

Institutional Aspects of Environmental Management in Road Development

JACOB GREENSTEIN AND MARKO EHRLICH

Environmental protection and remediation are integrated activities of road administration. International lending agencies such as the Inter-American Development Bank and the World Bank and the lawmakers of both developed and developing countries insist that all projects be environmentally sound. To achieve this goal, road departments need adequate institutional capacity to address and resolve all the environmental issues in a timely and cost-effective manner to reduce or avoid remedial costs. Experience with the administration of environmental units within road departments is detailed in this paper. The principal responsibilities of such a unit are the administration of environmental impact assessments; research, development, and adaptation of new technologies; and education and training of the department's managerial and technical staff. This kind of environmental management is set within a defined legal and regulatory framework and requires interinstitutional cooperation and coordination. In order for this program to succeed, institutional strengthening is required for the development of human resources, improvement of the organizational set-up, implementation of environmental policies related to road administration, and improvement of the administration of environmental impact assessments. A typical institutional set-up and its responsibilities are presented.

In road administration, construction, improvement, rehabilitation or maintenance, and environmental protection or remediation are complementary aspects of the same agenda. The inclusion of environmental considerations in road development is being recognized by road planners and engineers as a legitimate concern to (a) promote better highway planning, design, and construction and (b) benefit society as a whole through protection of the environment and prevention of the loss of recognized environmental values (from aesthetic values to biodiversity). In other words, the era of classifying environmental considerations as a "required nuisance" seems to be over. A few indicators that strengthen this conclusion are as follows (1-6):

- Local communities are demanding cleaner and safer construction sites, especially in projects related to rehabilitation or improvement of existing roads and bridges. This concern comes waxes and wanes, but there is an overall upward movement.

- Environmental regulations are getting stricter and will continue to get more rigorous.

- New economic instruments—taxes, charges, and tradeable permits—are rewarding "clean" companies. Business in general is calling for the increased use of such instruments.

- International lending agencies such as the Inter-American Development Bank (IDB) and the World Bank (IBRD) insist that all projects be environmentally sound and that the executing agency have adequate institutional strength to properly address all the environmental issues (2-4,6).

- Commercial banks are more willing to lend to companies that prevent pollution rather than paying for expensive clean-ups. There are two main reasons for this. First, there is growing concern among bankers about their liability for the environmental misdeeds of borrowers. Second, a company that is unlikely to be liable for large clean-up bills is a company more likely to be able to repay its loans on schedule.

Considerable progress has been achieved at integrating environmental concerns into standard engineering practice, and road economic evaluation increasingly includes a greater portion of environmental mitigation as part of the road construction costs. Although environmental quality of road development has probably benefited from this progress, much still needs to be done to secure and improve these achievements and to institutionalize environmental work as an integral part of infrastructure administration. A simplified institutional framework for an environmental unit (EU) and its set-up and function within the organizational structure of a road department is presented.

GENERAL OBJECTIVES AND TASKS

The main tasks of an EU are to (a) ensure proper analysis of project alternatives during the planning process; (b) perform adequate quality assurance (QA) and quality control (QC) procedures during the project construction and operation; (c) where needed, implement protection measures to prevent or reverse negative environmental impacts in order to reduce or avoid remedial costs by addressing the issues in a timely and cost-effective manner; and (d) participate in the development and implementation of environmental policies related to road administration. Research, development, and adaptation of new technology to be used by the department's managerial and technical staff, consultants, and contractors who provide advice and services to the department form another principal task. Education and training are other important activities needed to relate the daily work of the road administration to environmental regulations.

Environmental Impact Assessment

As part of its QA function, the EU needs to be closely (though not necessarily directly) involved in the preparation of environmental impact assessments (EIAs). Specifically, the unit's task is to prepare the EIA's terms of reference in order to make it a comprehensive and flexible management tool tailored to the entire range of the department's activities (i.e., construction, rehabilitation, maintenance) in the different environmental conditions of the

