Road planning, funding and administration

by

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EXECUTIVE SUMMARY

This report examines how roads are funded, planned and administered in developing countries. It is set against the background of several key developments:

- The continuing pressure (emanating principally from donors) to devolve responsibility and ownership of roads administration to regional and local level
- The corresponding pressure to encourage private participation in the delivery of roads administration
- The continuing uncertainty in sources of funding road development, and the consequent shortfalls and reliance on donor support
- The continuing development of analytical tools, whose application is not always consistent, 'user-friendly' or indeed foolproof.
- An increasing requirement to incorporate poverty and social benefits within road planning

For many developing countries, the overall planning process appears to be inconsistent and very far from optimal in meeting any sensible framework of objectives. The geographical allocation of funds will often bear little relation to any conventional specified economic objective. Similarly, maintenance management systems give contradictory advice on priorities compared with economic planning models.

The report is presented in three parts, the first two sections reflect the issues at stake and the way in which some countries have applied their institutional resources in the administration of roads. The last part presents the overall conclusions. There can, of course, be no 'correct' organisational model for the planning and funding of roads; political and cultural realities will always influence ideals. Road investment, like any other major sector spending programme, has a very high public profile, and hence is politically very sensitive. Furthermore, even in an ideal environment, the planning of roads would still be a complex process, involving many decision processes and trade-offs with other options for spend. However, the sharing of experiences in the outcomes of different models supports the process of effective development.

The evidence is that roads development continues to be under-funded and reliant on external support; that the planning and funding processes are still not as transparent as would be hoped (particularly by donors), despite the inroads of Road Boards, private participation, maintenance management systems and other new analytical techniques. The trends may be in the right direction, but the effective progress is rather slow.

ROAD PLANNING, FUNDING AND ADMINISTRATION

1. INTRODUCTION

The purpose of this report is to examine how road planning and funding are carried out in Developing Countries. Road investment and maintenance planning has (by definition) a crucial role in influencing what investment and maintenance are undertaken, where it is undertaken and what standards are adopted.

In recent years those responsible for the higher level planning functions within road organisations have experienced pressure to take into account a wide range of objectives such as economic and managerial efficiency, equity, financial viability, poverty reductions in addition to other political considerations. They are increasingly required to make use of a range of different modelling procedures, deal with new forms of accountability, and assimilate new organisational structures. In the short and medium term these pressures are likely to increase.

Planning is, perhaps, the main channel through which higher level objectives for the sector are first translated into action. Planning is not undertaken in isolation from the administrative structure that provides funding or implements decisions. A variety of procedures are followed during the planning process. These procedures reflect both the implicit and explicit objectives of the funding sources. Different donors will require different planning procedures for their individual programmes. Sometimes domestically generated funds will be used for particular road investment programmes that bypasses any kind of appraisal process. Hence the nature of road planning can be seen to be a direct function of the objectives of the funding organisation.

For many developing countries the overall planning process appears to be inconsistent and very far from optimal in meeting any sensible framework of objectives. The geographical allocation of funds, for the road maintenance or road rehabilitation, will often bear little relation to any conventional specified economic objective. Similarly maintenance management systems give contradictory advice on priorities compared with economic planning models.

There is an increasing awareness that alternative funding has to be found to halt the deterioration of the present network of roads in many developing countries. It is recognised that commercialisation and new forms of organisation may be required. New forms of funding and organisational structures will have important knock-on effects on the planning process. For example, toll road projects, when ranked by financial viability, are likely to give very different priorities than when ranked by economic viability.

Very little work has been published on these procedural conflicts and institutional constraints within the planning process of road planning organisations within countries with developing or transitional economies. This report presents material from different organisational models, based on experience of the authors, case study observations and literature review. Although most of the material is drawn from developing countries, examples from developed countries are also included where appropriate. Rather than present definitive guidelines, the aim is to present the

outcomes of different planning procedures and organisational models in order to provide material for informed discussion about the merits of alternative development strategies.

The report is structured in three parts:

- Part A examines the general issues and approaches to roads administration. It draws heavily on the literature that has accumulated on the subject, as well as the authors' own analysis and interpretation. Rather than repeating the arguments, it tries to present the essence of these arguments and the current status of thinking.

- Part B presents the case study material which demonstrates how roads administration is being practised in various countries, and experiences that can be drawn.

- Part C presents discussion and conclusions

PART A: ISSUES AND APPROACHES

2. KEY ISSUES

The following is a summary of key issues that have an important bearing on road planning and funding. The list is not exhaustive but it provides a useful introduction and context for the case study material.

2.1 OBJECTIVES, GOALS AND VALUES

Both within the general literature on road planning and within most road planning documents there is remarkably little discussion concerning the overall objectives of the road planning process. In most instances economic efficiency or economic development are taken to be the central goal (or goals). Sometimes the objective is articulated in terms of "minimum total transport costs". This is a measure of static economic efficiency. "Minimisation of road agency costs" is also referred to, however this is a very different objective because it ignores the costs of road users.

Other important objectives to consider are: road safety, minimisation of environmental impact, poverty reduction, employment generation, provision of basic access. There are now several ways in which environmental considerations are incorporated into the planning process. One method is via a multi-criteria approach. Another way is to ensure that, within reason, steps are taken to mitigate the most important adverse environmental effects. Hence the costs of the project are increased to cover the additional mitigation costs. Road safety is sometimes treated as another component of transport costs (i.e. through valuing life, accidents etc) at other times it may be treated as an environmental impact.

There is now some debate as to extent to which economic efficiency covers poverty reduction. In the long run the evidence suggests that improvements in general economic efficiency will help to reduce poverty. However to achieve poverty reduction in the shorter and intermediate term definite poverty focussed programmes will be required.

Although rarely articulated there is often substantial political pressure on road authorities to ensure some degree of geographical balance in the allocation of funds. If the objective is exclusively to meet economic efficiency objectives then it is likely that most funds would be concentrated on improving the most heavily trafficked roads in the richest and most economically active areas of the country. Such a programme could well be politically difficult if it meant that large parts of the country are left out.

Within rural road planning "provision of basic access" may be specified as a goal. This is a cost effectiveness objective, i.e. the overall objective of providing basic vehicle access may be taken as a given, the main interest is then focussed on how this can be achieved at minimum cost.

2.2 ARE ROADS THE ANSWER?

Road investment is only one solution to the problems of high transport costs, congestion, inadequate access and poor personal mobility. As an instant solution that is provided free at the point of use, road investment is very popular with transporters, contractors, highway organisations, politicians and donors alike. However, it may not represent the best, most cost effective, long term solution. High transport costs are the result not only of poor road surfaces or an inadequate network; they also arise because of an inefficient, monopolistic road transport industry. In much of Africa (where long distance transport costs are believed to be in the order of three to four times that of countries in Asia) the evidence is that a much bigger impact on transport costs are likely to be achieved through establishing a competitive efficient industry (Hine & Rizet, 1991).

The poor availability of transport services in remote rural areas in much of the developing world result from a combination of a lack of demand, poorly organised transport services as well as the poor state of the road network. Again there is evidence to suggest that directly improving transport services through combination of measures may be more cost effective than investment in rural roads. (Hine and Rutter 2000).

For some time there has been concern that a concentration on road investment will not alone solve rural transport problems and assist with long term poverty alleviation. (Dawson and Barwell, 1993). In a study of four countries Irish Aid found little evidence of long term benefits for the poor. As a result of the work new guidelines were issued in which the focus was changed to consider other interventions beside roads to assist the rural poor including consultation with householders on their transport requirements, an examination of short distance transport (and how these demands may be met), and the promotion of a co-ordinated response by different sectors such as health, water, education, agriculture etc (Irish Aid, 1998). Other donors (eg. Danida, SIDA, SDC, GTZ) have been keen to stress the need for a comprehensive solution to the problems of rural accessibility and poor mobility including more participation and consultation, access to basic services, promoting access to intermediate means of transport (IMTs), the establishment of local markets, and promoting labour based construction solutions.

The new Sustainable Livelihoods Approach (see Carney, 1998) can provide a useful framework for analysing the impact of different types (or combinations) of road and non-road intervention on communities. The emphasis of the approach is multidimensional; there is less emphasis on immediate income generation and more emphasis on the value and maintenance of the five types of capital assets (Natural, Social, Human, Physical and Financial) that people can draw upon to build their livelihoods. Improved accessibility and mobility can help increase the value of the asset base of all forms of capital. The role of transport in agricultural production and marketing is well understood (i.e. principally involving natural and financial capital). However transport also has a role in the development of human and social capital. Improved access to clinics, hospitals and schools is an obvious example. There is also increasing recognition that social trip making can also be valuable in helping to maintain a person's social capital and thus help in reducing their vulnerability to adverse changes in circumstances.

For the Sustainable Livelihoods approach to work effectively it is necessary to understand in detail for different communities with different degrees accessibility and mobility exactly what different types of trip making are being undertaken, what forms of transport are being used in what seasons, how much the fares are, what the running costs are of locally own transport, what cash reserves are available at different times of the year. With this more focussed information the key access and mobility constraints can more readily be understood. From this the likely impacts of different interventions for different communities my be predicted.

It has long been recognised that an integrated approach to transport planning is required to solve the transport problems of urban areas. New road investment needs to be planned alongside traffic management measures, better public transport and effective land use planning.

The bias towards road investment as a solution to transport problems is reflected in the organisation and staffing of roads and transport Ministries, Authorities and Agencies. It is common to find that the staffing levels of those who need to monitor and control the transport industry and are responsible for transport legislation and planning the integration of different modes are a tiny fraction of those that are employed dealing directly with road issues. For example just four per cent of the 1620 staff the Uganda Ministry of Works, Housing and Communications have been assigned for "planning, regulation and monitoring".

Because of the high levels of government expenditure involved road organisations tend to be politically powerful and can ensure that their voice is heard. In contrast those that have a wider transport function have greater difficulty in attracting attention despite the fact that the road transport industry as a whole typically consumes ten to twenty times the resources that go to road investment and maintenance.

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2.3 The Conflicts and Bias in Planning and Funding Procedures

The frequent conflict in road planning and funding procedures has been identified in the Introduction. One purpose of this report is to draw attention to, and examine how conflicts, inconsistencies and bias might arise. Conflicts can arise in a variety of ways. One important way is through differences in the way that funds are allocated by governments and donors to different functional and geographical programmes and the subsequent selection and appraisal process that then takes place within each programme.

"He who pays the piper calls the tune". The extent and nature of road planning that is undertaken is a function of the objectives of those that supply funding. Different donors will demand that road planning is done in different ways. Sometimes domestically funded projects and programmes may have no formal economic planning at all. For example it was reported that in the 1990's the funding for the Thana connecting road programme in Bangladesh came via different channels than other road programmes and no formal planning was required.

Although in most countries major road projects are usually subject to economic appraisal most road maintenance activity including reseals, overlays and regravelling are not subject to economic analysis.

Bias can arise in the way that planning is carried out. Data may be deliberately selected, or falsified to help give a favourable result. Although rarely documented it is well recognised that planners and engineers can often be under substantial pressure to produce "acceptable" results. The assumptions behind conveniently positive results are rarely questioned in any detail. If there is any follow up the basic uncertainties in road planning can always provide a useful alibi.

2.4 The Shortage of Maintenance Funding

The shortage of road maintenance funding is well recognised. One estimate (Harral and Fiaz, 1988) suggested that for the Developing World as a whole, maintenance funding was running at about half of economic requirement. In many instances it is well below this (e.g. a recent estimate for Tanzania suggests that maintenance funding is currently at 30% of the optimal level).

The economic benefits of good road maintenance have been well recognised for some time. Poor road maintenance increases road roughness, and hence vehicle operating costs (VOCs) to vehicle users; it will also have an effect of increasing capital expenditure on roads through reducing the life of road pavements. The marginal productivity of road maintenance expenditure will vary from place to place depending upon the quality of the network, the traffic levels, the level of maintenance expenditure and the costs of undertaking different maintenance operations.

It is widely agreed that for most developing countries, particularly those in Sub - Saharan Africa, the level of road maintenance is way below an economic optimum. Heggie (1995) quotes a number of examples to illustrate this. For example, for Kenya it was estimated that the $40 million annual shortfall in road maintenance increased VOCs by between $100 and $150 million. For patching, on an annualised basis, it is estimated that each dollar spent saves at least $3 and could save as much as $22. However, overall, Heggie suggests that each dollar saved on road maintenance will lead to decreases in VOCs by between $2 to $3. Other authors have come to conclusions suggesting 10 fold returns, and more, on road maintenance expenditure are possible (Robinson, 1986).

The 1994 World Bank Word Development Report has suggested that timely maintenance expenditures of $12 billion in Africa would have saved road reconstruction costs of $ 45 billion over the previous decade. In the past, road maintenance and rehabilitation projects have given very high rates of return. An analysis of 341 road projects by the Operations Evaluation Department of the World Bank found an average economic rate of return of 38.6 %.

The shortage of funding has encouraged considerable interest in developing new sources of funding, for example via ear-marked road funds or from road tolls.

The shortage of funding has a number of important ramifications relating to:

- Shortage of general engineering / planning capacity
- The shape and nature of donor programmes
- Appropriate road design and appraisal

These issues are discussed below.

2.5 The shortage of general engineering and planning capacity

Although the situation obviously varies from country to country there has, for many years, been a particular shortage in Africa of good quality engineers and planners working in Highway Authorities, Road Departments and Ministries. Pay is usually very poor in relation to what is available in the private sector.

Because of poor pay, staff moral is often low and staff frequently "moonlight" or seek other methods of supplementing their income. Because of staff shortages senior staff very often work extremely long hours.

2.6 The nature of donor programmes

In many countries the road investment programme is completely dominated by donors. Traditionally donors have also preferred to fund new investment and to rely on local sources to pay for road maintenance. An example is the 1998 Road Sector Development Plan of Ethiopia (RSDP I) of the US$ 2619 million programme donors were identified to provide US$ 1478 million for rehabilitation, reconstruction and upgrading together with US$ 17 million for policy support and institution building. The US $ 210 million identified for road maintenance was planned to be funded entirely by domestic sources.

As maintenance deficiencies have become increasingly apparent so donors have been willing to support programmes to enhance maintenance capacity and effectively to directly meet part of the maintenance effort. In the longer term to meet rural access and poverty objectives it may be necessary for donors to agree to build in the funding for routine and periodic maintenance for the programmes, if domestic funding remains severely constrained. There is of course a natural fear that host governments will become too dependent upon donors to meet their ongoing maintenance expenditure. Perhaps an extreme example of the host/ donor relationship is Nepal where, for many years, different roads were named by their respective donors (i.e. the "British road", the "Indian road", the "Chinese road" etc.) and, for a long time after the initial investment, donors were held responsible and indeed undertook the subsequent rehabilitation of "their" road.

Donors have their own agenda and they will often be choosy about what they want to support. Unfortunately the overall outcome of the variety of different donor programmes may not really meet the needs and objectives of host countries. Feeder road investment has been popular with some donors because of its association with helping the rural poor. The focus of most donor feeder road investment programmes has been to upgrade existing earth roads and tracks, typically to a full gravel standard road, rather than to extend vehicle access to as many communities as possible, or ensure a minimum degree of all year round vehicle passability. A consequence of this approach has often led an "unbalanced" rural road network with typically a third of the rural access road network built to a very high standard, whilst for a substantial part of the remainder of the rural network vehicle passage may be extremely difficult and often effectively impassable for many months of the year. In addition the more important secondary roads are often totally ignored. There are many examples of

networks of high standard feeder roads leading on to the most appalling secondary roads, often taking 50 times the traffic, which have been ignored by donors and officials alike. Yet the likelihood is that for any trip undertaken from a village on a feeder road (say to a district centre), a far greater proportion of the journey will be on the secondary road than on the feeder road.

Partly to overcome this problem the Kenyan 'Roads 2000' programme adopted a "network" based approach to the maintenance and improvement of secondary and feeder roads. The maintenance treatment was very deliberately designed to be purely traffic based, with the lowest trafficked roads only maintained by hand, and regravelling only adopted for the highest volume unpaved roads. A key part of the approach was that donors who were interested in supporting Kenya's road programme should support the network of an area, with different classes of roads, rather than just improving specific feeder road links.

Donors have a direct impact on the road planning process. They will usually demand that appraisal of the road investment programme takes place in a certain way often using a specified model such as the Highway Design and Maintenance Standards Model (HDM III) or the Highway Development and Management Model (HDM4) for main road investment (Kerali, 2000) A range of different planning procedures (e.g. ranking, prediction of agricultural output, community participation etc) may be specified for feeder road investment.

2.7 Road design and design standards

Each country has its own recommended design standards. In the developing countries the standards are usually a blend of standards derived from previous colonial powers and from local experience. The choice of standards relate to safety, engineering capacity, environmental considerations, and economic efficiency. Although engineers and users may prefer high design standards, with limited budgets, the net result is likely to be less kilometres of road improvement, and hence less accessibility, for those communities that have been left out. Design standards (e.g. relating to selection of suitable materials or compaction standards) may also have implications for the choice of technology for road construction.

Design standards have important implications for investment and maintenance budgets. Frequently, engineers recognise that a given standard may inappropriate. However, changes in standards cannot take place without the necessary institutional knowledge and formal agreement. Because of institutional inertia, and sometimes vested interests, it is often extremely difficult to achieve this.

Very poor maintenance can influence the most appropriate design. The most appropriate lifetime economic solution will usually involve substantial timely maintenance. If planners and engineers have no confidence that the maintenance will in fact take place then they are likely to recommend much more expensive solutions.

2.8 The choice of road technology

A range of technology is available for road construction. At one end of the scale expensive a "capital intensive" solution may involve the use of large bulldozers,

scrapers and graders etc. together with a relatively small labour force. At the other end of the scale a "labour intensive" solution may be employed where a relatively large labour force is employed using hand tools and very limited amounts of mechanical equipment. Between these extremes "tractor based" technology may be employed (using tractor towed graders, water bowsers, rollers, trailers etc) and intermediate amounts of labour. There may also be various combinations as with "labour based" technology which might be seen as intermediate between labour intensive and tractor based technology.

