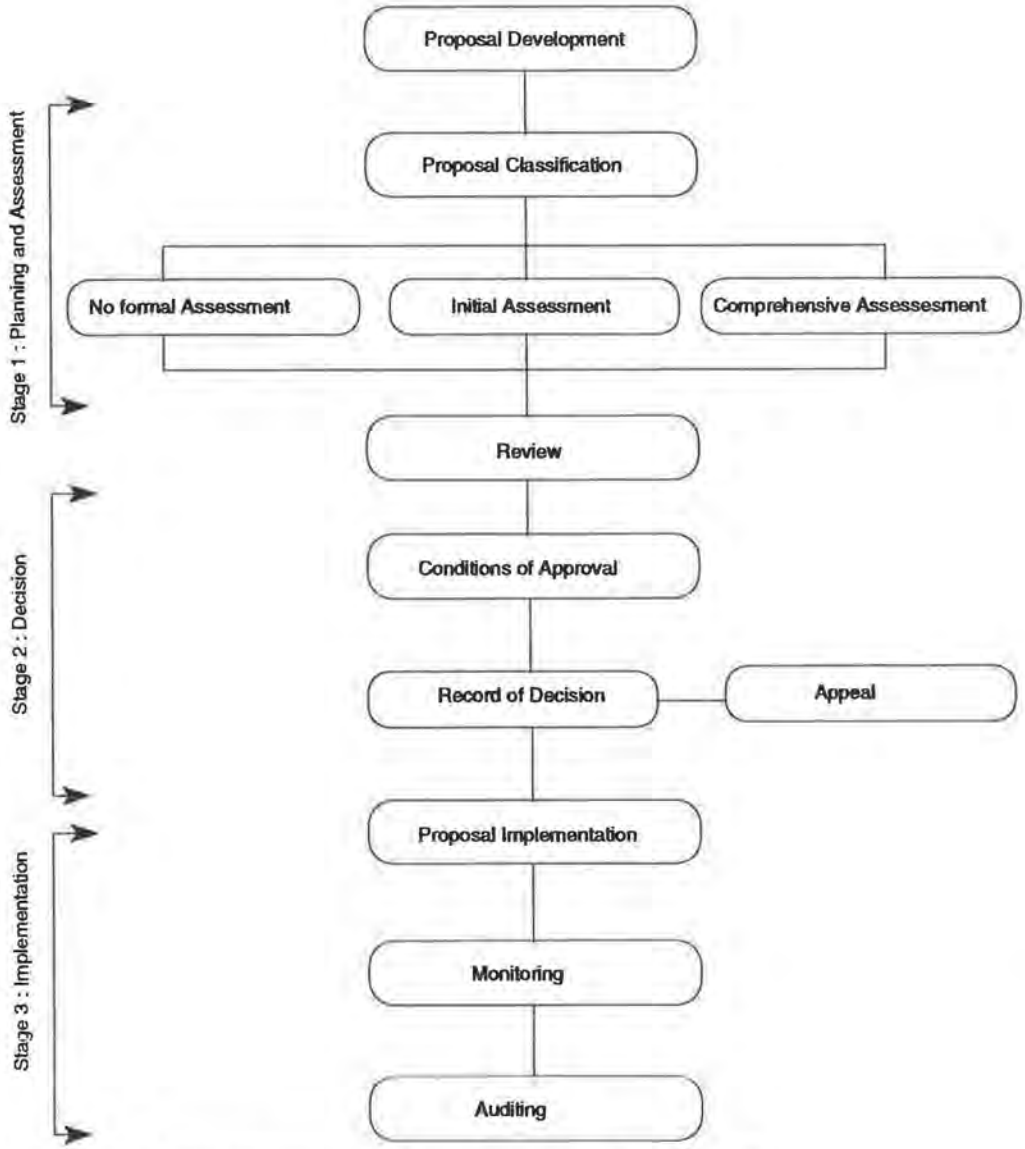

FIGURE 1 Integrated environmental management procedure for roads.

planning of proposals, rather than be addressed once the project has begun. By incorporating the recommended steps from the beginning of the project, the proposal will be better planned and the decision-making process will be streamlined. In the early stages of any size project, an appropriate person from the road authority or developer, such as responsible engineer or an environmental scientist, should be appointed as environmental coordinator. This person will work with the project team to initiate the process with the following recommended steps (*3*).

- Consider all integrated environmental management requirements;
- Establish the purpose or need for the proposal;
- Notify and consult with land owners and residents adjacent to the proposed development, authorities and other potential interested and affected parties;
- Establish policy, legal, and administrative requirements;
- Identify issues and opportunities and consider alternative routes, methods, and designs;
- Consider mitigatory actions; and
- Consider management plan options.