state or country under its jurisdiction. Although there is no fixed inventory of issues to be evaluated in any particular project, it is usually necessary to coordinate the EIA preparation with other public institutions directly responsible for environmental issues at both the central and regional levels. In order to ease decision making and optimize expenditures dedicated to evaluating the environmental quality of any given project, it is common to adopt an environmental classification system. According to the IDB (2,3), projects are classified in four environmental impact categories: beneficial, neutral, moderate or potentially negative, and significantly negative. The IBRD classifies projects in three categories: complete environmental analysis is required because the project may have diverse and significant environmental impacts, more limited environmental analysis is appropriate because the project may have well-identifiable and manageable environmental impacts, and environmental analysis is not usually necessary because the project is unlikely to have significant environmental impacts. Such a classification system is useful to determine work priorities and assign the necessary funds and personnel needed to properly carry out the EIA or environmental analyses (2,5,6) and to determine whether the project

1. Affects areas with animal or plant life worthy of protection or areas with particularly vulnerable ecosystems;
2. Creates barriers to movement in areas with conservation-worthy or particularly large wildlife populations;
3. Affects areas with significant historic and cultural remains or landscape elements of importance to the local population;
4. Causes regressive or progressive erosion;
5. Leads to high rates of consumption of scarce material resources;
6. Leads to increased accessibility to protected areas or vulnerable natural resources;
7. Changes the way of life of the local population in such a way that it leads to an increased pressure on the natural resource base;
8. Leads to major conflicts with regard to existing land use and ownership of land;
9. Obstructs or leads to changes in the traditional resource exploitation patterns either directly or indirectly affected by the project;
10. Modifies the natural drainage patterns and groundwater characteristics and quality;
11. Contributes to air and water pollution;
12. Increases noise and dust impact on the local population, especially along unpaved roads;
13. Affects the increase of motorized transportation (with possible increased dependency on imported fuels);
14. Affects the nonmotorized transportation economy because of changes in land use, increased availability of motorized alternatives, or both;
15. Causes illegal timber cutting and illegal land clearing; and
16. Causes illegal invasion by squatters and poachers of homelands of indigenous peoples.

The preparation of the EIA usually requires coordination with other governmental departments and nongovernmental organizations to ensure compliance with national and international standards related to road administration minimize overall expenditures. To achieve so many ambitious goals, the EU must ensure that the department's managerial and technical staff and the con-

sultants and contractors that provide advice and services are educated in environmental concerns and qualified to carry out their duties. In other words, the EU should help all involved with the department's activities to understand how their work relates to the environment.

Resources Needed To Prepare EIA

The time required to prepare an EIA and the resulting cost vary with the local, sociocultural, and environmental conditions (e.g., fragile tropical forest area versus semiarid zone); the type, size, and complexity of the project and its characteristics (e.g., new construction versus rehabilitation); and the amount and quality of environmental data already available. Experience indicates that EIAs need as much time as do feasibility studies, of which the EIA is essentially a part, and usually take from less than 5 months to more than 18 months to complete (2,4-6). Implementation of EIAs does not usually delay projects; on the contrary, in many cases, the EIA has shortened the total time from identification to operation by promptly revealing environmental issues that might have halted work altogether had they emerged at a later stage. In other words, whether a particular EIA actually delays a project depends largely on how well it is coordinated with feasibility studies and other preparation activities.

EIA preparation cost rarely exceeds 1 percent of the total capital cost of the project and is frequently less than that. The cost of implementing mitigating measures can range from 0 to 10 percent of total project cost, with 3 to 5 percent being common (4). These estimates do not take into account possible remediation cost savings resulted from a cost-effective environmental analysis.

CONCEPTUAL FRAMEWORK

As mentioned earlier, environmental concerns permeate every stage of road development from planning to design, to construction and supervision, to operation and maintenance. They also involve a great many different actors within both the public and the private sectors. Concretely, transportation-related environmental considerations involve the different levels of decision making, such as the road department, national and local governments, and other autonomous agencies (i.e., agrarian and forestry institutions, national parks, and wildlife agencies). Other concerned groups include local residents, tourists, and recreational travelers. In other words, environmental considerations in road administration are cross-institutional issues that need to be addressed through an interdisciplinary and participatory approach involving a wide range of public and private interest groups.