The choice of technology may be specified in contracts for the work or it may be left to individual contractor to make the decision. However the nature of the contract, engineering standards and payment terms may be critically important. The decision will clearly be influenced by a whole range of factors including labour wage rates, experience of the use of different forms of technology, availability of labour, the cost of equipment, average levels of machine productivity, employment and poverty reduction policy and the nature of the work. Although low wage rates obviously favour labour intensive solutions it is often not realised when making cost comparisons that new capital equipment may be much more expensive, supplied to a developing country compared with an industrial country. Furthermore studies have shown that because of poor availability of spare parts, poor maintenance techniques and poor organisation the utilisation rates of expensive plant can often be a very small fraction of what is theoretically possible while agricultural tractors and labour based work may achieve better results (see Roberts and Gaituah 1983)

Labour intensive and labour based technology are often advocated for rural road works in the lower income developing countries because, with proper organisation, it is possible to carry out the work to an adequate standard at similar cost. In addition it provides opportunity for the population to learn useful skills and the extra paid employment can be helpful in providing an opportunity to build up a cash reserve that can often be very important in helping people develop their farms, a new business or to overcome periods of adversity.

Although many labour intensive programmes have been organised as part of direct labour operations it is now much more common to find the work organised through the use of private contractors. A number of programmes of training to facilitate the use of labour have been organised through the ILO. Regular cash flow is critically important to the success of labour intensive and labour based work organised by small scale contractors. This is important because substantial delays in the payment of general engineering contractors have been notoriously common in many developing countries. Clearly small scale contractors do not have the cash reserves or credit worthiness of large scale contractors and without regular payments dissatisfaction will arise and the work will stop.

Labour intensive and labour based solutions continue to be widely used in much of Asia. In contrast, in Africa, despite a number of initiatives the take-up has been more disappointing. In recent years donors have often not been keen to influence the decision. Many highway engineers remain suspicious of the technology and large scale contractors that own equipment are very influential and remain keen to ensure that restrictions are not placed on its use.

2.9 The Provision of Basic Access

There is growing recognition of a lack of consistency in the design standards and the evaluation of low-volume roads in many developing countries (Gannon & Lebo, 1999). Excessive design standards (in terms of road width and use of expensive surfacing materials) have commonly lead to expensive solutions for access roads often taking traffic volumes ranging from a few vehicles per month to 20 vehicles per day.

The case for a basic access approach to rural infrastructure has been restated by Lebo and Schelling (2001).

> *"Basic access is the minimum level of Rural Transport Infrastructure (RTI) .. required to sustain socio-economic activity. Accordingly, the provision of basic access is often viewed as a basic human right, similar to the provision of basic health and basic education. Consistent with a basic needs focus, the basic access approach gives priority to the provision of reliable, all season access, to as many villages as possible, over the upgrading of individual links to a higher than basic access standard. A basic access intervention, in this context, can be defined as the least-cost (in terms of total life-cycle cost) intervention for ensuring reliable, all-season passability for the local prevailing means of transport."*

Appropriate design solutions to guarantee basic access should include a "spot improvement" policy particularly to deal with water crossings, drainage, low lying sections and difficult slopes to ensure that motor vehicles can get through year round. The roughness of very low volume roads is very much a secondary consideration. Basic access is much more suited to the use of labour intensive and labour based technology the equipment based technology. Labour is much more suited to small scale interventions. In contrast the utilisation (and therefore unit rates) of heavy equipment is dependent upon large scale uniform movement of material that are common with larger scale works.

There are very strong economic and social arguments to ensure that basic road access is spread as widely as possible. The economic costs of moving produce by headload for example can be as much as thirty times that of moving goods by truck. Similarly moving a sick person to hospital without vehicle access can be an extremely difficult, arduous and time consuming process; for many remote communities it is often an impossible task. In contrast the economic or social benefits of improving an existing accessible road or track to provide a smoother road surface may be very small in comparison to providing new vehicle access.

2.10 Administrative Change and Decentralisation

A wide range of reforms have taken place over the last 15 years in the finance and management of the road sector. World wide there have been moves to increase efficiency of road maintenance by moving towards commercialisation and the introduction of competition. There is now much less reliance on using "force account" or in-house capacity. In some instances (e.g. in the UK) even the planning function has been let out to contract.

The introduction of road funds, sometimes with a significant amount of non-governmental representation at Board level has also been an important development. In Africa, many of these reforms have been systematically supported by the World Bank and other major donors through the Road Management Initiative (RMI) of the Sub-Saharan African Transport Program.

In the last five years decentralisation of local road planning and maintenance has become a key issue across the world. This has been as a result of the desire to support local democracy and encourage local government districts to take an initiative and become involved in planning their local environment. Currently the topic itself often takes considerable resources in manpower, meetings, and consultancy assignments, as the topic is examined and debated. Despite the debate there has been a reluctance to provide the financial and technical resources to districts to enable them to undertake their allotted tasks. In comparison with many other functions run by districts, road projects are often on a very much larger scale and they generally require a much higher level of qualified technical manpower than the districts are used to dealing with.

2.11 The Complexity, Validity and Uncertainty of Road Planning Models

It is not commonly realised that HDM-4, the main technical/economic model used to appraise interurban road investments in developing countries, is far more complex, in terms of the number and range of different relationships and parameters used, than most of the models used to appraise similar scale road investments in developed countries. The reason for this complexity is because the model includes a range of road deterioration and road user effect relationships that are usually absent from the models used in developed countries to appraise paved roads. To give an idea of the complexity of HDM-4 the road network database has provision for 159 data elements for each road section; similarly within the vehicle operating cost module there are 103 variables that can be adjusted to change the operating costs of each vehicle type.

With modern computers complexity in itself need not be a major issue, provided the models inputs and outputs are straight forward and user friendly. However, because of the objectives of the model and the wide range of circumstances in which it might be used a considerable amount of understanding and technical skill is required. To run the models properly it is necessary to calibrate a wide range of parameters to suit local conditions. A consequence is that it is invariably necessary to employ specialist engineers and economists for the purpose. Inevitably in most developing countries there are very few who are skilled in its use and external consultants are nearly always required.

Sometimes substantial efforts have been made to train local engineers in the use of HDM and even here the results have often not been translated into useful action. An example is Zambia where a recent consultant's report complained that the Highway Management System (based on HDM III) was too complex for the available staff to operate and that because of this the proper national planning of road maintenance was prevented exposing the process to political interference (Zambia ROADSIP mid term review, Dec 2000)

A simplified model (Roads Economic Decision Model (RED)) for planning low volume rural roads has been developed by the World Bank under the Sub-Sahara African Transport Policy Program (SSATP) (Archondo-Callao R., 1999). However so far a range of alternative approaches have tended to be employed that often incorporate ranking procedures, social criteria, community consultation and agricultural output criteria. For feeder road planning more judgement and experience of these issues are usually required. However, even here there are few within road authorities and ministries who can undertake the expected tasks and it is more likely that local or foreign consultants will undertake the work

Urban road planning models can be very complex in the way they model the interaction of traffic flows and the network link and junction capacity. Like HDM, these models usually require external consultants.

Despite the complexity of road planning models there is a very high degree of uncertainty in the road planning process. More information on this is included in Section 4.2. Because road capacity is overwhelmingly provided free of charge at the point of use, there are no revenue streams or indicators of profitability to confirm or test the validity of decisions that are made. Separate post evaluation studies are required but even here little is known about what the costs or outcomes would have been in the absence of the investment.

2.12 Poverty Reduction and the Wider Benefits of Road Investment

The road planning models discussed above are used in the framework of conventional cost benefit analysis to identify the "first round" costs and benefits of road investment (see Section 4.1). Within conventional cost benefit analysis the costs and benefits are treated the same irrespective of who the gainers and losers are. It is possible to differentially weight costs and benefits to different classes of people but this is hardly ever done in transport project appraisal. In economic theory a conventional transport cost benefit analysis is believed to estimate the final economic impact on the economy provided that prices reflect their true opportunity costs and the economy is fully employed.

There are two key inter-related problems with the conventional approach. Firstly it is not known how different classes of investment will differentially affect the poor. The current world wide policy objectives in favour of poverty reduction makes it imperative to consider how the conventional forms of analysis may be modified to meet this objective. Secondly it is a characteristic of developing countries that prices do not necessarily reflect their true opportunity costs and that there is often considerable unemployment of labour and natural resources. Also there is plenty of evidence to suggest that many of the poorest countries do not have competitively efficient economies. There is a lot of evidence of transport cartels in Africa that keep transport tariffs artificially high. Hence there may be an unmeasured bias in the estimation of benefits. The two issues maybe brought together when the wider impact of the indirect benefits are considered.

Although there may be a policy to direct investment towards say rural access roads in order to provide greater benefits to the rural poor this may not be immediately realised on the scale anticipated if uncompetitive transport markets prevent the transporter's

cost savings from being passed on to the users in lower fares and tariffs. (Hence there is a need for complementary measures to tackle this issue.) Similarly in areas with more well developed and responsive land markets (e.g. in urban areas) there are arguments to suggest that a substantial part of the transport cost savings benefits may ultimately result in higher land prices and higher rents. In this case the immediate beneficiaries may be land owners rather than transport users. However, of course, the poor may benefit in the second or third rounds of expenditure when the transport cost savings, or higher rents are "spent".

Uncompetitive markets are not all "bad news" to the transport planner. Current research suggests that their presence may well mean that conventionally measured transport benefits are significantly underestimated. The technique of computable general equilibrium models (CGEs) is a procedure that is currently being developed to address this problem. (See Venables and Gasiorek, (1998) and the Standing Advisory Committee on Trunk Road Assessment (SACTRA) Report (DETR, 1999).

Most research on the impact of road investment has concentrated on looking at the effects on agriculture of rural access road improvements. The wider effects of road investment on the national economy and trade have nearly always been overlooked. However recent research relating to a number of developing countries suggests that changes in transport costs can have dramatic unanticipated effects on international trade, and therefore on employment and economic development. An elasticity of -3 has been found between transport costs and trade implying that a 10 per cent reduction in transport costs could induce a 30 per cent increase in trade. (Limao and Venables, 1999).

3. An Overview of the Road Planning and Funding Process

Important tasks that need to be addressed in the road planning and funding process are identified below.

3.1 Initial Selection of Roads for Improvement

Before the detailed analysis of a road investment is undertaken it is often necessary to make an initial selection of roads that may justify investment and therefore warrant further investigation. This is sometimes considered as part of the normal "Pre-Appraisal" process.

There are a variety of procedures involved in this initial selection process. Road sections that exceed certain specified traffic and/or road condition thresholds are obvious candidates. Data from previous studies and road management systems can be very useful sources of information. Sometimes, particularly for feeder and minor roads, specific studies are commissioned to examine the whole or parts of the network to make an initial recommendation. Donors may specify areas of the country or specific types of road for investigation. Nomination may also take place directly through local or national political pressure, or through formal consultation procedures.

The objectives of the initial selection process may be drawn from a variety of disciplines including economics, engineering, environmental and social development.

3.2 Definition of Appropriate Solutions and Design

For any problem or project it is necessary to decide in broad terms what type of solution is required and then to decide the most appropriate design. In most instances there may be little alternative to some form of road investment. However, alternatives to roads will be explored, particularly in urban situations where the best solution may be a traffic management or public transport scheme. In rural areas a ferry crossing or a bridge may be the best solution. Obviously rail, water and air transport all need to be planned in conjunction with road investment. In coming to decide the most appropriate solution the skills of transport economists and transport planners will complement those of the engineer.

Virtually all countries have nationally agreed design solutions for roads. In most instances the engineering design of a road (in terms of road width or pavement type and layer thickness) for a given traffic volume will usually be derived from standard engineering practise. However, models such as HDM III, HDM-4 etc. can help define an economically optimum solution for each individual project and these models are increasingly used for this purpose.

3.3 Appraisal of Specific Investment Projects

Many governments and aid donors insist that road projects above a certain size should be separately evaluated to ensure that the project meets certain criteria. Economic viability is the most widely recognised and understood criterion however studies are also carried out to provide statements of environmental and social impact.

Economic viability (i.e. "Are the total future discounted benefits greater than total future discounted costs?") may be established through a range of different procedures varying in complexity and robustness of assumptions. The key economic benefits from road investment are vehicle operating cost savings (from reduced road roughness or shorter journey lengths or faster speeds) and values of passenger time (from faster trip times). However, other factors such as changes in road maintenance costs or, for rural roads, induced agricultural production may also be examined.

3.4 Listing and Ranking of Projects

Once an initial selection has been carried out and an assessment of the overall desirability of a project has been made the project may be listed or ranked for final inclusion in an investment programme. Of course, for the very largest projects that may attract separate donor finance ranking may not be required. In this case the project may be subject to separate negotiations and its own timetable.

To carry out ranking economic decision criteria such as Net Present Value (NPV) or Net Present Value over Cost (NPV/C) are widely used. As mentioned above a wide variety of ranking procedures (involving non-economic criteria) are used for feeder roads.

3.5 Analysis of Different Investment and Maintenance Interventions

In order to assist with defining the most appropriate design standards and maintenance levels, for different traffic volumes, it is useful to carryout a detailed cost-benefit analysis using the road investment models in which both road deterioration and vehicle operating costs can be predicted. From this type of analysis the optimum economic design solutions can be defined.

Although "optimum" solutions can be derived from analysis carried out in other countries, conditions vary greatly between countries that will affect the most appropriate solutions. Key differences can occur between countries in the cost and availability of materials, the influence of climate on road deterioration, the costs of manpower and the nature of vehicle operating costs. For example, the optimum traffic volume for upgrading gravel roads to paved bitumen standard have been found to be particularly low (at below 50 vehicles per day) for Zimbabwe that has poor quality surface gravel coupled with a dry climate where paved roads deteriorate very slowly (SFRDP Final Report, 1995). Very different results would be found for countries which have lots of good quality surface gravel and wetter climates in which paved roads deteriorate quickly.

3.6 Identifying Funding Sources, and Negotiating and Bidding for Funds

The main sources of road investment and maintenance funds are:

- National government funds via the finance ministry
- Aid donors
- Road fund organisations (often from fuel levies)
- Private finance
- General local government funding
- Road tolls and octroi payments

Each year bids must be made to the finance ministry for both investment and maintenance funding. There are often long delays before the final budget is prepared and authority is given to let contracts.

The new Road Fund organisations often operate relatively independently from the finance ministry. An important source of funding often comes directly from roads users via a fuel levy as well as from other direct tolls and charges. One important advantage they may have is that they are not necessarily constrained by the annual government budgeting cycle; thus money can be accumulated and spent over several years. However, in most cases it is still necessary for road agencies to "bid" for funds.

Aid donors that are interested in supporting the road sector usually enter into a dialog with host governments and road authorities over how they want to support the sector. This process inevitably takes some time. Negotiations will eventually lead to a formal agreement between the parties. The donors may be interested in a particular area of the country, a particular road or wish to give general institutional support for maintenance or planning. Often very specific appraisal requirements will be specified. A host of other detailed specifications may be made covering how bidding is to take

place, how the work is to undertaken, how the work is supervised, how accounting is to be done and sometimes specific technical audits may be requested as the work progresses.

International private finance is mainly confined to the funding of major urban and inter-urban toll road projects. The extent to which a project can generate toll revenues is of course critical. In order to secure international finance it may be necessary for the government to give some guarantees over how the tolls will be set (if necessary agreeing to give compensation if toll levels are held down) and the freedom to repatriate profits.

Most of the poorest developing countries have a very weak capacity to generate local government tax revenue and in most instances local government is very dependent upon national government for revenue. However, the octroi system levied on the movement of goods through local government boundaries used in South Asia can generate large amounts of funds. In Pakistan the procedure is relatively efficient. A private company will bid for the rights to collect the octroi from an area and each time a truck passes through the company will collect the toll based on the cargo manifest. In most instances the transaction will only take a few seconds and in general it does not add significantly to the cost of freight movement.

3.6.1 Can private finance provide an answer?

The introduction of private finance into infrastructure projects began in the late 1970s in the developing world. It was seen as a means for countries with limited sovereign borrowing capacity and severe budgetary restraints to acquire needed infrastructure, such as power plants, toll roads, port facilities, transmission lines and water supply systems. Private finance has been used in infrastructure in the developed world for longer but its prominence only increased at around the same time. This reflected the changing political and economic climate, in which governments were increasingly keen to maximise the use of the private sector, at the same time as reducing the role of government in a country's economy and reducing the public sector debt.

Many different terms are used for private financed road projects. BOT (build, own or operate, transfer) is the most common acronym for the typical approach, in which the private sector finances, designs, builds, maintains and operates a facility for a fixed term before transferring it to the owner (host government). Similar approaches include DBFO (design, build, finance, and operate) and BOOT (build, own, operate and transfer). Sometimes the private sector takes on ownership of the facility in perpetuity, in which case there is no transfer of ownership at a later date but these approaches are less common in the road sub-sector. For the purposes of this report, BOT refers to the general approach adopted by all of the above examples. The advantage in the private sector being involved in the running and maintenance of a project are perceived in terms of the lower running costs, greater efficiency in service delivery, the greater capacity to maintain capital equipment over the public sector.

The key difference with regards to funding, between a BOT scheme and the more traditional government funded approach, is the means by which revenue is raised. A BOT scheme obtains its initial investment through two routes: equity investments (typically between 10% and 30% of project costs) which are raised through

shareholder agreements, and debt financing (typically between 70% and 90% of project costs) from commercial sources, which are usually backed by export credit guarantee agencies, and bilateral and multilateral lenders. The return on this investment is made by charging road users a toll during the term of operation. In some cases where tolling might be unacceptable, such as the UK DBFO schemes, a 'shadow' toll approach is used, in which the government pays the Project Company a rate for each vehicle which uses the road (which is bid in the tender documents).

The key difference with regards to planning between a BOT scheme and the more traditional government funded approach is the types of analyses used to justify the project. Government funded schemes will normally use an economic analysis which assesses the project contribution to government development objectives for the whole economy. Privately financed schemes will tend to emphasise financial rather than economic issues, will place a higher emphasis and cost on risks (to ensure financial viability) and will use a higher discount rate (to reflect the increased cost of non-government borrowing).

The role of private finance in the road sector in developing countries has been almost exclusively confined to the provision of very heavily trafficked toll roads particularly in relatively developed countries such as Indonesia, Malaysia and Mexico. It is now recognised that the wider involvement of the private sector in this area may be constrained by a number of factors including the complexity of setting up a BOT arrangement, the perceived risks to the private company and the costs of raising finance. The financial viability of a BOT project over its life must be sufficient to service the project debt and to provide a return on the equity that is commensurate with the long term risks of the equity investors. For externally financed toll road projects the arrangements to increase toll rates with inflation and the exchange rate risk are of critical importance. Sometimes governments are surprised at the implicit rate of return expected by a project. Foreign investors may well be looking for rates of return in the range of 18 to 30 per cent. It is often argued that finance can be provided at lower costs by the Government.

The overall commercial climate in the country is very important to the viability of setting up a BOT project. In this respect industrialised countries will usually be in a much better position to adopt a BOT type projects. The conditions for a successful BOT project are identified in the Table 1 below.

