4.3 SAFETY AND THE ENVIRONMENT

Problem **Transport is associated with pernicious external effects: road crashes are a major cause of death and injury in developing countries, and a serious drain on economic development; transport development also brings in its wake environmental damage which is hazardous to both health and livelihoods.**

Solution **Understanding the nature and the causes of transport externalities is a first step towards developing remedial measures to mitigate the problems.**

BACKGROUND

It has been estimated that 86% of the world's road fatalities (which number well in excess of half a million per year) occur in the least motorised countries, which are synonymous with the developing world. The same source also estimates that these countries also incur some 12 - 23 million road accident casualties per annum. The economic cost (lost output from individuals involved in accidents, and resources - police and medical - allocated to the aftermath of accidents) is generally estimated at 1 - 2% of gross domestic product (GDP), which in global terms is about US$65 billion (1997) for all developing countries.

The high environmental externalities of transport relate largely to the impacts of road construction (materials extraction, changes to land-form and water courses, severance, etc.) and vehicle emissions (particulate matter and noxious gasses). Quantification of these effects is complex, but as an example of the probable magnitudes, one estimate suggests that urban air pollution from transport in developing countries contributes to the premature death of over half a million people per year, and imposes an economic cost of up to 2% of GDP (World Bank 2001).

Clearly, these are not insignificant problems, and they require attention. Many countries have, or are now putting in place, environmental standards and procedures for monitoring and enforcing them (the standards). The procedures also cover the assessment of new projects, and the implementation of mitigating factors to resolve potential environmental problems. Donors invariably require (in fulfilment of the terms of their loan agreements) the adoption of such practice, and compliance with either their own standards or those of the recipient. Safety audits for transport projects are also becoming more commonplace, though are not yet necessarily enshrined in law (to the extent that environmental standards are).

ADDRESSING ROAD SAFETY

Institutions & information systems

There is a need to strengthen the various institutions responsible for road safety, and to increase their capability for multi-sectoral action. The whole process of planning and implementing road safety improvements should be multi-disciplinary.

The setting of targets is a well-established management strategy and, when applied to crash reductions, has proved very effective in many developed countries. A national target needs to be disaggregated so that all those with safety responsibilities are given their own specific and realistic targets, with adequate funding directly related to those targets. To manage this efficiently, the authorities should produce an annual Road Safety Plan, which clearly states current crash reduction targets and how they are to be achieved.

Road safety organisations should thus be established on a full-time basis, and be capable of:

- Diagnosing the road crash problem
- Drawing up an integrated plan of action, including the setting up of goals and objectives
- Co-ordinating the work of all organisations involved
- Procuring funds and resources
- Producing design guides
- Designing and implementing improvements
- Monitoring implementation and evaluating measures
- Feeding back information from the evaluations and amending the action plan as necessary

Engineering and Planning

Despite the fact that human error is probably the chief causal factor in most road crashes, there is little doubt that engineering and planning improvements can affect road-user behaviour and reduce the frequency with which errors occur. Engineering and planning can improve road safety through two distinct mechanisms:

- Crash prevention: resulting from good standards of design and planning of new
- Road schemes and related development; and
- Crash reduction: resulting from remedial measures applied to problems identified in the existing rural road network.

Vehicle Safety

In developing countries, the safety design of vehicles sometimes lags behind that of industrialised countries, particularly when vehicles are locally manufactured or assembled. Similarly, vehicle condition is likely to be more of a problem when it is difficult to obtain spare parts. Overloading of goods and passenger vehicles is another factor that commonly contributes to high crash severity and casualty rates.

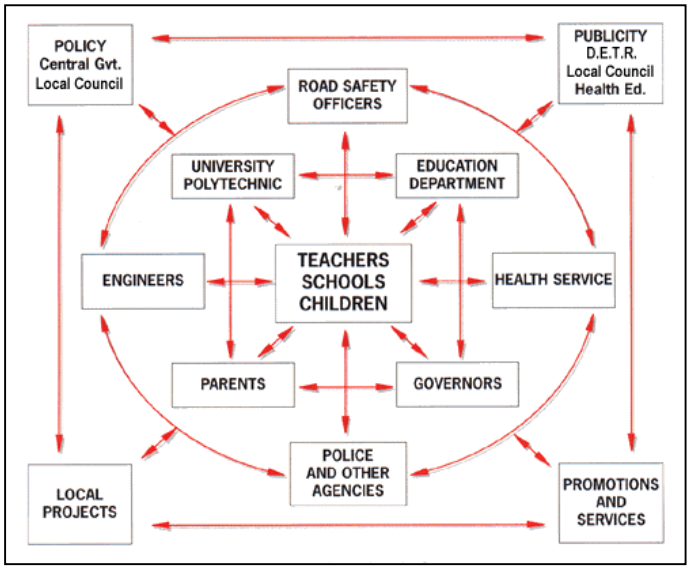
Legislative controls on the overloading of passenger-carrying vehicles, combined with improvements in the design of such vehicles would also seem to have some potential for crash and casualty reduction in developing countries. For example, in Papua New Guinea (PNG), it is common for passengers to be transported in open pick-ups and, perhaps not surprisingly, an exceptionally high proportion (45%) of the road crash casualties come from such vehicles. This is especially important in rural areas where a high demand for transport services, but low supply of vehicles proliferates the overloading of passenger vehicles, which substantially increases the crash risk on feeder roads.