INSTITUTIONAL STRUCTURE

Given the interdisciplinary, interinstitutional, and intersectoral nature of environmental management, the EU must be positioned sufficiently high in the organizational structure of the road department to effectively administer the policy and the technical and managerial work. The EU must support the top management decision-making level with proper technical advice and constantly update policies, guidelines, and QA and QC procedures. To do so, EU must work closely with the legal and planning departments in

order to affect decision making early in the project cycle and within the appropriate legal and regulatory framework. Whenever necessary, the EU will provide essential inputs to the planning and legal departments in order to develop a coherent and effective road development strategy. The EU must also participate in the decision making at the technical level, including the programming, design, construction, supervision, and road maintenance departments. Technical specialists of the EU work closely with all the technical units to assist in the project implementation and operation monitoring and, when needed, all remediation work.

COMPOSITION AND FUNCTION OF EU

The three principal institutional criteria that the EU must fulfill are (a) adequate location in the organizational structure of the road department, (b) qualified personnel, and (c) sufficient budgeting. Moreover, a variety of fields of expertise need to be addressed by the EU, including, among others, ecology, hydrogeology, geography, regional planning, rural sociology, forestry and natural resources management, civil engineering, and hazardous waste management. It is always a challenge to integrate this many skills into the routine activity of the road department. Teamwork and a constructive exchange of information are needed to break traditional barriers and preconceived ideas to assess and improve (a) the type and quality of the mitigating and corrective measures, (b) their timing and most effective application mechanism, (c) the requirement of the EIA process as a result of field analysis, and (d) the proper and most effective monitoring procedures. Close cooperation between the EU and the other professional and managerial personnel from the department is necessary, in addition to effective cooperation with other public- and private-sector institutions, affected communities, and the population at large. Such an institutional composition and structure would require approximately 60 to 80 professional person-months per annum to administer the environmental activities related to a road network of 7,000 to 10,000 km (7-9).

QA AND QC PROCEDURES

Environmental QA is obtained through the implementation of a set of guidelines that describe the impact prevention procedures and mitigating measures related to construction, rehabilitation, improvement, and maintenance of roads and bridges (7,8). This set of guidelines covers, among other things, construction specifications; employee and workplace safety features; extraction, processing, and use of construction materials; management of hazardous materials; air pollution and water and soil contamination; noise control; preservation of wetlands; erosion and sedimentation control; acquisition of land and property; conservation of the right-of-way zone; protection of indigenous groups; protection of archeological sites; ecosystem management and biodiversity conservation within the project influence area; prevention, mitigation, and correction procedures related to road administration; and allocation of responsibility and cost recovery for environmental damage.

The QC procedures are the site-specific or detailed environmental requirements that, together with the general guidelines, are an integral part of the project specifications. These specifications must define precisely the environmental parameters and the ways

to measure changes during the implementation and operation of the project, for example, what the level of noise and dust should be during the construction period and how it should be measured; methods and parameters to monitor water quality before and after the construction; means to design erosion control measures taking into consideration soil and climatic characteristics; optimum gradation and plasticity to reduce dust during traveling after completion of the construction of unpaved roads; and optimum size of embankment and drainage facilities to minimize alteration to the natural drainage pattern and minimize obstacles to wildlife. The EU with the assistance of legal and technical advice should constantly update the QA guidelines to meet international and local standards and legislation requirements.

INSTITUTIONAL SET-UP FOR ENVIRONMENTAL MANAGEMENT

There seems to be no universal model or institutional set-up that will be satisfactory in every situation of the highway department. In addition, the effectiveness of the EU within the highway department depends on the existence of a national process and the expertise of (a) environmental policies and laws, (b) the degree of incorporation of environmental concern into the planning and budgeting of investment and maintenance programs, (c) the coordination and cooperation with the central authorities or ministry of environment on relevant issues, (d) the establishment of clear guidelines for the EIA, and (e) the provision for independent review and approval of EIAs as well as monitoring programs. The preparation and review of the EIAs are very important aspects of environmental management and usually reflect the strengths and weaknesses of the institutional structure and its capabilities to carry out sound environmental recommendations related to road administration. The range of typical institutional problems is wide, and the questions that can be asked are correspondingly varied. Fundamental questions include the following:

1. What EIA procedures apply to the specific road department? Are there guidelines to make them operational? Are they being carried out properly by the EU?
2. How is the environmental information assembled and analyzed and by whom (i.e., consultants versus force account)?
3. How is the information used in selecting, planning, designing, and executing projects?
4. When intersectoral issues arise, such as with the agricultural department rural development program, which also includes a road component, how are they resolved? Are the mechanisms for resolution formal or informal?
5. What are the procedures for monitoring, evaluating, and reporting on project impacts during the construction or the operation stage?
6. How clearly are the responsibilities and authorities of the EU defined?
7. What are the formal and informal lines of communication between the EU and other units of the department?
8. Is there evidence of political and managerial commitment (adequate funding and other resources, leaderships, etc.) to accomplish the desired objectives?