Table 1 Conditions of Success for BOT Projects in the Developing World

REQUIREMENT	COMMENTS
Project financially sound, feasible and affordable	This must be demonstrated in the project feasibility study, and charges made to users must be affordable. Risk analyses of the project assumptions must be made, and supported by historical and comparative data.
Country risks manageable	A stable political and economic environment is required.
Strong government support	Government must demonstrate its support for such projects by promoting public-private partnerships etc.
High government priority for project	This must be demonstrated by the host government.
Stable legal framework	Enforceability of the various BOT contracts is *sine qua non*
Efficient administrative framework	Lengthy bureaucratic procedures create uncertainty for sponsors thus having a negative impact on such projects.
Fair and transparent bidding procedure	Bid evaluation criteria must be clearly defined and bids must be evaluated in a public and objective manner.
Transactions can be concluded within reasonable time/cost	Procurement procedures should be quick and transparent, to reduce the risk of forecasting for tenderers.
Experienced and reliable sponsors with sufficient financial strength	Award to the lowest bid is not a sufficient selection criterion as bidders must also be experienced and demonstrate financial strength.
Construction contractor experienced and properly resourced	The prime contractor should be capable of the work.
Rational risk allocation	Risks must be identified, allocated to the party best able to bear them and managed in a rational way.
Security for lenders	Various guarantees, insurance and trust arrangements must be established to allow lenders the right of the sponsors well in advance of any defaults on the loan agreements.
Currency/foreign exchange and inflation issues solved	Foreign currency must be available in the host country, the host government must allow conversions to such currencies, and the contractual arrangements must account for exchange rate fluctuation and inflation.
Contractual frameworks reflect economics of project	The contractual framework is complex and will require qualified legal counsel. Fair contracts which avoid surprises must be developed
Co-operation on a win-win basis	Experience shows that successful BOT projects are regarded as such by all parties to the contracts.

Source: UNIDO (1996)

3.7 Preparation of Budgets and the Allocation of Funds

Once a provisional budget has been agreed with the finance ministry, a further allocation to Provinces, and Districts is then likely be required. This may involve allocation to different types of organisations working in the sector (e.g. a tourist authority may be granted money for up keep of roads in nature reserves and game parks). For the allocation of funds to different districts a formal funds allocation model may be used. (This is discussed below).

For periodic maintenance (resealing, regravelling) individual road sections will be specified. Obviously the budgets will also need to be allocated to cover manpower, equipment, training etc.

3.8 The Appropriate Maintenance Intervention for the Network

Virtually all of the poorer developing countries have insufficient funds to undertake the complete range of maintenance activities that are required. The greatest shortfall in activities is usually for the more expensive periodic maintenance operations such as regravelling (often less than 5% of the requirement for this activity is actually carried out). Faced with a shortage of funds and resources this is a rational response; regravelling usually gives very low rates of return in an economic analysis of maintenance.

Because of the shortage of funds a decision has to be made as how maintenance resources should be rationed in the most effective manner. The rationing process may be carried out either through the use of an economic modelling procedure (e.g. HDM-4), or through engineering priority assessment (perhaps part of a maintenance management system) or through ad-hoc decision making. The economic modelling based approaches have as their objective to obtain the maximum value for money for the limited available maintenance funds.

In order to identify priorities it is useful to undertake specific studies of the consequences of different combinations of maintenance activities for different traffic levels and for different road pavements. Because of differences in price, availability and properties of materials and differences in climate and vehicle operating costs different solutions will appropriate for different countries.

3.9 The Phasing of the Investment and Maintenance Programme

The phasing of the investment and maintenance programme is commonly referred to as "Programming". From the available investment and maintenance projects that may be undertaken it is necessary to make a selection as to which projects should be included in the next annual budget, or how they should be phased over a longer term rolling programme. Obviously this programming function takes place in conjunction with the other planning and funding activities mentioned above.

In developing the programme it is, of course, necessary to leave space for, and/or make separate provision for, donor funded investments which are not subject to the same constraints as the domestically funded schemes.

3.10 Post Evaluation Studies and the Analysis of Road Impact

As part of the planning process it is also important to study whether the road investment has been successful in meeting its objectives. Ideally this will provide long term feedback into improving the planning process. Post evaluation studies (carried out sometime after the road investment has been made) are required to do this.

Despite the fact that large numbers of post evaluation studies have been carried out it is still difficult to interpret from them what the net effect of the road investment has been -or what effect may result from a similar investment. A difficulty with post evaluation studies is that it is never known what would have happened without the road investment. Often the impact is determined or modelled using the same modelling procedure, and much of the same data, that was used to justify the investment in the first place.

3.11 The Objectives and Priorities of Different Organisations Involved in the Funding and Management of the Network

Although there may be general agreement about the very long term goals of managing the road network (e.g. economic and environmental sustainability, economic development, the elimination of poverty, good government, transparency etc.) different organisations will have very different short term priorities and they will naturally allocate resources in very different ways. To a large extent these differences will reflect the differences in their legal responsibilities and institutional make up. However, an examination of these interests can help to highlight overall weakness in the planning and operation of the sector. Table 2 provides a perspective of the observed priorities of different institutions. The lack of support for road maintenance, secondary roads, and footpaths and tracks appears to be very common in many developing countries. In contrast there appears to be considerable support for main and feeder road new construction and rehabilitation. National governments and the larger multilateral agencies have been keen to support main highway investment while donors that have a strong poverty alleviation focus have been very keen to support feeder road investment.

Table 2. A Perspective of Institutional Priorities

Institution	District Allocation	Maintenance/ Investment Balance	Willing to provide enough maintenance?	Main Roads	Secondary Roads	Feeder Roads	Tracks & Footpaths
National Government	Will favour solution that matches relative political importance of districts	Investment and rehabilitation is the priority	No.	Highest priority	Often ignored	Will go along with donor interests	Usually totally Ignored
Poverty orientated Donor	Will favour allocation to poorest districts	Most support for new investment some support for increasing maintenance capacity	No. Hopes to rely on local resources	Not interested.	Not interested	Supports large programmes on "social" grounds	Some support given
Efficiency orientated Donor	Will favour a traffic based allocation	-As poverty oriented donor-	-As poverty oriented donor	Large Support given.	Limited interest.	Will support if "agricultural development" identified	Limited interest
Road Fund	Will favour a traffic based allocation and districts that "perform"	Interested in increasing resources to maintenance	Would like to provide more support	Highest priority	Medium priority	Lower priority	Administration is very difficult so ignored
Highway Organisation	-As Road Fund-	Investment and rehab. is the priority.	No.	Highest priority	Low priority	Low priority	Ignored
Feeder Road Organisation	Favours a balance between traffic and other criteria	As Highway Organisation but sensitive to funder's priorities	No.	Not applicable	Some interest	Main function	Some interest but aware of admin problems
Regional Government	Interest is dependent on the Region's geographic makeup	Investment and rehab is main interest.	No.	Main roads are highest priority	Concerned about relative neglect	Some interest	Largely ignored
District Administration	Like to maximise funds to the District so view is dependent on District's makeup	Would prefer new investment but concerned about road condition	No.	Some interest	Concerned about relative neglect	Very conscious that half the feeder road network is neglected	Would like to give support
Local Participation	Like to maximise funds to District - but keen to support maintenance once recognising funds are limited		-	Some interest	Concerned about neglect	Keen interest	Very interested when in very poor state

3.12 KEY COMPONENTS OF THE PLANNING AND FUNDING PROCESS

Figure 1 outlines the key components of the planning and funding process. For the sake of clarity the complex linkage between the components have been omitted. The main flow of information and influence is from the top downwards.

The figure illustrates the nature and complexity of the road funding and planning process. The planning and programming that is undertaken is a function of the objectives of the funding institutions. There are a variety of planning procedures and processes that may conflict with each other in the way they interact. Key planning procedures and influences that have been identified include:

- Screening and ranking procedures
- Community consultation
- Engineering/ economic models
- Funds allocation procedures
- Maintenance management systems
- Ad hoc political decision making

By their very nature each procedure is designed to meet a different objective. The success with which they meet that objective will be dependent upon the validity of the data that is used, and the validity of the explicit and implicit models and assumptions that each procedure relies upon.

The final output from these procedures and influences are drawn together and integrated into a final programme of road investment and maintenance. Although the overall programme may turn out to be broadly politically acceptable and its individual components may have a certain rationale because of the complexity it is difficult to know how well the final programme will meet a comprehensive "Mission Statement" of the ultimate goals for the sector.

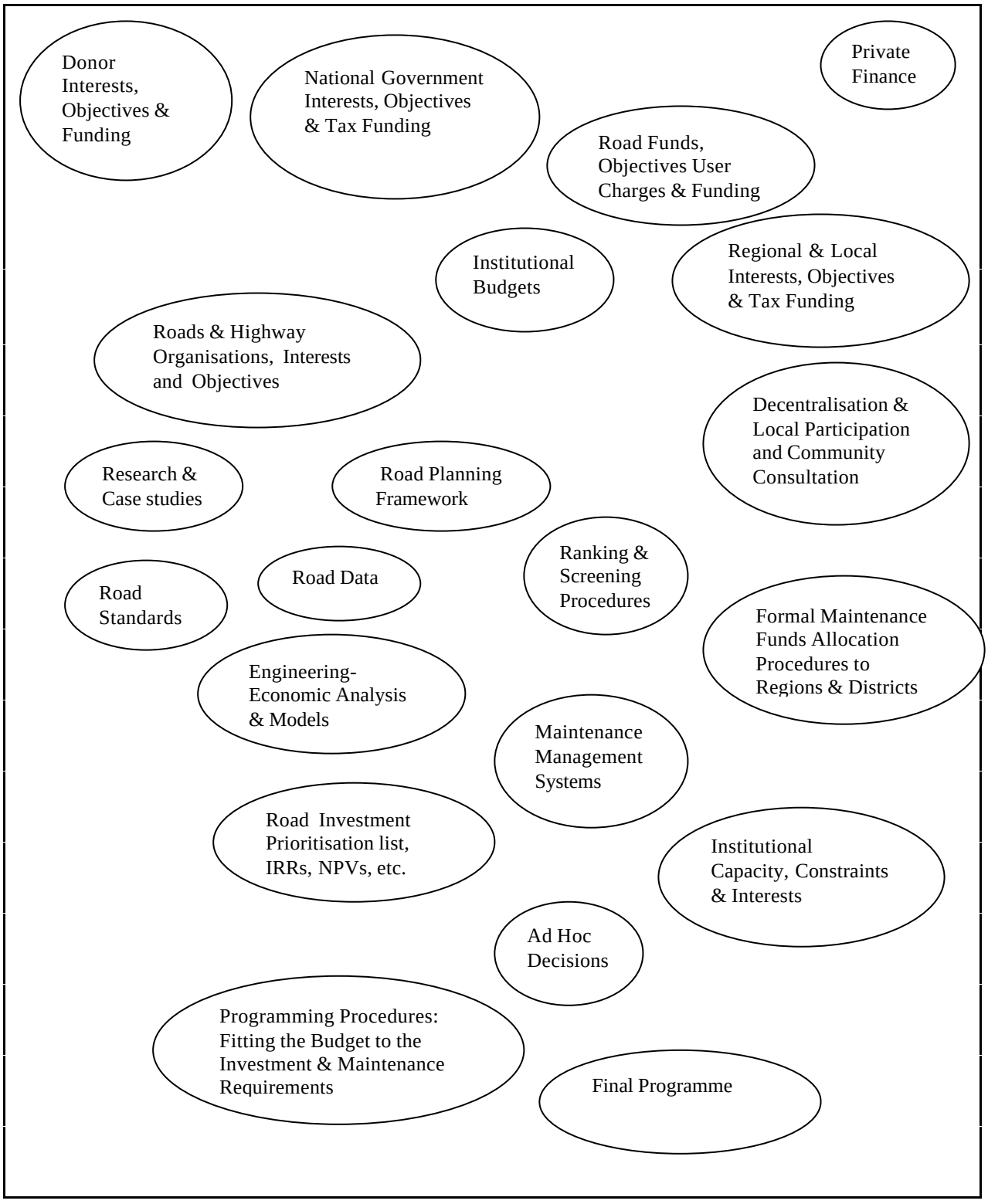

Figure 1. The key components of the planning and funding process

4. Prioritisation and Allocation Using Formal Procedures

4.1 Cost-Benefit Analysis

Cost-benefit analysis is a term used to represents a general procedure for identifying and measuring the forecast costs and benefits of a project. An economic analysis considers a project from a national point of view. It will use "economic" prices and include the costs and benefits that arise from a project irrespective of who incurs the costs or who benefits from the project. Although some form of distribution weighting is sometimes used it is usual to treat each dollar of benefits as being of equal value to each individual irrespective of his or her income level. A financial cost-benefit analysis uses market prices and is usually carried out from the perspective of a particular individual, or company or government department.

Economic cost-benefit analysis is an extremely flexible tool that can be used to assist with a wide variety of decisions. Within road planning the following types of issues can, in principle, be addressed:

- Is the project worthwhile?
- If there are a range of alternative options which gives the best return?
- Is project timing optimal?
- Should the project be phased over a period of time?
- Should non-road or traffic management methods be combined with the road investment project?
- What is the most economic pavement design ?
- How wide should the road be?
- How does risk and uncertainty affect the choice of projects?
- If funds are limited and there are many worthwhile investments, which should be built first?
- What is the best combination of maintenance interventions?

However, as with all forms of economic analysis its success is dependent upon the validity assumptions and models that are used. These assumptions cover factors such as future prices, forecasts of traffic, future economic activity, behaviour of operating costs, road deterioration behaviour etc. Because of the difficulty of pricing economic cost benefit analysis cannot easily cover environmental effects, social benefits or the differential weighting of benefits to different individuals.

Economic cost-benefit analysis is used in variety of ways to appraise road projects. A bridge project might compare the investment costs of the bridge with the forecast time savings and operating costs of running a ferry. An urban road project might compare the project investment costs of the road scheme with the forecast passenger time savings and vehicle operating cost savings of the project. A feeder road project might compare the road investment costs with the net forecast rise in agricultural production. An interurban road project to surface a gravel road might compare road investment costs with forecast changes in vehicle operating costs due to reduced road roughness.

Toll road projects and urban passenger transport projects will require a financial analysis as well as an economic cost benefit analysis to evaluate their viability. For these investments, particularly if private finance is involved, it is common for the

financial analysis to be paramount; the economic analysis may even be forgotten or carried out as an afterthought. Unless there are very substantial adverse environmental consequences most toll road and urban passenger projects will usually give a much lower financial than economic rate of return. The reason for this is that the toll road or other facility will usually reduce congestion, and maintenance costs, on alternative routes and these benefits will be measured and included in the economic cost benefit analysis. In contrast the financial analysis can only capture (part of) the benefits of direct users of the facility; no benefits arising on alternative routes will be measured or included.

Cost-benefit analysis can cover a very wide range of effort and analysis. It may involve just a few, relatively simple, assumptions with a few lines of calculations or it may involve many man-years of effort and require the use of considerable computing and modelling activity.

A key problem for officials reviewing, comparing and evaluating different road investment appraisals is to assess the validity of the cost-benefit studies that are presented to them. Where a consultant has used a recognised computer model (such as HDM III, RTIM3, RED or HDM-4) and has clearly identified the key assumptions it should be possible to reproduce the results and to test how robust they are by varying key assumptions. However, many consultants will use their own non-standard models (often incorporating simplified versions of the relationships used in the main models) as a result the reproduction of results is very difficult. Unfortunately the complexity of some modelling procedures is such that the full range of assumptions are often not spelt out and the procedure is seen as "opaque".

Because of the uncertainties involved in the economic appraisal of roads absolute measures of economic worth are likely to be subject to wide margins of error and therefore may be relatively suspect. In contrast greater confidence may be given to the economic ranking and comparison of similar projects, or project alternatives, using the same procedure.

To carry out an economic evaluation it is necessary to identify a *"base"* or *"without investment" case* in order to make a comparison with different *"project"* or *"with investment" cases.* Different forecasts are prepared of both traffic volumes and transport costs to estimate benefits. In order for the economic analysis to be as realistic as possible the base case should included a level of road maintenance that is appropriate to the expected traffic volumes. It is often easy to artificially inflate the value of a project case by assuming an unrealistically poor base case with little or no maintenance. Such practises should, of course be avoided. The case for upgrading an earth road to gravel, or paved road standard will often fail if very frequent grading is tested as an alternative.

Similarly very expensive investment options have sometimes been chosen as the best solution because a lower cost alternative that meets the overall objectives of the project has not been analysed. It has usually been found that a *"minimum do something"* alternative will give the best results.

4.2 Engineering and Economic Road Appraisal Models

Engineering and economic road appraisal models such as HDM4, HDM III, RED and RTIM3 are widely used in a cost benefit framework to evaluate rural and interurban road investment. The main benefits predicted by these models are the changes in vehicle operating costs associated with reduced road roughness. Changes in passenger travel time and in road maintenance are also measured by the models. The wider economic impacts (such as changes in industrial or agricultural output) are not included. Originally the models could only deal with road traffic travelling in free flow conditions on uncongested roads. However, the most recent form of the HDM model (HDM-4) has been able to model speeds and fuel consumption on congested interurban roads.

The models do not, however, model junction behaviour and delays and are unsuitable for urban road appraisal. In general urban road appraisal in developing countries uses the standard urban transportation modelling techniques. Models such as TRANPLAN and EMME2 can model the complex interaction of urban traffic movements. Estimates of trip distances, trip times and link volumes and link speeds are provided by these models. From these outputs changes in vehicle operating costs and passenger travel time can be estimated. Most urban transportation modelling currently undertaken assumes a "fixed trip matrix", i.e. there is no generated traffic induced by the investment, so no new trips are forecast as a result of the investment change. It is now possible to introduce generated traffic within urban transportation models, however both the traffic modelling and its associated economic treatment are uncertain and complex.