Undertaking these steps at the inception of the development of the proposal will integrate the planning and assessment stages, thereby expediting the process and facilitating informed decision making. Recently, interested and affected parties have placed considerable pres-

sure on road authorities, even for a single impact such as noise. Therefore, it is advisable to identify these individuals or groups and their respective issues before any designs are started. This will help to avoid possible legal action, unnecessary delays, work stoppages, and the need for redesign.

Classification of the Proposal

The classification of the proposal determines whether or not an impact assessment is required. The options at this point include the following (*3*):

- No formal assessment required,
- Initial assessment to determine whether or not a comprehensive assessment is required, and
- Comprehensive impact assessment.

The classification is done by the proponent and his consultant in consultation with the relevant authorities and leading interested and affected parties.

No Formal Assessment

This course is followed if the road authority or private developer is certain that the proposal will not result in any significant impact. For road projects, this will be unlikely except in the smallest of undertakings. If no formal assessment is undertaken, the proposal can be directly submitted for review. The relative authority should return the proposal for an initial assessment if further information is required before the correct decision can be made. Provision is made for lodging an objection to a proposal. This highlights the importance of notifying interested and affected parties at the proposal development stage.

Initial Impact Assessment

Even if no significant impacts have been identified during proposal development, uncertainty about potential impact may still exist. In that case, an initial assessment should be undertaken. This assessment should determine if there will be significant impacts (if a drainage structure has to be upgraded and the impacts on downstream water users cannot be immediately quantified). The proponent should ensure that the initial assessment is undertaken by a competent party with enough expertise to determine if significant impacts are likely. The assessment may be based on available information, but it may require that new information be obtained. If necessary, an initial assessment report should be produced to provide the background information for the scoping stage of a comprehensive impact assessment. If no significant impacts are identified, the report will be submitted for review. The initial impact assessment report can also be returned for further investigation if the relevant authority feels that further information is required to make an informed decision.

Comprehensive Impact Assessment

If activities during proposal development or the initial assessment indicate that the proposal will result in significant impacts, a comprehensive environmental impact assessment should be initiated. Examples where such an assessment are likely include the following:

- All new road construction, especially roads through urban and rural residential areas;
- Road developments in natural areas, including nature reserves;
- Developments which will result in significant increases in traffic; and
- Developments which will result in the transportation of hazardous substances.

There are three principal components of a comprehensive environmental impact assessment: scoping, investigating, and writing the environmental impact report (*3*).

Scoping

This component determines the extent of the approach to the investigation. The proponent, working with other relevant authorities and the interested and affected parties, determines which alternatives and issues should be investigated, the procedure that should be followed, and the report requirements. Scoping methods include holding public meetings, conducting surveys, and establishing individual personal contact. The appropriate method will depend on the number of people affected and the circumstances of the particular development.

Investigation

Guided by the scoping decisions, the investigation provides authorities with enough information on the positive and negative aspects of the proposal and the feasible alternatives to make a decision. The extent of the investigation will vary from a relatively brief assessment to a very detailed assessment, depending on the circumstances of the project. If the project involves an extensive environmental impact assessment, the proponent should seriously consider appointing an environmental consultant with the relative experience to conduct the study. The interested and affected parties may also require that the assessment be undertaken by an independent and impartial establishment. The appointment of specialists will depend on which issues have been iden-

tified. Common environmental concerns raised during road and transport developments will have been identified; these can be included on a checklist to ensure that no issues are overlooked during the investigation. These issues question whether the proposed development will have a significant impact on, or be constrained by, the environment. These questions include the following (2):

- Physical characteristics of the site and its surroundings, including land, freshwater, marine and estuarine systems, and the climate;
- Ecological characteristics of the site and its surroundings, including vegetation, animals, and natural and semi-natural communities;
- Current and potential land use and landscape character, including general considerations applicable to all development proposals, urban open space, and protected, recreation, residential, commercial, industrial, agricultural and forestry areas;
- Cultural resources;
- Socioeconomic characteristics of the affected public, including demographic aspects, economic and employment status, and the welfare, health, and cultural profiles;
- Other infrastructure services, including energy supply, water, waste management, adjacent transport networks, education, housing, telecommunication, and financial implications to the region;
- Social and community services and facilities, including health, emergency services, and recreational activities;
- The nature and level of present and future environmental pollution, including air, water, noise, vibration, lighting, visual, and solid and liquid waste pollution;
- Risk and hazard;
- Health and safety;
- Cumulative and synergistic effects; and
- Enhancement of positive characteristics.