INSTITUTIONAL STRENGTHENING

Institutional strengthening is the permanent activity of updating and improving the environmental managerial capability of the

highway department to administer the EIA and to ensure that investment and maintenance projects are environmentally sound and sustainable. To achieve this goal, the EU should have or be able to obtain the capacity to produce a satisfactory EIA, incorporate the EIA findings into designs and implementation plans and specifications, monitor and manage the construction and operation of the project, and evaluate the results in order to improve future activities.

To identify the scope of institutional strengthening, a diagnostic is done to determine the specific weaknesses that can impair the effectiveness of the environmental administration. The five principal institutional weaknesses are discussed in the following sections (4,7,8).

Human Resources

The most common institutional problems in any environmental organization stem from shortages of qualified personnel or deficiencies in the management of the personnel available, or both. The causes are frequently found to be some combination of lack of managerial capacity, low salaries, low job status, lack of strong leadership, and inadequate resources for education and training.

Organizational Structure

The most obvious structural shortcomings affecting the environmental administration are the absence of a strong coordination unit to perform key functions, such as EIA review, technical supervision, monitoring, or regulation, and the fragmentation of responsibility for key functions among the other units of the department without an effective mechanism to coordinate them. Other common weaknesses stem from structures that do not integrate environmental considerations into development planning, especially when intersectoral issues are involved.

Environmental Policy, Laws, and Regulations

Common problems with legal instruments include the absence of (or lack of commitment to) a clear national policy, lack of up-to-date laws and inconsistent regulations of environmental management, lack of implementation of QA/QC guidelines, and improper laws and sanctions that are inadequate to promote compliance with environmental requirements.

Environmental Management Procedures

It is frequently the case that national procedures of environmental management have not been defined. Even when the necessary institutions exist, there may be a need to strengthen the decision-making processes whereby programs and procedures are identified, assigned priority, and implemented to get results. Often monitoring programs, if any, have not provided adequate baseline data for environment-related decisions. Successful interagency coordination, without which many environmental issues cannot be resolved, is difficult to achieve in the absence of established procedures. Many projects that result in adverse environmental impacts in spite of proper planning and design do so because of

weak or nonexistent programs essential to sound implementation—monitoring and supervision, operation and maintenance, and community involvement are the ones most frequently cited in this regard.

Financial Issues

Financial factors may be the basis for many of the human resource, organizational structure, and procedural weaknesses discussed above. Funding for the environmental administration (planning, supervision, implementation of mitigation plans, monitoring, measurement of impacts, feedback, etc.) may be inadequate, either because the environment has been given low priority in economic planning and budget preparation or because the available resources are not being managed effectively. Poor project performance can often be traced to insufficient provision of operating and maintenance costs.

Once the principal weaknesses have been determined, the institutional strengthening of the EU may include the following:

- Organizational mechanisms to ensure that environmental policies are followed in all programs and projects;
- Interagency and interdepartment coordination on environmental issues;
- Follow-up to the National Environment Strategy and the environmental action plans;
- Assistance for other units of the department in strengthening their own capacity to deal with environmental issues and develop environmentally sound guidelines, specifications, and procedures of QC and QA;
- Definition of overall needs for environmental education, information, promotion, and training;
- Programs for adequate operation and maintenance, including funding, staffing, facilities, and equipment;
- Rational and equitable cost recovery system to sustain the operation and maintenance functions; and
- Planning, authorizing, and funding processes that provide decision makers with adequate information to meet their environmental protection responsibilities.