Despite the effort put into developing road appraisal models, very considerable uncertainty exists in our ability to predict both road deterioration and changes in vehicle operating costs. For example, in attempting to explain the roughness of unpaved roads (roughness is the most critical factor in vehicle operating costs) Paige-Green (1989) summarises his own work and that of the HDM in the following:

> *`In all of these models, as in the Brazilian models, the r-squared values are poor (only between twenty and thirty per cent of the variation is accounted for by the models). Low r-squared values for the prediction of pavement distress are generally reported in the Literature (Middleton and Mason, 1987). The HDM3 Manual identifies high prediction errors (95 percentile confidence intervals of 20 to 40 per cent) as being typical of this type of study (World Bank, 1985) and ascribed them to large variability of material properties, drainage, surface erosion and the high roughness levels of unpaved roads..'*

The modelling of the deterioration of paved roads is very complex and some studies have achieved much better explanation than the 20-30 per cent r-squared values quoted above. However, problems arise when we compare the results of different studies. For example, through a reanalysis of the AASHO road test data and using different model formulations Shook and Finn are reported to have found a damaging power of four times that of Liddle for a 66.5 kN wheel load while Konder and Krizek have found a damaging power of 60 times that of Liddle for a 4.5kN wheel load (Lister 1981). More recently, TRL's own research on pavement deterioration within the tropics has shown that climatic

factors often dominate the performance of paved roads and that the mechanisms of failure have been misunderstood.

Although gravel road deterioration has been relatively well researched and understood far less is known about the deterioration of earth roads and tracks. Because of their variability it can be difficult to define and model the critical behaviour of these types of infrastructure. Seasonal accessibility or traffickability (the ease of movement along the road) are, in general, the most important problems affecting this class of road. Road roughness is very much a secondary issue. There is an important need for adequate engineering planning tools to help define when and how earth roads and tracks should be improved and what type of maintenance interventions are required to keep these roads open to traffic. Almost certainly a basic access approach will provide the most cost effective solution. The recently developed Ghana Feeder Roads prioritisation procedure does attempt to address this issue (see Section 8.1).

Within the road planning models the vehicle maintenance cost/road roughness relationship is the most important component of the user effects part of the model. Changes in vehicle maintenance costs frequently account for over two thirds of the benefits of reduced road roughness. Because of its sensitivity to road roughness the vehicle maintenance cost/ road roughness relationship effectively determines pavement standards, maintenance policy and investment viability. However, of all of the components of vehicle operating costs vehicle maintenance costs are the most uncertain. In fact different studies carried out in different countries have identified *ten fold* differences in the sensitivity of maintenance costs to road roughness (Cundill, et al. 1997).

It is now believed that earlier versions of RTIM and HDM over-predicted vehicle maintenance costs and so for HDM-4 the 'default' sensitivity of maintenance parts consumption to roughness used in the model has been reduced. However, in view of the uncertainties involved it is important not to rely on the 'default' options. It is very important for different countries to collect local information about vehicle maintenance costs and to calibrate the model relationships within the models.

HDM III has been found to substantially over-estimate fuel consumption. Fuel consumption can now be predicted relatively accurately (for example using the Australian Road Research Board's model "ARFCOM" that is incorporated into HDM-4). However it is first necessary to accurately predict vehicles speeds. Whilst this may not be difficult for uncongested roads there is still considerable uncertainty over how this may be achieved with congested roads.

The values of passenger and crew time are input directly into appraisal models. Despite its potential importance relatively little research has been carried out on the values of time in developing countries. There is now some evidence to suggest that previous estimates of passenger time values based on a fixed proportion of the wage rate (often taken as one third of the wage rate) are both wrong and misleading. A number of studies carried out in Europe indicate that the elasticity of passenger values of time with respect to incomes are less than one. Evidence from Indonesia confirms this. Hence poorer people appear to have higher values in relation to their income levels than richer people. (Hine et al 2000).

4.3 The Prediction of Agricultural Change Following Road Investment

Many feeder and rural road projects appraisal include some impact on agricultural production and the wider economy. Impact estimates in this area are usually the most controversial and contentious element of any assessment. They are often no more than very crude guesses based without any foundation (Hine, 1983).

There is no simple, widely accepted method with which to estimate agricultural benefits from road investment. A number of model frameworks have been developed to assist with incorporating agricultural benefits into a road planning model and perhaps the most well known of these is the 'Producer's Surplus Model' (Carnemark et al. 1976). However, the weakness of this model (and most others that attempt to address the same problem) is that the key element of agricultural response has to be estimated by the user. As far as we are aware, there are no calibrated, predictive models of road investment and agricultural production in general use.

One approach to the problem is to rely on the results of post evaluation road impact studies. Unfortunately the evidence of response is, in total, extremely difficult to summarise. As with most forms of economic development, agricultural production does not grow in a smooth and even manner. Usually there are large yearly variations in output which mask any changes brought about by the road investment. It appears that the more information that is collected during an evaluation study the more complex the situation appears to be. Evaluations which are carried out soon after the investment has been made can rely, unchallenged, on previous trends and the standard models used in the appraisals. The difficulties start when attempts are made to reconcile the results of 'repeat' and 'control' surveys with what we believe should have happened based on our preconceived notions, trends and models.

There are examples when traffic has apparently fallen after a road has been built and on other occasions, agricultural output has fallen in the vicinity of both the control road and the project road. And sometimes there appears to be no apparent effect. Often, the changes that are seen in traffic and agricultural output appear to be a function of changes in the national and local economy, the weather and of factors other than the road investment. Large year-by-year fluctuations in both the composition and the total output of agricultural production can be caused by the weather and by farmers responding to changes in market prices. Major fluctuations in coffee and tea prices in Kenya have made it particularly difficult to interpret road evaluations in that country (Airey & Cundill, 1999)

4.4 Ranking Procedures, Cost Effectiveness and Multi-Criteria Analysis

Whilst conventional economic cost-benefit analysis is commonly used to prioritise main, secondary and urban roads, other methods are often employed to prioritise low volume rural or feeder road investments. These procedures are often referred to as "ranking" or "screening" procedures. Although there are many formulations the different procedures are not deliberately designed to fit within a conventional economic framework. The procedures often include indicators or measures of social as well as economic demand, need or benefit. Compared with a conventional economic appraisal less attention is given too the precision of coverage of benefits (e.g. relating to double counting). Sometimes the procedure will include a method of

incorporating consultation (either of local communities or officials) in the selection and prioritisation of road investments. Examples of different ranking procedures are given for Ghana (see Section 8.1) and Zambia (See Section 8.5).

A critical difference between conventional economic cost-benefit analysis and ranking criteria is that the former has an established theoretical framework and that practitioners can test their assumptions, through research, against an external reality. In contrast, ranking procedures are much more dependent upon the subjective values of those who initially construct the criteria and by those that are consulted in its implementation. It is for this reason that economic cost benefit analysis used in road project appraisal is broadly similar across the world, even though there may be differences in the engineering and economic models employed. In contrast, there is a very wide variation in the formulation and characteristics of ranking criteria.

The main advantages of ranking procedures are:

- Speed and simplicity
- Transparency
- The ability to incorporate a measure of social benefits
- It can directly incorporate community choice

The main disadvantages are:

- The procedures may involve summing and weighting totally different characteristics (i.e. adding up "apples and pears")
- The weightings adopted are unlikely to be stable in the long run
- It is difficult for the procedure to assist with the range of ancillary planning choices that may be covered by a conventional economic appraisal such as project timing, alternative project designs, combinations with other investment and maintenance options, etc.
- The solution may be very far from optimal, leading to economically wasteful investment in the sense that the same objectives may be achieved with less resources.

Within the context of road planning, "social" as opposed to "economic" benefits usually refers to the need for people to make trips for social reasons. It covers trips to health centres, hospitals, schools, government offices and to visit friends and relations. The latter are deemed important because they strengthen the social capital of the individual and may help in personal or community crisis.

Conventional cost-benefit analysis does, of course, include benefits for social trip making. All personal trip making along a road will be treated the same. The lower transport costs associated with road building for a trip to hospital will be valued the same (along the same road) as the benefits for a trip to market.

The argument for separately introducing "social" benefits is strongest when roads become impassable to motorised traffic. When this happens whole communities may be cut off from conventional social services and hence personal trip making will be severely curtailed. The conventional economic analysis of road investment relies heavily on vehicle traffic movements in the estimation of transport benefits. If roads

are impassable or suffer from strong traffickability problems, then clearly a measure based on existing traffic volumes alone will underestimate the benefits from road improvement. Even though it is possible, under the conventional analysis, to predict generated traffic and value the associated benefits it can be argued that when roads are cut off (and people directly denied access to critical services) this procedure is faulty and unlikely to give a reasonable estimate of the benefits of re-establishing access.

Where access is not threatened, and there are no compelling reasons to believe that road improvement will dramatically affect trip making, then the benefits of road improvement can be more clearly identified as the savings in transport costs to existing traffic. In these circumstances the arguments to include a separate measure of social benefits are much weaker. It is for these reasons that social benefits and ranking criteria are used to a much greater extent for rural access and feeder road programmes while conventional transport cost-benefit analysis is used for main and secondary road investment.

The population served by a road is often used in ranking criteria a direct proxy of social benefits. It is used either as a total proxy for all benefits or in combination with other traffic based benefits.

Population is used as a key factor together with the costs of upgrading in the following cost-effectiveness criterion used in Andhra Pradesh:

$$\text{Cost-effectiveness indicator of link}_{(j)} = \frac{\text{Cost of upgrading of link }_{(j)} \text{ to basic access standard}}{\text{Population served by link}_{(j)}}$$

So links that have the lowest ratio are chosen in priority for the investment (Lebo and Schelling, 2001). The two key drawbacks of this approach is that there is no measure of the change in road condition (in fact the cost in improving access is likely to be highly correlated with the change in access provided) and secondly no importance is attached to traffic.

Another approach has been advocated by Airey and Taylor (1999) here two indicies are derived one for impassable roads, the other for passable ones. For impassable roads ranking is based on the minimum cost per head of establishing access. Once access has been established the second prioritisation index is calculated as follows:

$$\text{Prioritisation Index} = \frac{\text{Estimate of trips x Access Change}}{\text{Rehabilitation Cost per km}}$$

The estimate of trips is derived from estimates of trips generated by district services, agriculture and fishing. The access change is the "after" rating subtracted from the "before" rating on a scale where " 0" is very poor and "5" is good. In this approach population is used as the measure of benefit for impassable roads while traffic is used as the measure for passable roads.

Another approach is to estimate social benefits as the product of the population multiplied by the prospective change in transport costs. This latter approach has been used in the recent Ghana feeder road prioritisation procedure. In this procedure two

measures of benefits are used based on both traffic (for both motor vehicles and other users) as well as on adjacent population (See Section: 8.1) In Ghana seasonal accessibility was identified as a major problem and to address this more variable situation a combined index was developed. Both the Ghana Prioritisation Index and Airey and Taylor's approach include a measure of accessibility change within the index.

In the form of multi-criteria analysis, ranking procedures may be used to combine together economic, social and environmental and other considerations in the final choice of alternatives for major road investment. The procedure has been widely used in this way in Indonesia. For each characteristic the different projects are assessed and put into rank order (e.g. 1st, 2nd , 3rd etc). This process is then repeated for the other characteristics. Weights are then assigned to each characteristic and an overall score is obtained. The process is demonstrated below in Table 3. In this table, to achieve the desired result, the ranking is presented in reverse order, i.e. the highest number rank refers to the best. (Thus for the economic evaluation, alternative 1 is the best, alternative 2 the worst, and alternative 3 is intermediate.)

Table 3. Example of Multi-Criteria Analysis

	Alternative 1			Alternative 2			Alternative 3		
	Rank	Weight	Score	Rank	Weight	score	Rank	weight	score
Economic evaluation	3	50	150	1	50	50	2	50	100
Environmental evaluation	2	30	60	3	30	90	3	30	90
Development	3	10	30	2	10	20	1	10	10
Public transport	3	5	15	2	5	10	2	5	10
Accessibility/ Severance	1	5	5	2	5	10	3	5	15
Overall score	-	-	260	-	-	180	-	-	225

Where, for two choices, there is little difference in the ranking then they may take the same overall score. In the table it can be seen that for the environment evaluation alternatives 2 and 3 are equally desirable. The overall score gives a measure of the overall desirability of the project. Here it can be seen that alternative 1 has the highest overall score while alternative 2 is the least desirable.

In the example the high weight given to the economic evaluation (50% of the total) is a reflection that the economic analysis is a combined evaluation of engineering, traffic, travel times, user benefits and identifiable costs associated with resettlement and environmental mitigation. Sometimes within multi-criteria analysis these components may be introduced separately, although if they are, then there is the danger that “double counting” of costs and benefits will result if economic decision criteria such as the NPV or IRR are also included in the final choice analysis.

Whilst it is usually possible to rank, for each characteristic, the desirability of different alternatives it is far more difficult to develop the weighting procedure. This is, of course, very subjective and best carried out through a process of wide consultation of different experts. It is important to remember that the weighting procedure should only relate to making a comparison between choices. The absolute value of any characteristic (e.g. the environment) is not being assessed.

An important weakness of the approach is that, sometimes, small differences in one characteristic can often be given undue prominence within the procedure and thus override, in the weighting process, major differences in other characteristics. In the analysis careful checks should be made to ensure that this does not happen.

4.5 The Framework Approach

The framework approach is used within the UK to determine the final choice of alternatives of major investment projects. Like multi-criteria analysis it brings together economic, environmental and other factors. In the framework approach the different effects and characteristics of a road project are summarised within a framework in such a way that the advantages and disadvantages of the different alternatives are easily seen and understood. The components are not explicitly weighted; however, through a process of paired comparisons the reasons behind the recommended choices become transparent. Inevitably within the procedure there is a danger of "double counting" the costs and benefits (or advantages and disadvantages). However, because the process is transparent and the different effects are not weighted and added up (as with the multi-criteria analysis), the user is in a position to take account of these factors and make necessary adjustments in the final choice. The approach relies on the good judgement of those involved in preparing the approach to make sensible decisions.

The framework approach may be summarised as follows:

- The key quantifiable and non-quantifiable effects and characteristics of each alternative option are summarised within a table; particular attention is given to the critical differences between the alternatives
- Alternative pairs of "project cases" are then compared together. Through comparison of the key differences, one alternative of each pair is rejected
- The pair-wise comparison is continued until one "project case" remains. This is recognised as the most desirable investment option. This alternative is then finally compared with the "base case" or "do-minimum case"
- A recommendation is then made whether the project should go ahead or not.

The factors that might be summarised within a framework analysis are likely to include many key components of the economic and environmental evaluations as well as results from participatory exercises and any other ancillary studies. Examples of quantified components that may be included are:

- VOC and time savings
- Accident savings
- Noise levels
- The number of properties within a given distance from the road
- The area of land acquisition covering different land uses
- People affected by resettlement
- Environmental mitigation costs
- Construction costs
- NPVs and IRRs
- The percentage of people that prefer each option.

Examples of non-quantifiable aspects might include statements on the following:

- Visual intrusion and the way that local amenities may be used and affected
- The effects on public transport
- The differential effects on future development
- The nature of the wider effects on the natural environment
- Severance and accessibility effects on different communities.

4.6 Funds Allocation Procedures

Within the roads sector, funds allocation procedures are used to allocate funds for road rehabilitation and maintenance to different regions and districts. The procedures may be based on bidding and negotiation between national and local authorities and road organisations or they may be based on a formula. In general the allocation of funds is not tied to network condition. Budget allocations need to be allocated amongst different levels of the road network, between rural and urban roads and finally divided among different districts. For Sub-Saharan Africa often the budget allocations for maintenance for local government roads may be given a very small fraction (i.e. between 5 and 15%) of estimated need.

Although a rational funds allocation procedure is essential to an effective road maintenance policy, the area has not been researched or widely discussed in any detail. "Allocating the funds among various levels of the network is a murky business." (Malberg Calvo 1998). In Ethiopia the allocation of the road fund for routine maintenance to the Regions is based on simply the length of the network to be maintained. Other countries adopt a more complicated approach. Characteristics such as road length, area, population and income per head will often be used. Similar formulae are used by governments in other sectors to distribute funds for the running of schools, health clinics and to cover general local government funding.

An allocation procedure proposed for Tanzania (described more fully in Section 8.4) is as follows:

Allocation index = population density + road density + Prime Minister's Office rank

The Prime Minister's Office rank provides a mark based on the stage of development. The variables are given a rank of one, two or three depending on whether their values are high, average or low. The procedure has been criticised because it does not reflect affordability or equity. Wealthy districts receive a greater allocation because of the Prime Minister's Office rank. (Malmberg Calvo, 1998, Heggie 1995).

In fact the procedure could equally well be criticised for not taking into account road condition and giving insufficient attention to traffic volumes. In reality most governments are concerned to maintain regional balance of funds going to different districts and regions. This will help ensure that the poorer, more and less populated areas of the country are not ignored in the allocation of maintenance funds. However, such an approach will tend to conflict with economic efficiency and the opportunity costs of not giving sufficient funds where needed can be very high. Unpaved road deterioration is heavily dependent on traffic levels. To show the importance of this

point a detailed examination (using the road planning model RTIM3) was undertaken of maintenance funds allocation to two districts (Trans Nzoia and West Pokot) in Kenya. Trans Nzoia is a more densely populated district with much higher traffic levels (38 % of the District road network had traffic levels above 100 vehicles per day); in comparison, West Pokot had very low traffic levels with only 1% of the road network with traffic over 100 vehicles per day.

For one district (Trans Nzoia) funds were so short and the need for routine maintenance and grading (sometimes referred to as blading) so high that only for those roads with traffic over 330 vehicles per day was regravelling economically feasible. In this case the marginal benefit-cost ratio of maintenance expenditure was estimated to be 64:1. By contrast in West Pokot funds were much more readily available and it was economic to regravel a road with only 39 vehicles per day; in this case the marginal benefit-cost ratio was only 7.4:1. This suggests that the existing funds allocation was such that to shift one dollar of funds from West Pokot to Trans Nzoia would have produced a calculated economic benefit in Trans Nzoia of over *9 times* the benefits forgone in West Pokot and the maintenance funding would have paid for itself by over *60 times*! Although one may have reservations about the engineering/economic analysis, the data presented suggests that the allocation procedure was very far from optimal.

The example shows the importance of ensuring that there is feedback between economic analysis of maintenance funding and funds allocation procedures. Even if there was desire, for equity reasons, to provide more funds to poorer, less-trafficked districts (a key point of funds allocation procedures), it is very important to realise the overall opportunity cost to the economy.

4.7 Maintenance Management Systems

Road maintenance management systems are designed to help maintenance engineers monitor the performance of the network and to plan appropriate maintenance interventions. Of necessity, because budgets are limited, engineers have long recognised the need to establish priorities between maintenance activities. Different methods of establishing priorities have been developed that, over time, have become increasingly more sophisticated and more demanding in their data requirements and use of computing resources. These different approaches have been incorporated into computerised maintenance management systems that are commonly used in different countries.

In discussions of maintenance management, different systems have been grouped as "first", "second", and "third" generation depending on their ability:

- To deal with factors such as variable section length
- To consider a number of different treatments at the same time
- To carry out an economic analysis
- To prioritise with budget constraints.