Road Safety Education

In developing countries the child pedestrian crash problem is generally more serious than in developed countries; a problem exacerbated in areas which experience low school attendance figures. It is therefore important that education, through community programmes, is considered in addition to the school system (see **Figure 1** for community approach to road safety education).

It is recognised that road safety education programmes should be graded and developmental and that teachers need guidelines on what and how to teach. To meet these requirements, many countries have produced syllabus documents and teacher guides, including some in developing countries.

Figure 1: Community approach to road safety education



Source: Department of Transport, Local Government and the Regions (DTLR)

Driver Training and Testing

In developing countries, the problems of poor driver behaviour and knowledge described earlier are likely to be due, to some extent, to inadequacies in driver training and testing. Professional driver instruction tends to be limited because:

- Driving instructors are not properly tested or monitored
- There are no driving or instruction manuals
- Driving test standards and requirements are inadequate

Consequently, there is likely to be considerable scope for raising driving standards by improving driver training and testing.

As well as providing such advice on driving standards, many countries need to improve the licensing, training, testing and monitoring of instructors to ensure that these standards are taught. In training systems where learner drivers are free to choose how they learn, it is important that driving tests demand a high standard of driving especially for the practical 'on the road' assessment. More difficult tests should encourage learners to purchase more lessons from professional instructors.

Enforcement

A large number of studies have examined the effectiveness of enforcement systems in developed countries, particularly with respect to traffic police operations. A conspicuous police presence was shown to lead to improvements in driver behaviour in the vicinity of the police.

In developing countries, the traffic police are generally less well trained and equipped and are often non-mobile, i.e. stationed at intersections. Traffic police operating under such conditions are likely to find it difficult to influence moving violations. Improvements in traffic policing have considerable potential for both improving driver behaviour and reducing crashes, provided that the police's capability to enforce moving violations is enhanced.

ADDRESSING ENVIRONMENTAL ISSUES

Various environmental appraisal 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
Project Development		
• 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)
Project Implementation		
• Initiation/monitoring	Activate EMP	Monitoring Reports
• Operation/monitoring	Environmental monitoring	Review Reports
• Evaluation	Environmental Evaluation/Audit	Evaluation Reports

The EIA Process
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

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.

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, and international best practice
- 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.

Checklists
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 **Box 1**.

Box 1: Screening Checklists (illustrative only)

- ***Environmental Features***
  Areas containing rare or endangered species
  National parks, nature reserves, Etc.
- ***Development Features***
  Important policy changes likely to affect the environment
  Major changes in land tenure or use
- ***Potential adverse and beneficial effects***
  Livelihoods
  Culture
  Land management
  Water quality and quantity
- ***Impact characterisation***
  Is the impact beneficial, benign or harmful?
  What is the scale and intensity of impact?
  Are effects irreversible?

Checklists for Policy Approvers and Decision-makers (illustrative only)

- ***Project setting***
  Have underlying causes of environmental damage been considered?
  Would these underlying causes be better addressed by other means?
- ***Impact identification***
  Is there any effect on environmentally sensitive or important areas?
  Have the environmental and social risks been evaluated?
  Have indirect effects been addressed?
- ***Mitigation measures***
  What mitigation measures are proposed?
  What measures will be taken to enhance environmental benefits?
  What consultation was there with concerned stakeholders?
- ***Procedures***
  Have appropriate guidelines been followed?
  Have the beneficial and adverse environmental effects been integrated into the economic analysis?
  Have the appropriate authorities been consulted?
- ***Implementation***
  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?

Based on DFID (1999)

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.

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 terms of 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 and significance.

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.

Environmental Audit/Evaluation
When the project is in existence, then an environmental audit may be required in order to confirm 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.

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.

Mitigation measures
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.

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.

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.

KEY REFERENCES

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