Environmental Impact Report

The report must communicate a variety of often complex issues to a wide audience to assist the decision-making process. The report should be concise and logical and should provide a clear analysis of the facts to facilitate the comparison of alternatives. Where applicable, the report can include recommendations for revising, mitigating, and monitoring the proposal (3).

The completed report will be reviewed by the relative authority and the interested and affected parties. If identified as a need during scoping, it will be viewed by the public as well. The proposal may be sent back for further investigation if the reviewers feel that they cannot make an informed decision on the information provided in the report or question the adequacy or accuracy of the assessment.

Stage 2: Decision

Review

A decision about the acceptability of the proposed road or transport development is made when the authority and the interested and affected parties (and, if applicable, the public) are satisfied that sufficient information is provided to make a decision, that sufficient consultation with interested and affected parties has taken place, and that the proposal complies with requirements.

Conditions of approval can be identified by the authority and the interested and affected parties before a final decision is made. These conditions may be those set in accordance with planning, legal, policy, and administrative requirements. Approval may also be given subject to certain mitigating measures or other conditions, which are usually described in a management plan. This management plan will describe the following (3):

- How the proposal will be implemented,
- The controls over the implementation, and
- How environmental restoration after construction will be carried out or how final rehabilitation of the environment will be performed after construction has been completed.

An environmental contract may be required. This would assign penalties for not adhering to the conditions of approval during construction. For example, penalties may be assigned for stream pollution during bridge construction or unnecessary damage to vegetation during preliminary earthwork operations. Recently, environmental education and awareness of the contractor is preferred to penalties, which should only be implemented as a last resort.

In instances where the proponent is also the authority, independent specialist review should be commissioned to assess the proposal (3).

Record of Decision

A record of decision should be registered whether or not the proposal is approved. Where appropriate, an explanation of how environmental considerations should be taken into account and compared to other considerations should be included. Conditions of approval should be reflected in the record of decision (3).

Appeal

The decision-making authority must provide an opportunity for appeal. Appeal can also be made through a court of law if malpractice is suspected (3).

Stage 3: Implementation

Monitoring

After the proposal is approved, the construction or implementation can begin. A monitoring program should be implemented for all approved proposals, whether or not there is a management plan or an environmental contract. This program should include clear guidelines of what should be done, who should do it, and who should finance it. Aspects to be covered include the following (*3*):

- Verification of impact predictions,
- Appraisal of mitigatory measures,
- Adherence to approved plans, and
- Compliance with conditions of approval.

Audits

Periodic assessments of the positive and negative impacts of roads and transport projects should be undertaken. These will serve to provide instructive feedback on the following (*3*):

- Adequacy of planning at the proposal development stage,
- Accuracy of investigations in the initial and comprehensive impact assessment stages,
- Wisdom of the decisions at the review stage, and
- Effectiveness of the conditions of approval and monitoring program at the implementation stage.

Legal Requirements

Numerous acts and ordinances are applicable to the roads and transport industry (*1*), and a number of these provide direct or indirect measures to exercise control over the negative environmental impacts of road transportation. Interested and affected parties in many countries have used legal means to prevent or delay projects, so the road authority or private developer must be aware of the implications.

Conclusion

By their nature, transportation routes can be environmentally intrusive. It is important to construct them to minimize the impact on the environment. The environmental impacts should be addressed throughout the project to allow uninterrupted construction and prevent costly time delays that result from disputes and actions involving affected parties.

Implementing an integrated environmental management process in road and transport-related projects will ensure that the environmental consequences of the development proposal are understood and adequately considered at all stages of the development process. This encompasses a broad range of methodologies that include terrain evaluation, ecological studies, cost benefit analysis, social impact assessment, risk assessment, technology assessment, and future research. In most cases, a satisfactory compromise can be achieved without the environment being excessively degraded or the road project being unnecessarily disadvantaged in terms of economics or construction duration.

The integrated environmental management procedure described in this paper should not be seen as an additional work burden for the project team, but as a necessary part of the normal project life cycle. At the beginning of any size project, the new development will be considered by an individual or a team. At this stage, environmental awareness should be encouraged by proposal development. During the initial feasibility studies of the projects, an initial environmental impact assessment can be undertaken. If necessary, a comprehensive environmental impact assessment can be undertaken during the feasibility study on the selected option. The environmental impact report will form part of the feasibility report of the study, and approval will form part of the approval of the entire project. The detail design phase of the project can include an environmental management plan, and environmental audits can be carried out with routine financial audits.

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