More details on the separate methods can be found in Road Maintenance Management Concepts and Systems by Robinson et al, (1998)

First generation approaches include methods based on serviceability defectiveness or the level of defectiveness compared with a treatment intervention level. The methods give priority to treatments where road conditions are most severe and are sometimes known as "worst first" approaches. There is evidence to suggest that these approaches lead to a long run increase in costs and are not recommended. Another example of first generation method is a maintenance priority based on treatment choice. An example of this is given in Tables 4-6 drawn from the Transport & Road Research Laboratory's Overseas Road Note 1 (1987). The final table presents priorities based on a combination of treatment type and traffic volume. The highest priority task is emergency work, designed to keep the road open to traffic. Obviously the heaviest trafficked roads have priority over lower trafficked roads. Although there is an economic rational behind the approach, it is relatively crude. It does not analyse the cost consequences to users or the implications for future road conditions.

Table 4. Maintenance Traffic Classification

Category	Average daily traffic	Surface type
1	Strategic roads	Paved
2	Greater than 1000	Paved
3	500-1000	Paved
4	200-500	Paved
5	Greater than 200	Unpaved
6	Less than 200	Paved
7	50-200	Unpaved
8	Less than 50	Unpaved

Table 5. Treatment Priorities

Rank	Task
1	**Urgent**
	Emergency repairs to cut roads
	Removal of debris
	Informing police of broken-down vehicles
2	**Routine drainage work**
	Clean out and recutting ditches and turnouts
	Clean out bridges and culverts
	Filling scoured areas
	Building check drains and scour controls
	Repair of structures
3	**Recurrent work on pavement**
	Dragging brushing, grading or filling of unpaved roads
	Patching, or local sealing of paved roads
4	**Periodic work**
	Regravelling unpaved roads
	Surface dressing paved roads
5	**Other routine work**
	Filling on shoulders and slopes
	Grass cutting
	Cleaning, repainting repairing and replacing road furniture
6	**Special**
	Overlaying
	Reconstruction

Table 6. Maintenance Priorities

Category of Maintenance activity	Priority							
	Traffic category							
	1	2	3	4	5	6	7	8
Urgent work	1	7	8	9	10	11	12	13
Routine drainage work	2	14	15	16	17	18	19	20
Recurrent work	3	21	24	27	30	33	36	39
Periodic work	4	22	25	28	31	34	37	40
Other routine work	5	23	26	29	32	35	38	41
Special	6	42	43	44	45	46	47	48

Second generation prioritisation methods have been developed to deal with programming budgets and take account of agency costs; they most work through the concept of cost effectiveness. Cost effectiveness may be defined in terms of the expected life and condition of the treatment divided by its costs. Different treatments can be compared in terms of the differences in performance as deterioration in condition is predicted over time. Second generation approaches do not attempt to directly measure or incorporate user costs.

Third generation maintenance prioritisation approaches apply formal economic cost-benefit analysis to maintenance management. They include optimisation of multiple options and full life cycle analysis of both road administration and user costs. The approaches can maximise the net present value of a maintenance programme subject to a budget constraint. HDM-4, including its expenditure budgeting model, represents an example of the third generation approach.

From the above it can be seen that very different systems have been, and continue to be employed to define maintenance priorities. Clearly the third generation maintenance management procedures can help allocate maintenance resources on a more rational economic basis and are perhaps most useful in helping to decide when the larger scale interventions, such as resealing or overlays, should take place. Because of the weaknesses in the underlying models they are less useful in allocating maintenance resources for the lowest volume roads when vehicle accessibility becomes a major problem or when funding is extremely limited and routine maintenance is threatened.

4.8 Preparation of the Final Programme

Computer programming techniques have been developed to determine an optimal investment and maintenance programme. The objective of the computer program might be to, say, maximise the long run economic Net Present Value (NPV) of the road investment programme subject to a set of budget constraints.

It has been pointed out that an impossible amount of computer effort would be required to calculate the effects of every conceivable treatment for a road network of any size over say ten years (e.g. it would require 6^{50000} calculations for 5000 sections for 6 treatments for 10 years). For this reason, dynamic programming methods are adopted that only examine a small number of the most favourable solutions. (A more detailed review of these issues are included in Robinson et al 1998.)

Although the Net Present Value/Cost ratio is a simple useful technique to help define the optimum solution with a budget constraint, additional calculations (using incremental analysis) are required when mutually exclusive alternative investments and treatments are to be explored. This is the case when alternative designs or alternative combinations of maintenance treatments need to be analysed.

Currently the expenditure planning module of HDM-4 can be easily used to define an optimal programme for a road programme with budget constraint for one year. For a multiple year budget constraint, a careful year by year re-specification of investment options is required.

5. The Institutional Structure

5.1 Objectives and Policy Framework

The importance of a policy framework to provide the context for all decision relating to the road network has been stressed by Robinson et al. (1998). Policies determine the course of action as to how future decisions are to be made and are clearly distinct from plans. A policy framework provides a framework of advice for policy makers, planners, engineers and technicians working at different levels within government and the road administration. It is suggested that the policy framework should be set out in a policy document and should comprise:

- A mission statement which sets out the broad goals of how the road network is to be managed. It is necessarily brief and should broadly cover the overall *planning function* and objectives of the organisation. It is usually of most concern to senior policy makers and senior management within a road administration.
- Objectives. In order to translate the broad goals into meaningful instructions it is necessary to set specific objectives for each area of the mission statement. The objectives need to be measurable, relevant, specific and achievable. Specific objectives are deemed to be of most relevance to the *programming function* of road management. Their application is most concern to professional engineers and middle level management.
- Standards and interventions levels specify detailed targets or the precise instructions as to when an intervention is to be made. The application of standards and interventions are of most concern to junior professional and technicians in *the preparation and operations function* of road management.

The division into three components is because each component is directed to a different target audience, or administrative level within the road administration.

The existence of a written policy framework does not, of course, guarantee that the objectives are consistent or logically follow from the mission statement or that the standards and interventions that are applied logically follow from the specified objectives. In practise written statements, particularly relating to the higher level objectives, may bear little relationship to reality.

Each management and professional group have their own vested interests. Both the Policy Framework itself and its application in practise will influence the security,

professional status and the income earning opportunities of each group. Clearly, where possible, pressure will be exerted to meet the interests of each group. Unnecessarily high road standards are an obvious example.

5.2 Improving Performance and The Management Of Change

5.2.1 The hierarchy of management issues

It has been recognised that in the 1970s and early 1980s many attempts to improve road management resulted in failure because effort had been primarily directed towards improving the technical capacity of organisations without ensuring that the institutional capacity or the wider environment could support change. Clearly without addressing issues such as inadequate institutional funding, poor pay and poor morale improved technical training of professional staff may be of very little use.

A study of several road organisations suggested that there was a hierarchical relationship, in the form of a pyramid, between technical factors, institutional factors and external factors. External factors are the foundation of the pyramid and little progress can be made in the institutional or technical development of the organisation unless the external environment is adequate. Likewise an adequate institutional structure is required before technical change can be developed. (Brooks et. Al. 1989).

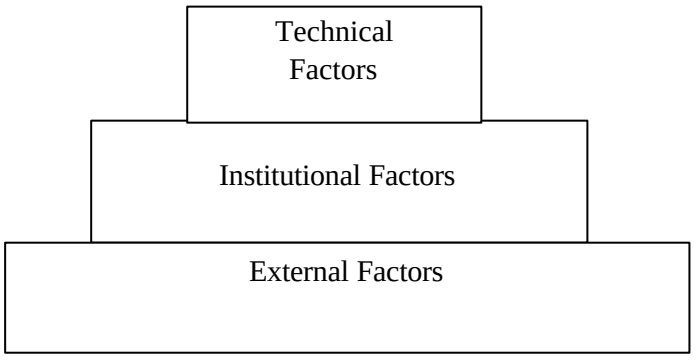

Figure 2. The Hierarchy of Management Issues (From Brooks et al, 1989)

5.2.2 The Road Management Initiative (RMI)

The Road Management Initiative (RMI) identified the following four key components to improving the performance of road maintenance in Africa (Triche 1996):

- Creating ownership, by involving road users in the management of roads
- Stabilising finance, by securing an adequate flow of funds
- Clarifying responsibility, by establishing who is responsible for what
- Strengthening the management, by introducing private sector management systems and procedures, and enforcing managerial accountability.

Specific recommendations for improving the operation and management of road agencies have been identified for:

- Staffing reform, through the introduction of competitive salaries
- Contract maintenance. All periodic and most routine management must be made by contract

- Labour based methods. These represent an effective tool for improving maintenance and improving employment
- Privatisation of plant pools. Reform of publicly owned pools has not been successful. It is now recommended that pools should be privatised so users (public or private) can lease equipment as needed.

5.2.3 Functional separation and competition

In common with other public sectors of the economy there have been substantial changes within the road sector, in recent years, to improve efficiency through the more widespread adoption of more market orientated policies. By their very nature roads cannot be completely privatised. For most countries there is no satisfactory way of directly charging for more than a tiny proportion of the road network. Roads have to be planned and controlled by public bodies. However, it is possible to functionally separate higher level planning and administration from maintenance operations and the latter can be undertaken by competitive contracts.

Organisation roles can be split into the following categories:

- Owner. The owner is typically a ministry, department or local authority with overall responsibility for network
- Administrator. The Administrator is typically a Roads Authority or Agency responsible for implementing policy
- Manager. The manager is responsible for specifying activities, letting contracts, and supervising and monitoring work. In most instances this is done with the Roads Authority but in some countries this activity may be contracted out to consultants
- Contractor. The contractor is responsible for directly undertaking the physical work on network.

Although there are examples to the contrary the balance of evidence points to substantial savings if road maintenance is undertaken via competitive contract rather than being carried out “in-house” by force account. It is reported that Brazil has reduced road maintenance costs by 25% for equivalent service quality through switching from force account to maintenance by contract (World Bank, 1994). Zietlow (1998) suggests that savings of more than 50% of maintenance costs per km can be achieved when contracting is used compared with using the road administration’s own work force. However, in evidence he quotes an example from Australia where cost savings of up to 41% per km have been achieved.

Some authors argue that the separation of functions and the letting of competitive contracts will give efficiency benefits and that in-house operations can also improve their efficiency and successfully compete provided managers are given sufficient flexibility and that there is a minimum of political interference. (Parkman et al, 2001).

Although it is relatively unusual it is possible for the management, programming and planning functions to be undertaken by consultants under a long term contract. An example is Berkshire County Council where the management of the road network was let out to contract.

5.2.4 The Management of the rural road network and decentralisation

For the management of rural transport infrastructure, Malmberg Calvo (1998) stresses that an effective strategy needs to address the following issues:

- Who should own local government roads and community roads and paths?
- How can capacity for managing these be economically mobilised at the local level?
- Who will provide a steady source of funding especially for maintenance?

Because the management of rural infrastructure must be local in character strengthening local institutions is seen as a key component. Key symptoms of rural transport problems are seen as:

- Unclear responsibilities
- Disintegration of the planning system
- Insufficient and uncertain maintenance funding
- Inadequate local capacity
- Inappropriate design standards and methods

Connerley and Schroeder (1996) stress the lack of local capacity in Africa and that assigning "ownership" to local communities is unlikely to be successful. They also point out that the existing planning system is "vertically" or sectorally orientated, not "horizontally" across sectors.

There is currently a world-wide trend towards delegation of decision making relating to the rural road network through either decentralisation of authority to local authorities or through deconcentration of central authority to the regional or local office of the Ministry or Department. The justification for these changes has been to provide greater transparency, accountability, responsiveness, probity, frugality, efficiency, equity and opportunities for mass participation. Decentralisation is seen as a way to simplify complex bureaucratic procedures, increase sensitivity to local conditions and needs, help national government ministries reach a wide range of groups in decision making and help increase political stability through allowing citizens to have more control over public programmes at the local level (Stiedl and Robinson, 2000).

Unfortunately the evidence suggests that few of these benefits have been achieved so far. The assumption has been that rural road activities are simple and straightforward to manage using local population and skills. However although rural roads may be technically less complex than main roads the management and procurement problems are just as complex and planning problems are very far from being simple.

Road investment projects are often much larger in scale than other programmes that might be managed at the local level. The lack of success in this area is not confined to the road sector. In a large number of developing countries there is a severe shortage of funding and administrative and technical capacity at the local level. Furthermore local governments often have limited political influence at the national level in order to overcome these problems. (Stiedl and Robinson, 2000).

PART B: APPLICATION

6. ORGANISATIONS

6.1 THE MAIN FRAMEWORK

Primary responsibility for roads is usually within the remit of a sector Ministry, which may also cover other sector issues. Examples include the Ministry of Roads and Transport, the Ministry of Works, the Ministry of Works, Transport and Communications and Le Ministere des Travaux Publics et de l'Energie. Historically, many road sector Ministries have evolved from an erstwhile colonial Ministry of Public Works, which would have had responsibility for all infrastructure programmes, as well as parastatal construction and transport companies. Over time, political and administrative expedient has been responsible for the restructuring of the responsibilities of Ministries. For example, the Ghanaian Ministry of Roads and Highways was recently been merged with the transport wing of the Ministry of Transport and Communications to create the new Ministry of Roads and Transport. (Yet more recently, this merger has been revoked.)

A Ministry's primary role in its responsibilities for roads lies in policy development programme budgeting and financial control. The tasks involved in road administration are assigned to either a Department of the Ministry, or (increasingly in recent years) an Agency of the Ministry.

An Agency is a more autonomous body (than a Department), whose constitution will be backed by legislation setting out its purpose, objectives, means of support, obligations, etc. An Agency is a step along the road towards full privatisation of the executive responsibilities of roads administration. There are few examples of full privatisation in the developing world (though see Section 6.3.4 on Zambian local roads), but models do exist in the industrialised world (for example, the contracting of engineering services to the private sector by many local authorities in the UK).

A Department is an operational wing of the Ministry, and as such it will be more closely associated (than an Agency) with the Ministry itself. The Department's role, purpose and obligations are likely to be encoded through Ministerial powers and duties, as enacted by Parliament.

6.2 WHICH MINISTRY ?

Roads fulfil both national and local functions. This difference is reflected in the issue of where Ministerial responsibility for their development should lie. Local roads (i.e. non-trunk roads at District and Municipal level) development is closely identified with urban and rural development, and as such within the remit of the Ministry of Local Government (or its equivalent). This distinction is not always clear-cut, or is still in a state of transition. In Ghana, all roads are still essentially administered through the roads ministry, though the plan is to decentralise responsibilities for local roads to local administrations. In many other countries (e.g. Zambia and Sri Lanka) decentralisation is complete in the sense that local roads are now the responsibility of regional and district administrations which come under the purview of the Ministry of Local Government.

This issue of ministerial responsibility does cause tension; one model for its resolution is that adopted in the UK where a 'super-Ministry' (the Department for the Environment, Transport and the Regions - DETR) has been created to cover both local and national transport issues, as well as regional and local government issues. The Highways Agency, which comes under DETR, administers the designated national trunk network, while all other roads are administered by local highway authorities.

6.3 Agency or Department?

In separating from government the functions of road administration, the sector Ministry is left with responsibility for policy, legislation and budgeting. The body tasked with the administration of roads takes on the responsibility of delivering (on behalf of the government) the mission for the road sub-sector by meeting defined objectives and carrying work out to meet agreed standards. This body, in principle, can be a public (Department), parastatal (Agency or Authority), or a private organisation. It is outside the day-to-day control of ministers, but still publicly accountable for its activities, both to the Minister and to Parliament. The relationship between the sector Ministry and the road executive body is defined closely by legislation: in general, ministers can publicly issue specific policy directives and the executive body is responsible for carrying these out. Similarly, the executive body can publish the proposals they make to the ministry for new policy initiatives and also their budget proposals.

6.3.1 Tanzania

Over the last ten years there have been a series of major changes in the management of the road network in Tanzania. During the early 1990's a number of studies had emphasised the need for "adequate road maintenance, adequate remuneration of staff, increased delegation and decentralisation, the separation of executive and regulatory function, avoidance of duplication and a more businesslike approach" (SSATP/ RMI Country Coordinator Reports, Lyatuu and Haule, 2001).

In the early 1990's the Department of Roads & Aerodromes (DRA) was totally dysfunctional. It had over 200 qualified engineers, but they were paid such pitiful salaries that they were demoralised and forced to find other ways of supplementing their incomes. In 1991/92, the overall salary range for engineers was $928 to $957 per year. More specifically, a graduate engineer with 3 to 4 years experience received a total remuneration package (including allowances) of about $70 per month (in 1970 they were paid $250 per month), while their counterparts working for local consultants and contractors received $350 per month. The salaries of senior staff were little better. The total remuneration package of the Director of Roads was only 40 percent that of the Managing Director of the railways, while the salary of the former Director of the plant pool increased 10 times when the plant pool became autonomous.

DRA could not have implemented the First Integrated Roads Project (IRP-I) with their own resources. Consequently, nearly 40 expatriate engineers were financed under the project to effectively take over management of the main and regional road networks. A process of debate and consultation was also started to try and find a solution to the above problems. The debate was largely orchestrated by the RMI

programme and was supported by several small studies which looked at specific aspects of the problem. Among other things, the studies looked at the road legislation to see what options were available for strengthening the road agency, and they also looked at DRA's organisational structure.

Over a period of time a series of reforms took place transfer the Directorate of Roads into an autonomous and commercially orientated agency. The reforms included

- Assignment of responsibilities between different Ministries with road responsibilities and implementing agencies. A Department Roads was established within the Ministry of Works; its role was to defined as policy formation, regulations and monitoring. A Central Roads Board (CRB) and Regional Roads Boards(RRBS) were established to advise on the management of the main and regional road networks.
- Involving private sector in the execution of road works (previously the job of direct labour). A deliberate policy of contracting out maintenance was adopted. Arrangements were made to allow for small village contractors and local communities to contract for road works.
- Involving road users in the finance of road maintenance. A dedicated Road Fund was established to meet the costs of road maintenance through the use of a fuel levy.
- The commercialisation of the supply of road works plant and equipment. The Ministry of Works plant was transferred to a Plant and Equipment Hire Company (PEHCOL) initially owned by the Ministry of Works. The formation of other private plant pools were encouraged through Government statements.
- Implementation of an interim performance based incentive scheme for roads staff .
- Carrying out of a study on terms and conditions of employment for roads staff in other regional countries and, based on that, developing and implementing an adequate remuneration package for DRA staff.
- Undertaking a series of studies to define the most appropriate organisational arrangements for the road network including the possibility of creating a semi-autonomous road agency.