INSTITUTIONAL STRENGTHENING OF COLOMBIAN ROAD DEPARTMENT

As part of an effort jointly supported by the IDB and the IBRD to modernize the country's transportation sector, the Ministry of Public Works (MOP) of Colombia has established an EU within its roads department organizational structure (7,9). Coordinated and financed jointly by both banks, the EU will receive technical assistance, training, and equipment to become a key player in the establishment and implementation of the MOP's environmental policy. The technical assistance component will consist of consultant services directed to (a) review and reformulation of the legal, regulatory, and administrative framework related to environmental management in road projects; (b) development of effective and efficient EIA procedures covering the entire project cycle; (c) establishment of administrative and normative procedures to supervise the proper application of environmental protection, mitigation, and remediation at the different stages of road administration; (d) development of effective environmental

monitoring procedures; and (e) establishment and monitoring of institutional mechanisms for interdepartmental and interinstitutional coordination and cooperation as well as for public participation on environmental and sociocultural issues related to road development.

The EU institutional strengthening program includes specialized training both locally as well abroad on such topics as EIA administration, natural resource planning and conservation, environmental monitoring, environmental QA and control, sociocultural aspects of road development, field survey and research and data base management and training.

Logistical support to be provided by the IDB and the IBRD includes all field and office equipment, such as office furniture and hardware (including photocopiers, printers, and facsimile machines), computer software, four-wheel drive vehicles, and field motorcycles.

Additional institutional support will be provided by the Colombian Institute of Natural Resources and Environment (INDERENA) specifically directed at (a) standardizing EIA procedures, including project classification and impact evaluation criteria and methodology; (b) improving mechanisms of interinstitutional coordination and cooperation; (c) staff training and development of educational and promotional programs for field technicians, municipal or local government workers, and community groups; (d) preparing field manuals; and (e) developing conceptual framework and methodology for conducting applied research on environmental aspects of road administration.

Special attention is given to the preparation of environmental studies of potential road projects in fragile areas such as the Amazon basin or the Pacific coastal region. These studies offer the opportunity to (a) train EU staff in dealing with complex environmental issues related to road administration; (b) plan land use and sustainable resource development in anticipation of road construction in an undeveloped region; (c) consider cultural and indigenous issues as well as biodiversity before unplanned land settlement and habitat degradation and resource depletion occur; and (d) allow for public involvement and community participation at an early stage in the decision-making process when it is still feasible to make changes. Through financial support for the institutional strengthening of MOP's own environmental management capability, the IDB and IBRD expect to contribute significantly to environmental protection and sustainable development in Colombia.

CONCLUSIONS

The following conclusions may be stated:

1. Environmental protection and remediation are integrated and principal components of road administration. In other words, environmental expertise is incorporated during the planning, design, construction, and project operation.

2. The main tasks of an EU within the road department are to ensure a thorough analysis of project alternatives, perform adequate QA and QC procedures, and implement protection measures to prevent, mitigate, and remediate adverse environmental effects.

In addition, the EU is responsible for research and development, training, and the raising of environmental awareness.

3. Environmental assessment procedures including project classification, impact evaluation, mitigation and remediation measures, and monitoring methods are integral components of a road development project.

4. Adequate allocation of human and financial resources to prepare EIAs avoids unnecessary delays in project preparation and does not significantly raise cost and at the same time can improve project quality and reduce future remediation cost.

5. To effectively incorporate environmental responsibility into the structure of the roads department, the EU must be located simultaneously at the highest managerial and technical decision-making levels.

6. To optimize the functional integration of the EU within the structure of the road department, it is necessary to address environmental issues in a interdisciplinary and participatory manner. The participatory process should include units inside the department, such as planning, design, construction, maintenance, and more important, other governmental, nongovernmental, and community-based interest groups.

7. Environmental management depends upon legal and regulatory frameworks, existing institutional capacity, public awareness, and interinstitutional cooperation and coordination.

8. Institutional strengthening is an ongoing activity essential to adequate performance and an environmentally sound road project. Key elements to be considered under institutional strengthening are (a) human resources development, (b) an organizational structure that allows efficient administration of the work (done mostly by consultants), (c) an environmental policy related to road administration, (d) formulation and implementation of EIA procedures, and (e) updating and improvement of evaluation and monitoring systems to optimize the allocation of financial resources to perform the unit responsibilities.

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