A Roads Fund Board was established in 1999 to administer the Road Fund. It consists of nine members drawn from the private and public sector. The government is represented by the Permanent Secretaries of the Ministries of Works, Finance, Presidents Office of Regional Administration and Local Government (PORA & LG). The Director of Trunk Roads, Ministries of Works is also a member. The private sector is represented by representatives of three road user groups (Tour Operators, Federation of Cooperatives, Truck Owners Association).

The process of establishing a Roads Agency was facilitated through the appointment of an Agency Implementation Team by the Ministry of Works. The Tanzania National Roads Agency (TANROADS) was established in mid 2000. It was formed under the Executive Agency Act of 1997 as a semi-autonomous agency. In a phased programme it is in the process of taking over responsibility for managing the trunk and regional roads network (totalling about 35,000 km) from the Department of Roads.

Since its formulation it has been recognised that the Road Funds Board (RFB) has strategic management responsibilities. The Chief Executive of TANROADS is responsible to the Chairperson of the RFB for maintenance work. For new road construction financed by other resources than that of the Road Fund the Chief Executive reports to the Permanent Secretary of the Ministry of Works. The Ministry of Works still maintains an overarching responsibility for the road network including the formulation of policy, planning the regulation and monitoring of contractors, co-ordination of donors.

6.3.2 Agencies and Departments in Ghana.

Ghana is perhaps unusual in having a mix of both Agency and Departments to administer its road sector. The sector Ministry of Roads and Transport (MRT) has the following organisations within its roads remit: Ghana Highways Authority (GHA), Department of Feeder Roads (DFR), Department of Urban Roads (DUR), Road Fund Board (RFB), Accounting and Management Information Systems Unit (AMISU).

The erstwhile Ministry of Roads and Highways (MRH) had been created in 1982 to take over the responsibility from the Ministry of Works and Housing for the two road agencies then in existence, namely GHA and DFR. GHA was established in 1974 by decree and was originally responsible for all highways. DFR and Department of Urban Roads DUR were subsequently created in 1981 and 1988 respectively, to provide a specialised focus on feeder and urban roads. The basic legislation governing the road sub-sector has recently been amended (Roads and Highways Act, 1997) to reflect the new institutional structure, whereby many of the powers and responsibilities originally assigned to GHA have been taken over by DFR, DUR and MRH.

MRT is responsible for the formulation of road sector strategy and policy in addition to monitoring the performance of GHA, DFR and DUR in terms of budgeting, accounting and contract administration. AMISU was established in late 1994 to improve financial management in the sector through more effective disbursement, accounting, monitoring and reporting procedures. Currently AMISU is responsible for donor funded projects, though under the current Highways Sector Investment Programme this role is being expanded to cover all sector finances.

MRT is responsible for the annual preparation of:

- A five year strategy document, which sets out planned road development expenditure, as well as past performance.
- The budget estimates (recurrent and development)
- The Donors' Conference Report
-

These documents are largely based on data provided by the road agencies.

The GHA is administered by a Board of Management consisting of seven representatives from the public sector, a member of the Institution of Engineers, a representative from the Ghana Private Road Transport Union (GPRTU), and a Chairman. As noted earlier, in 1982 MRH was created to co-ordinate all works in the road sub-sector. Around the same time, there was a change in Government policy that

resulted in the creation of Interim Management Committees for all public Corporations including GHA. Government has now reinstated GHA's autonomy and Board, with the enactment of new legislation governing GHA's responsibilities, powers and duties in 1997. It now has greater private sector road user representation to encourage the Authority to become a more commercial, customer-oriented body.

DFR was created to take responsibility for a network of some 22,000km of feeder roads, while DUR was established to take over responsibility for roads in the five main cities: Accra, Kumasi, Sekondi-Takoradi, Tema and Tamale. Both Departments are scheduled to decentralise their activities to District/Municipal level, though the process is protracted. This may be due to inertia in the system, and a lack of local resources and capacity. Funding for local roads is still channelled though MRT rather than the Ministry of Local Government or from District/Municipal sources. The plan is that ultimately DUR and DFR will shed their implementation activities, and become small planning and advisory units within MRT.

Against this background, it is clear that the role of the Roads Departments is gradually changing, and that their scale of operations will diminish over time. However, this strategy does not completely resolve the underlying issue of where responsibility for local roads should lie, because presumably there will continue to be a division of responsibility between the Ministry of Local Government (funding) and MRT (planning and advisory), as long as the two roads departments continue to function.

6.3.3 Delegation to a Specialised Agency in Francophone Africa

There are benefits in 'sub-contracting' all or part of the road management functions to a specialised agency which can assume them under an agreement stipulating that certain results are to be achieved. These are peculiar to Francophone Africa and include cases in Senegal, Benin, Malagasy, Burkina Faso, Mali and Niger. In each it was necessary to create an executing agency and to delegate to it the necessary project authority under a negotiated agreement. There were no private local firms capable of performing this function, and since foreign firms specialising in contract management were generally not familiar with labour-based methods, they would probably have been expensive for providing services that did not correspond to the country's real needs. In all these cases, the agency has been accorded the status of a non-profit private association (of the type provided for under the French law of 1901). This status has two advantages:

- It has the status of a private company, meaning that:
  - It can operate along commercial lines, and is consequently not obliged to follow cumbersome public procurement procedures
  - It is independent of government
- It may hire, fire, and pay its staff without having to conform to civil service rules of employment or salary bands
- The agency does not seek to make a profit - this is very significant in the Senegal AGETIP case because it means that the selection of sub-projects for execution was not based on commercial considerations
- It also facilitated the conclusion of a negotiated agreement between AGETIP and the government

Where there is competition among management agencies, it is better to give them all ordinary commercial status.

The internal organisation of such an agency is flexible, and its management transparent. The board of association is composed of well-known figures or representatives of public-interest associations, and does not include any government representatives. In some AGETIP agencies, the Director General is the chairman of the association. However, in all cases, the Director General is the real executive head of the agency. He is chosen by the board, and is delegated very broad powers. He cannot be removed by the board except in very serious cases, but is required to provide monthly and quarterly activity reports to the board, the government, and to the donors where they are involved. The agency's activities are the subject of six-monthly management, financial and technical audits.

Delegation of project authority to an AGETIP-type of agency may not be all-embracing nor permanent. For instance, a road administration can at the same time manage directly most of its programme of works, and delegate authority on training projects designed to develop small contractors. The flexibility of the agency, and its familiarity with the issues that newcomers have to face can make the training programme more effective. At the same time, the delegation reduces pressure on the road administration's own staff, which may be important in some circumstances, such as when implementing a new road maintenance programme.

The use of an AGETIP-type of agency, whether regular or temporary, does not preclude the need for an overall review and reform of the institutional set-up of the owner-authority. However, it can show the usefulness and efficiency of streamlined procedures, and facilitate any decision to reform. Use of this approach is not a reason not to reform.

Broad delegation: AGETIP in Senegal. The Framework Agreement between the Senegalese Government and AGETIP delegated to AGETIP, on precise terms, the selection of sub-projects to be carried out on behalf of municipalities, centralised or decentralised road authorities, and others. These beneficiaries subsequently delegated project authority to AGETIP. This type of delegation is exceptional; the usual practice is for the owner to reserve the right to select the sub-projects to be carried out. The reason for this option being chosen was that it was thought desirable to take the selection of sub-projects out of the hands of the politicians at a time when the unemployment situation was particularly acute. The same powers of delegation have also been given to similar agencies in Burkina Faso, Mali and Niger.

Restricted delegation: AGETUR in Benin and AGIR in Malagasy. AGETUR was appointed as the owner's delegate by the Benin Government for an urban works programme making maximum use of labour-based methods. The programme is determined completely by the owner (government, city hall, etc.) and AGETUR's mission is to procure engineering services and manage the respective contracts for design and supervision, as well as the contracts for works. This type of activity is identical to that delegated by beneficiaries to AGETIP, and is exactly comparable to that carried out by a contract management firm in an industrialised country.

AGIR is a private organisation which has been set up as an interim measure while contract management capability is being developed by the Ministry of Public Works. The objectives of the agency, which will act as the owner's delegate, are as follows:

- Completion of rehabilitation works on high traffic sections of the road network
- Development of small and medium-sized contracting firms
- Setting up an efficiency reference in the management of contracts by the public service
- Employment creation in the building and public works sectors

The agency has statutes (articles of agreement), by-laws, a manual of procedures, and a framework agreement that delegates project authority. But AGIR organises the procurement, and in particular the slicing and packaging of lots, in order to use the capacities of the local contractors and consultants, award of design contracts, supervision, and for works execution. It then manages these contracts and pays for performance achieved from a special bank account opened under the agency's name.

6.3.4 Zambia: Managing Urban and Rural District Council Roads with Private Participation

Zambia has 15,980 km of rural roads managed by 48 rural district councils (average 333 km per council) and 3,625 km of urban roads managed by 8 urban district councils (average 453 km per council). As in many countries, these networks are far too small to support viable district road agencies, even when all infrastructure services are combined at the district level.

When the National Roads Board (NRB) took over management of the road fund in Zambia, they invited the districts to submit maintenance programmes for their (the NRB) consideration. The proposals which they received left a great deal to be desired. They typically consisted of a list of road names with a financial figure next to them and a total figure for all roads combined. There was no assessment of road conditions and no details of the proposed maintenance works. There was furthermore no indication of how the work was to be done, no specifications, and no contract documents. An added concern, was that the NRB felt unable to monitor the works being done by 61 councils all over the country.

The NRB therefore approached the Association of Consulting Engineers of Zambia (ACE) and asked them to help prepare acceptable maintenance programmes on behalf of the districts. This they agreed to do on the basis of a TOR which required them to work with the councils and:

- Agree on a programme of road maintenance and order of priority.
- Agree on procedures to be followed in calling for tenders.
- Assist in tendering and evaluation.
- Negotiate with winning tenderers.
- Agree on the selection of contractors.
- Negotiate and agree on terms of contract.
- Ensure implementation to a set time frame and deadlines.
- Assist and monitor progress of road works to ensure total quality management.
- Certify payments at each stage of road works on having been completely satisfied as regards quality of work done.

- Assist councils to undertake measures to control and reduce costs of road works and maintenance through consulting services.
- Advise councils on undertaking preventive maintenance activities to promote the quality and life span of road infrastructure.

Another innovation, was that the ACE agreed to the following performance indicators for their members (which have already resulted in one consultant being dismissed):

- Quality of the programme drawn up.
- Time frame for implementation.
- Unit costs of road works undertaken.
- Quality of work done.
- Volume of work done.
- Public relations and involvement of the local community.
- Preventive maintenance activities.

The ACE also agreed to a concessionary fee scale of 2.5 percent of total value of works, instead of the usual legislated fee which often runs up to 15 percent.

Bids were next invited from members of the ACE to act on behalf of all the districts in each province. Firms were selected by the NRB and the concerned districts, and one firm was appointed per province under a local government service contract (i.e., the contracts are not with the NRB). Within each province, a single consulting firm now works with the districts, prepares their maintenance programmes, prepares bid documents, helps them select contractors, and supervises implementation. Work done under contract is fully reimbursed by the NRB. When a district does work using in-house units (mainly confined to pot-hole patching), the NRB only pays for materials after certification that the work has been done according to specification. All work financed from the road fund is finally subjected to both a financial and technical audit.

Another innovation, is that the NRB has now opened provincial bank accounts. Once funds have been committed to a council, NRB now transfers the funds into the provincial account. Payments to contractors are then certified by the consultant and checks can be drawn on the provincial bank account on submission of a check carrying the signatures of the consultant and the concerned district council. This arrangement has had a surprising side effect. Since the district council cannot draw on the money for salaries and unauthorised expenditures, the districts are now inviting local business interests to add money to the account to extend the scope of present maintenance operations. The NRB has offered to match any deposits made by local business interests.

The above arrangements appear to be working well and visits to selected district councils have confirmed that all parties appear satisfied with the arrangement. Consultants are now considering what to do in the long term, including the possibility of turning the present contractual arrangements into an ongoing externalisation programme (at least at the district level).

6.4 Road Funds and Road Boards.

The establishment of Road Boards is not a new development, but there has been growth in their number in recent years with the advent of Road Funds and associated need for its (the fund) administration through an independent body which usually takes the title of a Road Fund Board or Road Board. Thus some Boards (in general the earlier established) have more of an advisory role to the sector ministry, while others have a more powerful role is administering funds and fund allocations. The latter are in theory set up as independent bodies outside the direct control of the sector Ministry. Their constitution, purpose, objectives and procedures are enshrined in law. The prime role of the Board is to administer a Road Fund. The Board is likely to have ex-officio members representing road users, financial institutions and central and local government. The sector ministry is represented, and may also provide the secretariat, though in the interests of independence this may not be the most satisfactory situation.

6.4.1 The Ethiopian Road Fund Board

An Ethiopian Road Fund Board was established in 1997 to fund road maintenance. The Road Fund Board is composed of five representatives from the Federal Government, six from the Regional States and four from the private sector. The Board plans to have 12 professional staff out of 22 staff in total. All routine maintenance has been funded by user taxes collected by the Board. From 2001 the Fund will begin to fund periodic maintenance.

The Road Fund Administration office collects money from a fuel levy and from an axle load charge and an overloading penalty. The proposed charges need approval from the Ministries of Finance and Transport and the Road Transport Authority. The road agencies are responsible for planning road maintenance and requesting funds. Before distributing funds the Board determines whether the requests are technically justified. The distribution of funds is on certain criteria. Dispersements depend upon progress made. However, there is a lack of capacity in the country (particularly in the private sector) to undertake maintenance and road work.

Since the introduction of the Fund the allocation for routine maintenance has increased from 110 million Birr in 1997/98 to 194 million Birr in 1999/00. It is now reported that Ethiopian Roads Authority (ERA) is now receiving maintenance funding up to its absorptive capacity.

The private sector transporters and Board members will put pressure on ERA to improve certain roads this has happened particularly with the diversion of traffic from Assab to Djibuti. But the Board does not allocate money to specific roads. At the margin it can allocate so much to different traffic categories to fit the budget.

The current allocation of funds is as follows:

11 municipalities	10%
9 regions (rural roads)	20%
ERA (main roads)	70%

This allocation can change year to year. The decision will be based in part by performance, a key issue is whether the money can be spent. The Regions have different road standards but roads below 30 vehicles per day are not included in the programme. Funding to the Regions is based on kilometres of road to maintain. In

recent years the Regions have had difficulty in spending allocated funds. There is special assistance to help some regions (currently four need help) with preparing plans. There is the possibility of establishing a community road fund for small traffic roads. One per cent of the funds (out of the 20 per cent) are kept for the smaller regions who do not have classified roads (there are 30,000 km of unclassified roads) who can distribute money as they think fit.

Office staff of the Board are financed directly from the Ministry of Finance. Accounting is on a quarterly basis. The agencies must report back (in physical and financial terms) to the Board on progress before they get the next quarter's money. The money is transferred in two weeks. All agencies must keep the road fund money in a separate account. These accounts are not limited by the Government end-of-fiscal year accounts so money is transferred to the next year.

There are plans to contract out financial and technical audits. The reports submitted must show what work has been done on which roads. Major problems are likely to occur with the technical audits. It has recognised that the many of technical reports have been grossly incorrect. The agencies have been warned and if the report are found in future to be wrong the Fund will not pay.

6.4.2 The Board of FinnRA

In Finland, a management board for FinnRA was established in 1990. The board was set up with three main objectives in mind, namely:

- To formally involve the public in discussions on road sector development, to strengthen concern for environment, to improve the effectiveness and efficiency of FinnRA, and to road planning more transparent.
- To separate co-ordination and policy formulation from operational management of the road network.
- To bring the Ministry of Transport and Communications into the overall management of FinnRA.

The board consists of a chairman and seven other members. The Director General of Roads is chairman of the board and the other seven members include representatives from the Ministry of Transport, Ministry of Environment, municipalities, Confederation of Finnish Industries and Employers, the road transport industry, and two persons representing FinnRA staff. The Vice-Director General of roads acts as Secretary to the board.

6.4.3 The Ghana Road Fund Board

The Ghana Road Fund was established under an Executive Decree in 1985 and was administered by the Ministry of Finance. Releases for maintenance works was not in conformity with the planned annual maintenance programme of the road sub-sector. This situation created budgetary problems in the sector and seriously undermined the objective of clearing the backlog of maintenance works, and thus putting the funding of road maintenance activities on a sustainable financial basis. Restructuring of the administration of the Road Fund has recently been completed, with the passing of the Road Fund Act (1997). The key elements of this restructuring were:

- Putting the administration and management of the Road Fund under the Road Fund Board on which road users are represented
- Increasing revenues paid into the Road Fund through road user charges
- Ensuring that the first charge on the Road Fund is for preservation of existing assets (routine and periodic maintenance)
- Using clear and consistent procedures for dividing funds, disbursement, and auditing.

The annual average for the period (1991-1995) before the new road fund policy became operative was about US$22 million. In 1996, there was a 35 percent increase over the 1991-1995 annual average. It is expected that by the year 2002 the required financial outlay for the funding of maintenance will be completely covered from the Road Fund.

The Road Fund management board is responsible for the disbursement of the road fund in accordance with each road agency's approved annual maintenance programme. The incidence of unplanned works being executed at the expense of approved programmed works, with its associated budgetary distortions, will be very unlikely.

The Road Fund is one of the main sources of revenue available to the road agencies and is a user charge made up as follows:

- Fuel Levy
- Motorway Tolls
- Bridge Tolls
- Ferry Fees
- Vehicle Inspection and Examination Fees
- Transit Fees

Although the fuel levy has been periodically reviewed, the portion going to the Road Fund has not fully compensated for the decline in the value of the cedi. As a result, the fuel levy expressed as a percentage of the retail price fell from a peak of 7.5% in 1992 to 3.2% in 1995. As part of its remit the Board is committed to ensuring an annual increment in real terms of the Road Fund through an increase in the fuel levy from 0.04US$ per litre in 1996 to 0.095 US$ per litre in the year 2002. In 1997, the fuel levy was increased to 0.05 US$ per litre.

The monies from the fuel levy are collected by the Ghana National Petroleum Company, which deposits the monies directly into the Road Fund Account at the Bank of Ghana. Monies for vehicle roadworthiness testing and road tolls are similarly deposited by the Vehicle Examination and Licensing Division of MRT and GHA respectively. The Board is responsible for accounting for the expenditure of these monies, and for an annual financial and technical audit to be undertaken. Disbursement cheques can only be signed by the Minister (Board Chairman), the Deputy Chairman or the Secretary (MRT Chief Director), with the prior approval of the Board The monies can only be used for routine and periodic maintenance.

6.4.4 Japan Road Council

The Japanese Roads Council is one of the oldest roads board and was established under the 1952 Road Law which lays down the basis of road administration in Japan. The Council advises the Minister of Construction on the contents of the road improvement programmes (mainly the 5-year road improvement programmes), national highway master plans (excluding those dealing with national expressways), national highway route designation, and the overall structure of the road network. In recent years, the Council has submitted important proposals for planning and implementation of the 5-year road improvement programmes and has also prepared several reports concerning the way the Ministry should manage the toll road system.

The Council consists of a chairman and 15 members. The chairman is President of the Japan Road Association (formerly an under secretary at Ministry of Construction) and the 15 members include representatives of the motor industry, business community, trades unions, academia and local government. Much of the substantive work of the Council is carried out by two sub-committees. One deals with road policy (chaired by the President of the Institute of Highway Economics), while the other deals with toll roads (chaired by a professor from Nihon University). The Council has no permanent secretariat.

6.4.5 South African Roads Board

The National Road Board was originally established under the 1935 National Roads Act. The Act was amended under the 1948 Transport (co-ordination) Act, and the Board became the National Transport Commission (with wider responsibilities). Finally, this Act was amended under the 1988 South African Roads Board Act, which established the current South African Roads Board (SARB). The Board established under the 1988 Act, consists of a chairperson and seven members who are appointed by the Minister of Transport, Posts and Telecommunications. The director general, transport, is *ex officio* chairperson of the Board, and the deputy director general, transport, and the chief director, national roads, are also members of the Board. The remaining five members represent provincial road authorities, city councils, road users, the engineering profession, and industry and commerce. These members are appointed after consultation with their respective constituencies.

The Board has two subcommittees. One, the Urban Transport and Planning Advisory Committee, reviews the transport plans prepared by the core cities of the metropolitan transport areas and makes recommendations on these plans to the Board. This subcommittee also manages the Urban Transport Fund. The other, the Toll Road Committee, advises the Board on all matters pertaining to toll roads.

The above arrangements are currently under review and the membership of the Board has recently been increased to broaden its membership, and it has also been decided to replace the *ex officio* chairperson (the Director General of Transport) with an independent chairperson.

The main purpose of the SARB is, subject to the provisions of the 1948 Act (as amended in 1988), to promote and encourage the development of transport in South Africa and, where necessary, to co-ordinate various phases of transport in order to

achieve the maximum benefit and economy of transport services to the public. The main objectives of the Board are defined as follows:

- To design, build, and maintain a national network of freeways and other roads, including toll roads;
- To compile a priority list of roads to be built or improved;
- To design and build various special roads that are in the national interest;
- To set geometric standards for the construction of national and special roads;
- To preserve the environment;
- To expend available funds in the most cost effective manner in the provision of a primary road network;
- To do or initiate research, whether in South Africa or elsewhere, in connection with the design, planning, or construction of roads;
- To grant bursaries or subsidies to enable persons to study or do research on any subject in connection with roads;
- To advise the minister, at his request, on questions relating to roads that may be raised by the government of any other country or territory;
- To provide rest and service areas, in conjunction with private enterprise, at strategic points on national roads in order to promote road safety.

The Department of Transport is charged with carrying out the executive and administrative work necessary to enable the SARB to carry out the duties and functions assigned to it.

6.4.6 Tanzania: Central Roads Board

The Board was established on 7 January, 1994 as a body corporate which:

- Has perpetual succession and a common seal
- In its corporate name, is capable for suing and being sued
- Is capable of purchasing and otherwise acquiring or alienating any movable or immovable property
- Has power from time to time to exercise and perform such other powers and functions as are conferred by the minister.

The Board consists of a chairperson and eleven members. The chairperson and one other member are appointed by the minister. The director of roads is also a member and acts as secretary of the Board. All other Board members are nominated by the organisations they represent.

Board members include five representatives of principal secretaries (Works, Communications and Transport, Finance, Local Government, Home Affairs, and Planning Commission), four representatives of the private sector (Chamber of Commerce, Institution of Engineers, Roads Association, and Automobile Association), and one member appointed by the minister. The Board elects its own vice-chairperson. The Board has a full-time secretariat in the office of the director of roads.

The function of the Board is generally to advise the minister (of Works, Communications and Transport) on matters pertaining to management and financing of roads, operation of the Road Fund, and any other matters which the minister may

from time to time refer to the Board. Specifically and without prejudice to the generality of the foregoing, the Board shall:

- Advise the ministry on suitable management systems for roads;
- Advise the ministry on issues of staff motivations;
- Examine the operation of the Road Fund and advise the ministry on suitable arrangements for disbursement of adequate funds to end users;
- Examine existing laws governing the operation and management of the road network and advise the ministry on necessary amendments.

The Board shall in the performance of its functions have regard to:

- Any general policies of the government notified to it by the minister; or
- Any general or specific direction given by the minister.

In the performance of its functions, the Board is required to establish and maintain a system of co-ordination, co-operation and consultation with other bodies, within or outside Tanzania, which have similar or related functions.

6.4.7 Zambia: National Roads Board

The NRB was established through Statutory Instrument on 24 February, 1994 under the Roads and Road Traffic Act. The Board consists of five *ex officio* members representing government ministries (Finance, Works and Supplies, Transport and Communications, Local Government, and National Commission for Development Planning) and seven members representing the private sector (Chamber of Commerce, road transport industry, Automobile Association, farmers, Institute of Engineers, Institute of Transport, Copperbelt University). All Board members are nominated by the organisations they represent. The Board elects its own chairperson and vice chairperson,. The day-to-day affairs of the Board are managed by an Executive Secretary and they are expected to have no more than four additional staff to deal with finance, planning, and inspection or auditing.

The order defines the main functions of the Board as follows:

- To administer and manage the Road Fund;
- To prepare and publish audited annual accounts of the Road Fund;
- To recommend to the ministers (for Communications and Transport, Works and Supply and Local government and Housing) additional fuel levies and other road user charges as required;
- To recommend projects for donor funding to the minister;
- To allocate resources for road maintenance and rehabilitation for various classes of roads as may be determined by the ministers;
- To recommend funding for the development of new roads;
- To provide guidance and technical assistance to various road agencies;
- To receive and consider reports from road agencies on their activities and prepare quarterly and consolidated annual reports;
- To prepare and award contracts, certification of payments, and advise the ministers accordingly;
- To review design standards and classification of roads and traffic sign for approval by the ministers;

- To prepare and review terms of reference and guidelines for the various road authorities and budget guidelines;
- To recommend to the ministers the granting of highway authority to any person or institution;
- To plan, manage, and co-ordinate the road network in the country;
- To review from time to time the status of road agencies and recommend appropriate action to the ministers, and make recommendations in relation to the siting of buildings on roadsides.

During the first 12 months of operation, the Board established its basic working arrangements. It manages the road fund in an executive capacity, accounts transparently for use of funds, and advises the Minister of Communications & Transport on all matters spelled out in the above Statutory Instrument. It reports to the Minister of Communications & Transport who endorse the recommendations of the Board and, where relevant, carries them forward to the Cabinet for their action (e.g. on recommendations concerning the level of the road tariff).

The Board does not directly plan road works or play any part in their physical implementation. However, it does participate in the planning of road works and is advised on all technical matters by two technical sub-committees originally established under the RMI programme. One sub-committee deals with main roads, while the other deals with rural roads. Both sub-committees have a broad membership and include most major stakeholders in their respective fields. The Board, advised by these sub-committees, ensures that plans and programmes:

- Give sufficient emphasis to maintenance
- Allocations for main, urban and rural roads are appropriate
- Technical standards and specifications are consistent and cost-effective
- The approved expenditure programme does not exceed the revenues available
- The overall expenditure programme is affordable and capable of being sold to the public.

Although in many ways the Zambian Roads Board has been a success it has not been as independent from Government as perhaps was originally envisaged. In 1999 the Government directed that funding directed towards rural roads should be spent on a "blitz campaign" to improve the Lusaka city roads. The Board had little option but to go along with this decision.

7. The Planning Process In Different Countries

Setting the national road budget is ultimately the responsibility of the Finance Ministry and/or Planning Ministry (or Secretariat which may or may not be part of the Finance Ministry). With the increasing development of Road Funds, allocation of consolidated funds to roads development is becoming less of an issue in some countries, with the Road Board taking responsibility for prioritisation and funds allocation. However, central government funding may still be needed for ministerial administration.

Historically, the main source of funding road development has been the consolidated fund. As noted above, Road Funds and other user-cost recovery schemes (e.g. toll roads) are replacing this source in many countries. There is no easy way to allocate scarce funds between different categories of road (national and local), or between different regions. Economic criteria must often give way to political pragmatism. An advantage of a Roads Board, which is autonomous and independent of the sector ministry, should be that it can apply economic criteria; but the evidence is that political intervention is not always avoidable.

7.1 The Planning Process in Bangladesh

For many years Bangladesh has adopted a formal centralised approach towards major infrastructure planning. A series of 5 year plans have been prepared under the guidance of the Planning Commission. Other long-term plans have been prepared including a 15-year perspective plan, and in 1992 a 3-year 'rolling plan'. In recent years, economists within the Roads and Highways Department (RHD) have prepared draft outlines of a road sector component. However, for the most recent perspective plan it appears that the actual list of roads (with costs) was prepared by the Planning and Programming Circle, with the written component is prepared by a team of economists.

The following table illustrates road sector expenditure for the period 1990-1994.

Table 7: Bangladesh Road Sector Expenditure

	10million Tk			
	1990-91	1991-92	1992-93	1993-94
Development Programme:				
Foreign Aided Projects	309	530	674	692
No.	(14)	(17)	(17)	(18)
Locally Funded Projects	75	158	217	388
No.	(20)	(21)	(18)	(17)
Of which Upzilia/Thana connecting Roads expenditure:	29	110	153	198
No. of schemes:	(?)	(529)	(514)	(474)
Technical Assistance	2	10	2	5
Total Development Expenditure	387	697	893	1084
Maintenance Programme:				
Routine	36	38	41	48
Periodic	41	82	118	109
Operation of ferries	21	21	16	23
Total Maintenance Expenditure	98	140	175	180

Real expenditure on road construction and maintenance dramatically increased over the four year period. With inflation of around 12%, development expenditure has risen 2.5 times and maintenance by about 64% in real terms. The routine and periodic maintenance expenditure in 1993/4 (1,540 million Tk) compares well with the Road Master Plan requirements. These were, in 1992 prices over 5 years (1991-96):

under the basic scenario	-	3,100 million Tk
under the alternative	-	4,550 million Tk
'without budget constraints'	-	6,296 million Tk

Expenditure in general is committed to a project when that project is included within the RHD's Annual Development Program (ADP). There are a series of steps that a project may go through to be adopted within the annual budget. Initial interest in a project is likely to come from an Member of Parliament who will contact the Minister of Communications, who will in turn contact the Chief Engineer for action. Alternatively initial pressure may come via local channels through the Regional Engineers who will also contact the Chief Engineer for action.

Once the Chief Engineer has agreed he will ask for the initial papers to be prepared. These will usually be prepared, in consultation with Field Engineers, by the Executive Engineer, Planning who reports to the Superintending Engineer, Planning and Programming. If the project is estimated at 100 million Tk. and above, and has been identified for foreign funding, a Preliminary Project Concept Paper (PPCP) is prepared. This is a two-page note on the project that outlines the case for the project and states whether it is included in the rolling plan and whether it is consistent with the 5-Year Plan and national development goals. A short statement on the 'socio-economic benefits' of the project is also included.

This paper is sent to the Ministry of Communications, then to the Planning Commission and then finally to the External Relations Division (ERD) of the Ministry of Finance before negotiation with donors. When tentative funding has been agreed, a more detailed Project Concept Paper (PCP) is prepared.

For most major domestically funded projects, a PCP will also be prepared. Again it will go through the Ministry of Communications to the Planning Commission. The minimum size of the PCP appears to be 6 pages. It requires traffic data as well as estimates of the project's NPV and EIRR that are usually left blank. Further information is required on foreign and local expenditure, as well as the predicted impact of the project on employment, environment, women, etc.

In general it appears that the main role of the ministry is to check the figures of RHD, query discrepancies and also to maintain a dialogue with the Planning Commission on the suitability of the project. If it is agreed, the PCP is passed to the Implementation, Monitoring and Evaluation Division of the Planning Commission. If approved the PCP is passed to the Pre-ECNEC Committee and then, if above 10, million Tk, to the full ECNEC (Executive Committee of the National Economic Council) which is the highest approving authority.

Sometimes, ECNEC decides that the PCP is insufficient and a request is made for a full economic appraisal of the project. In RHD, the Economics Circle usually carries this out. In recent years they have undertaken a number of bridge evaluations (for example replacing a ferry or converting a rail bridge to road) which are usually far from straightforward.

At the same time that ECNEC is considering the PCP, the preparation of the full Project Pro-forma (PP) can also take place, although its progress will depend upon final approval of the PCP. Again this is the responsibility of the Executive Engineer, Planning. This standard form is 22 pages long, and details estimates of the quantities of materials, detailed costing and design details. Once completed, the PP will got to the Departmental Project Evaluation Committee (DPEC) of the Ministry of

Communications (headed by the Secretary) where (presumably) the technical content of the project attracts more attention. After this it is passed to the Minister.

Once the PP has been approved it will pass to the Programming Engineer for inclusion in the Annual Development Program (ADP). In general, the ADP is built up from existing unfinished projects, and the new projects that have been approved. The available budget is spread as thinly as necessary to cover all projects.

Although this is the formal process to be included within the ADP, it is still possible for 'unapproved' projects to be included. The Chief Engineer can be asked by Ministers to include such projects in the list. The precise mechanism for funding these projects is unclear; it appears that money maybe sometimes diverted from other projects in the budget or extra money may be found often after the financial year has started. Ultimately it is expected that ECNEC will give approval for these projects even though they have already been started. PCP's will be prepared, and even in-depth economic appraisals will be undertaken after the project has started in order to get ECNEC approval.

Once funding has been approved for a project, the RHD field offices can prepare tender documents. The RHD Committee on Procurement (RHD COP) scrutinise the papers, check the estimates, and calls for tenders through newspaper advertisements to find the lowest bidder from the approved list of contractors. If all the papers are passed, the lowest bidder is recommended to the Chief Engineer. In general approval is given as follows:

<Tk 10 million	-	approval by field office
Tk 10 - 50 million	-	approval by the Chief Engineer
Tk 50 - 150 million	-	approval by the Minister
>Tk 150 million	-	approval by the Prime Minister

For projects above Tk 150 million there is a Divisional Committee on Procurement (DIV COP) and the Joint Secretary and Chief Engineer are members. This committee looks at the papers which are then forwarded to the Ministers Purchasing Committee before recommendations are made and sent to the Prime Minister.

The Senior Economist is a member of RHD COP for two main reasons. Firstly, the Ministry is keen to have a diversity of personnel on the Committee and naturally the economist provides balance to RHD's engineers. Secondly there are many contracts for consultancy studies and foreign aided appraisals where the proposals need to be examined by an economist.

The weaknesses in planning road investment within the Ministry of Communications have been recognised. For this reason a new HDM Circle has been set up within RHD and a new planning cell dealing with roads and road transport has been set up within the Ministry. The new HDM Circle is headed by a new SE reporting to the Additional Chief Engineer, Planning & Design. In total, 45 new staff are being appointed including two Executive Engineers, a Transport Economist, a computer programmer and a number of junior engineers. The role of the HDM Circle will be to use HDM as a basis for planning within RHD. The staff will collect roughness and other basic data relevant to the model.

It is intended that the new Planning Cell within the Ministry of Communications will contain six Assistant Chiefs/Research Officers and two Deputy Chiefs reporting to one Joint Chief. In total, 9 additional posts will be created. The cell will contain engineers and economists, as well as possible financial experts who will give a new direction to planning within the Ministry. It was planned that their role will be to take a wider view of issues. If RHD engineers and economists calculate transport costs and benefits then the planning cell will consider the issues such as resettlement, the environment, political priorities and social issues.

Overall it appears that very few domestically funded development projects are subjected to formal economic analysis. Within the Planning Commission there appears to be an underlying belief that roads provide 'social benefits' and therefore it is not necessary to evaluate their benefits too closely.

7.2 Aspects of Planning and Funding in Ghana

The National Development Planning Commission (NDPC) was established in 1990 and has responsibility for advising the President on development strategies and for co-ordinating the newly established decentralised development planning system. The work of NDPC culminated in the formulation of the long-term national development perspective 'National Development Policy Framework' or 'Ghana-Vision 2020'. This is a 25-year development framework document representing the long-term policy direction to be followed by all sections of society in order to achieve the long-term development agenda of Ghana. Within this framework the NDPC produces rolling five year development programmes.

MRT prepare the budget estimates of the road agencies for submission to the Ministry of Finance (MOF). Estimates are prepared for recurrent expenditure, which covers salaries and wages, establishment and administrative costs, etc. and development expenditure, which includes routine and periodic maintenance and rehabilitation.. In July each year, MOF provides MRT with guidelines for the ceiling on the following year's recurrent expenditure levels. GHA and the roads departments are provided with this information and are expected to work within these limits unless there are strong grounds for deviating.

No ceiling is given for the development budget, but the GHA and the roads departments will tend to bid for counterpart funding on projects for which they have assured donor funding. Donor terms typically require cedi counterpart funds to the value of 10% of the total project cost. Donor support also implies some degree of economic value in the project since donors have agreed with MRT and the road agencies to reject projects which do not achieve at least a 15% EIRR.

The Ministry takes no part in economic justification of the projects. Their only role is to collate the bids and perhaps make some minor adjustments to reflect regional equity. The estimates are submitted to MOF. Their allocation of available development funds inevitably falls short of the road agencies expectations. Furthermore, full disbursement of the allocations is never achieved. The Ministry allocates the available funds to the Agencies using criteria which are not wholly transparent, but involve judgement based on the relative network length, and degree

of assured donor funding. In this context the Road Fund Board is not yet acting in its role as arbiter of project priority and simply endorses the programmes put forward by the Agencies.

Until 1983, budget appropriations, together with donor grants and credits, were used to finance all road sector expenditures. However, because of economic constraints, the funds allocated were well short of the amounts required to meet even basic maintenance needs. As part of the governments Economic Recovery Programme (ERP), funding of road infrastructure was increased to help stimulate economic growth. Between 1986 and 1990, the road sub-sector accounted for 20 percent of Ghana's total capital budget. Funding has progressively increased, and in 1996 a substantial proportion of the national development budget (around 30%) was allocated to maintenance and development of road infrastructure.

Presently, only about 50% of the required maintenance budget can be recovered from road users through the Road Fund. Additional funds are provided through the Consolidated Fund which is the mainstay of Government revenue. The fund is used to finance the General Administration, Economic Services, Infrastructure, Social Services and Security of the country. The road sector allocation for development (maintenance, rehabilitation and reconstruction) averaged 35% from 1991-1995. Between 1995-1996, the road sector's share of the consolidated fund for development dropped from 45.6% to 32 %. In 1997 the total allocation from the fund for development was 19.2 percent. This sudden reduction is due to change in Government policy to have a dedicated fund for road maintenance. MRT view this trend with alarm. The current round (1998) of budget talks emphasises this concern, as MOF have offered only ¢4 billion from the consolidated fund against a bid by the Ministry of ¢200 billion. MRT is currently negotiating for ¢120 billion, a large proportion of which is needed to cover payment arrears of ¢100 billion.

The 1998 budget estimate will continue to address the arrears payment. The estimated outstanding payment stands at ¢146 billion as at September 1997. The Government total portfolio in the reconstruction of trunk roads stands at twenty-seven (27) projects with commencement date either in 1995 or 1996.

Against this background, an amount of about ¢1,045.76 billion made up of ¢432.77 billion in foreign inflows and ¢585.35 billion from Government of Ghana budgetary resources is programmed to be spent in the road sub-sector in 1998. The proposed breakdown is given in Table 8.

Table 8: Ghana Road Expenditure Breakdown for 1998

	Donor (¢m)	GOG (¢m)	Total
Ghana Highway Authority	247,253	353,607	600,860
Dept. of Feeder Roads	80,474	55,964	136,438
Dept. of Urban Roads	105,038	175,775	280,813
Total	432,765	585,346	1,018,111

Financial management and contract administration have been problematic in the past. There have been substantial budget and time over-runs which have resulted in large

arrears to contractors. Capital budgets were exceeded by some 64% in 1994 and 1995. The over-runs have arisen because too many fully funded contracts were signed in spite of tight budgetary conditions. In some cases there had been insufficient project preparation at the feasibility and design stages resulting in major changes in the scope of works during implementation. In other cases additional lengths were added to existing contracts instead of treating them as separate contracts, which is now the practice.

A common problem for the road agencies is the need for a reliable source of funding to make planning and programming meaningful. Even though donors have agreed to adopt the sector strategy there still appears to be vested interests in specific projects especially in feeder and trunk roads. This situation has led to a partial marginalisation of the urban roads for funding by donors.

Donors are concerned about the frequent award of reconstruction and rehabilitation contracts by Government at the expense of road maintenance. This seriously undermines the policy of giving maintenance highest priority. Also Government's attitude of awarding contracts without a secured source of funding perpetuates and increases arrears payment in the sector.

The long gestation period of donor loans and credits before they become effective has a negative dimension that can affect the credibility of Government. Out of frustration and in order to be seen to be active, Government may award its own projects to appease the people and in the process try to achieve a regional balance in development. The scarce resources are thinly spread over these projects and so Government financed projects take a longer time to be completed.

7.3 Planning and Programming in Ethiopia

7.3.1 Federal Road Planning

The Ethiopian Roads Authority (ERA) is responsible for the Federal road network. This comprises 3500 km of paved roads and 12500 of unpaved roads. In addition there are 10,000 km of Regional roads and a further 30,000 km of unclassified roads, tracks and trails in the country. In common with other sectors ERA has a ten year Road Sector Programme (97/8-2007/8). This can take two to three years to prepare. Once this is published and endorsed then for the remaining period it is used in order to programme priorities. A five year updated version is revised every six months. Since the early 1990's there was an eight fold increase in expenditure for the road sector to 1998. The current five year Road Sector Development Plan foresees a further doubling of expenditure over the 1997/8 level to over US $ 500 Million per year.

Projects come from above and below and from the Regions. Overall ERA does not suffer from unnecessary political interference. The Sector Program is taken as the "Bible" although from time to time a special case is made for an investment not in the Program for example to a power station or agricultural scheme but these are genuine reflections of national interest.

The Spanish consulting firm INARSA carried out the original "Road Transport Sector Study" (Aug 1995). This study collected together a baseline survey of the main ERA network and used RTIM3 to define investment priorities. Condition data on 7000 km

of roads are held by the Pavement Management Section. Evaluations have been undertaken using HDM III to update the program (included in "Road Sector Development Program I, Update 1997-2002, Aug 98) however there are now plans to introduce HDM4. The ERA planning branch helps to co-ordinate with Regions on their major investment programmes (e.g. the Tigray Rural Roads Action Plan) and helps put these into the Sector Program.

Traffic surveys in Ethiopia appear to be well carried out. There are 140 traffic survey stations covering 254 "legs". Surveys are conducted three times each year at each site in November, July and February. Data is collected over seven days; 6am to 6pm for five days and 24 hour counts for two days. No automatic counters are used.

Feasibility studies are done in house. But if a donor takes up a project then the project will be reviewed again. The European Union funded technical co-operation officers in ERA but most projects will demand a separate feasibility study with hired consultants. External studies have been carried out by the World Bank/IDA, the EU, KfW, and ADB. OPEC accepted an in house study while Italian Aid accepted the ERA feasibility study but the detailed design was contracted out. The ADB asked that locals should be trained. The only criterion of interest in the feasibility studies were the IRR and NPV.

When low IRRs were found both the IDA and ADB did not wish to finance those sections. The ADB were reluctant to finance a road with IRRs of less than 14%, while the World Bank/ IDA were reluctant to fund roads with an IRR of less than 10%. Environmental assessments are now done as part of many feasibility studies.

Government Finance has been used for three major project using the "ERA force account construction unit". No separate feasibility studies were undertaken for these roads. Although one road has low traffic volumes natural gas has been found in the area and hence there may be significant development activity.

Maintenance needs are identified in the Sector Program. Maintenance financing previously came from the treasury but now there is the Road Fund that is responsible for financing routine and periodic maintenance. It does not cover new construction and rehabilitation. ERA submits a financial plan to the Road Fund and Ministries. The Road Fund is planning to ask ERA to submit details for each segment and they will want to monitor activities.

There is a lack of fully trained people to undertake road planning using tools such as HDM-4. There is perceived to be a problem of both staff quality and to some extent staff morale. Many professionals have left for the private sector where salaries are better; this is a problem across government. However since reforms were introduced salaries in ERA for senior staff have been substantially increased and they are now much better than in other Government Departments. Salaries for economist are less than for engineers. Engineers usually stay in university for longer and the economists do not appear to complain. In engineering organisations (such as ERA or construction concerns) the senior posts are held by engineers. But in the Ministry of Economic Development & Co-operation engineers complain that the senior posts tend to go to economists.

Donors always insist on using their own experts to evaluate their programmes. But sometimes their quality is not so good. There is a perception that expatriates are not used properly and that more could be done to train local staff.

7.3.2 Environmental Assessment

An environmental management branch was established in ERA in 1998. It has an engineer, an ecologist, a sociologist and a hydrologist. It has carried out a number of assessments of road projects.

Now new road projects must include an environmental impact including the sociological impact on settlements. If a donor is to carry out a feasibility study then they will also pay for an environmental impact study. It is recognised that most road projects do not cause major environmental disruption (particularly if they do not go through environmentally fragile areas such as wet lands or forests). The approach is to avoid sensitive areas and to mitigate the remaining harmful effects. In Ethiopia particular issues include the checking of borrow pits, settlements, and the issue of compensation. Most projects are rehabilitation along existing alignments hence the impact to the natural environment tends to be minor.

There has been pressure from the World Bank and donors to establish capacity building in the environmental area in Ethiopia but so far there has been no direct support from donors. Currently the branch (via consultants) is trying to prepare a "user friendly" workable environmental manual.

7.3.3 Programming and Budgeting

The ERA Programming and Budgeting section is responsible for annual budgets and for the three year public investment programme. The branch works to the Ministry of Finance (for the ordinary supporting budget covering support units and operating departments, headquarters and 10 districts and road maintenance) and to the Ministry of Development and Co-operation (for capital budget and road construction) and to the Road Fund Administration Office (for routine maintenance). Capital equipment has been responsibility of the Ministry of Development & Co-operation but in future any capital equipment for road maintenance is expected to be funded from the Road Fund Administration Office.

In preparing the budget all managers and supervisors participate in preparing the budget. This is then compiled by the Divisions and be passed to the Planning & Programming Division. The Division compiles and submits the budget to a meeting of senior staff that might cut or add to it. After discussion it will be presented to Board Members who might make adjustments. The budget will then be returned to Planning & Budgeting for Final Submission to the two Ministries and the Road Fund Office.

The budget is defended at a budget hearing session in the two Ministries. It will then be presented to the council of Ministers. After adjustments the budget will be presented to the people's representatives for final approval for executive branch. Details will be specified for salaries, construction and maintenance. The budget will then come back from the Ministry of Finance to the General Manager of ERA. It will then be transferred to the Planning and Programming Division who will the pass it to the Programming and Budgeting Branch for final action to be transmitted to all units.

For capital projects where counterpart funding is required there is usually no problem with funding. There is a ceiling for the loan fund agreement, below this it is possible to request the amount required. Sometimes programming will phase projects to fit the budget.

For periodic maintenance the existing condition of the road will be a major factor in determining priority. An economic justification is not required for periodic maintenance. However for upgrading and construction the economic rates of return will be very important.

For budgeting maintenance funds to the ERA Districts various criteria apply. Key considerations are past history to spend the money, cash flow requirement, availability of equipment, and the likely improvement in the condition in the roads is also very important. Although some Districts can't spend money easily others can but performance is also very important. For construction projects payment certificates are required, for maintenance the monthly work programme and cash flow are important.

7.3.4 Rural Road Planning

There is no planning system in place at the moment for road maintenance of rural roads in the Regions. There are 8 Regional Rural Road Authorities that are responsible for the maintenance of at least 8000 km of roads. It is part of the Federalisation process to build up capacity in Regions. There is a program now to build up capacity by constructing small road authorities. Contract work is the long term policy and own account work will be gradually phased out. However, in the short term there is a policy to upgrade in house equipment. Originally road planning and maintenance was administered by the ERA.

There is a Rural Roads Institutional Capacity Study and new construction criteria are being developed. Because of the lack of information an important task is to carry out a road inventory. There is a lot of data available (e.g. population, cash crops, education, health etc) which could be entered into the GIS system. Donors are interested in an integrated approach with other sectors, capacity building projects etc and the GIS system could help with this.

GTZ is assisting by looking at two regions to set a proper administration covering road inventory, maintenance management, contract administration, environment training. But lots of staff are needed to assist with co-ordination and planning.

However a proper road map based on a GPS survey is required. Many roads are maintained by two Regions or Districts. It is important to define who maintains what.

7.4 The Budgetary Process in Uganda

The scarcity of funds in Uganda means that national policy evokes the need to concentrate on core functions. Under the road maintenance initiative, the following policies have been formulated:

- The adoption of network-based planning and programming
- The commitment to accord high priority to maintenance funding and timely disbursements within the financial resources available

- The increasing commercialisation of road maintenance
- Developing adequate capacity at all levels in both public and private components of the road maintenance sector

The Ministry of Works, Transport and Communication (MWTC) has formulated the following medium-term network policy for main roads. The provision of an efficient, safe and sustainable main roads network as a support for accelerated integrated development and consolidation of peace and national unity, and the development of a local construction industry as a measure of ensuring a sustainable road network.

The current budgeting process is largely 'top-down' rather than 'bottom-up'. Budgets are determined according to what can be afforded and are not driven by considerations of need. This is a pragmatic approach, given the present resource constraints. However, there are likely to be benefits from a more systematic approach to prioritisation of budget bids, on the basis of measured need in relation to agreed standards.

Overall revenue collection was estimated to be just under 10 percent of GDP 1994/95. Customs duty on petroleum products accounts for a significant proportion of revenues, and is the second largest source of government income after sales tax. In all, road-related revenue contribute 24% of the total.

Revenue is also collected directly by district councils. This consists mainly of the graduated tax (which accounts for 65-80 percent of revenues), market dues, and various fees and levies. For example: market fees can be collected on roads to markets, although road tolls may not be levied. The revenue base has been eroded during the last decade by the transfer of a number of taxes to the central budget, and by the weakened economy and inflationary trends. In addition, the basis for some revenue collection is occasionally inappropriate to local conditions. In particular, some taxation fixes minimum and maximum thresholds for collection arbitrarily and without consideration of the local situation. Collection efficiency by districts is generally rather low because of poor quality staff with inadequate training.

MWTC is granted a budget each year from government revenues to finance its operations during that year. The recurrent budget is distributed between different 'vote numbers', and this is sub-divided further into 'programs' and 'items'. The programmes correspond to various administrative units within the Ministry, whilst the items are used to break down expenditures into standard categories. The development budget is allocated to specific projects. The programme numbers used correspond to those in the recurrent estimates but, instead of vote numbers, ministries are allocated 'head' numbers.

The recurrent budget funds the day-to-day running of the Ministry and road maintenance. The government recognises that road maintenance, as a recurrent activity, should be financed wholly from local resources. This is not feasible within local financing constraints and so, in the interim, support has been sought from external donors. As a result, a 4-year prioritised road maintenance program has been devised.

In terms of District budgets and the budget of the Ministry of Local Government (MLG), allocations from central government include block grants, traditionally aimed at social sector expenditures, and allocations to match locally financed manual feeder road maintenance.

The recurrent budgeting process within MLG is similar to that in MWTC. Recurrent budgets for districts are decided at a meeting between representatives of the Ministry of Finance and Economic Planning, the Decentralisation Secretariat acting on behalf of MLG, and representatives of the districts. The block grant allocations are based on a formula involving size of the population, length of road, terrain, and a 'distribution factor'.

Districts can then redistribute this block grant according to their view of local needs. There is no requirement for the allocation at district level to match that proposed by MLG. However, in Mukono District for example, the estimate under the heading of 'Maintenance of access roads' in the District budget estimates for 1995/96 was USh97 million compared with Ush65 million allocated under the block grant from MLG. Unpublished information from the Decentralisation Secretariat of MLG indicates that releases are often only abut 40 percent of budget estimates. The low figure reflects difficulties in collecting local revenues, which are as low as 27 percent in one particular case. Locally generated revenue for Mukono has ranged between approximately 20 and 30 percent of the budget in the past two years. Donor contributions are of a similar magnitude to this, and the balance of about 50 percent is made up principally of transfers from the national budget.

Although roads-related revenues make a significant contribution to the national budget, a relatively small proportion are ploughed back into the road sub-sector to fund maintenance and rehabilitation. There is no link between the revenue that is used for this purpose and the road conditions that result from applying these funds. Roads are viewed as a 'common good' to be provided by the government, and not as a service that must be paid for in the same way as electricity, telecommunications and other utilities.

The MWTC considers that there are shortcomings associated with the system of budgeting adopted for road maintenance. Factors of concern include:

- It does not reflect the true cost of maintenance activities
- Headquarters costs and overheads are excluded and, instead, included under a more general item
- No account is taken of vehicle depreciation; purchases are considered a one-off payment funded by donors through the development budget
- There is a danger that, when recurrent budgets are revised downwards, for the reduction to focus on one specific item; hence the budget cut can result in a disproportionately large reduction in output
- It does not provide a convenient way of
- Relating expenditure to output
- Incorporating the effects of inflation

Problems have also been identified, with respect to budget preparation, in the following areas:

- Availability of data: some data that would be desirable for the preparation of estimates are not readily available because of delays in submitting breakdowns of expenditures by sections
- Data integrity: when good expenditure data are scarce, there is a danger of placing too much reliance on relatively poor data; the following issues being particularly problematic
- The differences between approved estimates, the amount of funds subsequently released, and the expenditures actually incurred
- The mis-labelling of expenditures to incorrect heads when pressure on funds is strong and/or expenditure control is weak
- Valuation: comparative analysis of different projects or activities over time has the following problems
- The use of realistic values of expenditures in times of high domestic inflation because of different relative price changes of items
- The different impacts of foreign exchange costs on the various components of projects or activities
- Budget categories: the breakdown of recurrent expenditures into administrative categories is not necessarily convenient for the analysis that needs to be undertaken by an engineer or economist; for example
- Salary and wage costs may be spread among a number of administrative units
- The lack of geographic categorisation makes it difficult to differentiate urban and rural expenditures

Problems have also been identified with respect to district budgets. The present revenue base in districts in inadequate for the tasks that, theoretically, should be undertaken. It is now difficult for most to sustain adequate payments for their labour force and support facilities. The decentralisation process appears to have resulted in a transfer of responsibilities to districts without the necessary posting and training of key personnel, or the allocation of extra resources from the central budget and/or the authority to levy other taxes at the local level. As a minimum, Districts need to tailor their expenditures to their cash receipts. There is also a need to prioritise activities throughout the year so that, if there is a shortfall of budget releases, the work program can be curtailed to accommodate this.

For example: experience from Mukono District indicates that a 'mini decentralised' budget is now being operated with 65 percent of the graduated tax being remitted to each sub-county for the maintenance of feeder roads using contract lengthmen. In addition, a budget sub-heading of about Ush100 million has been allocated at District level for the grading of 110km of feeder roads.

8 Examples of Planning and Funds Allocation Procedures

8.1 Planning Feeder Roads in Ghana

Until recently the main criterion used for planning the improvement of feeder roads in Ghana was based on a combination of transport cost savings and the producer's surplus approach involving predicting changes in agricultural output. The approach was felt to be unsatisfactory because it is extremely difficult to predict agricultural response and secondly where feeder roads are in very poor condition or the road is cut

it becomes difficult to estimate transport cost savings based on existing motorised traffic flows.

The UK Department for International Development was interested in establishing a feeder road programme to rehabilitate exiting roads and tracks in nine districts in the North of Ghana that had been relatively neglected in past, in part, because the area was subject to inter-tribal conflict. In connection with this project DFID was interested in supporting the development of a new feeder road prioritisation procedure. The general objectives of the procedure were as follows:

- Economic rationality
- To be sensitive to social and poverty objectives
- To include community participation
- To cover the issues of road impassability and traffickability (i.e. when motorised traffic is impeded by the road but not absolutely prevented)
- To address issues of non-motorised traffic and gender
- To be relative simple and transparent
- To be capable to being operated from Districts and Regions without high level external support.

The development of the procedure was undertaken by engineers and economists at TRL together with the assistance of an externally recruited social development adviser. The procedure took 18 months to develop. It includes both community consultation to nominate roads that are then assessed using a prioritisation index. The highest raking roads are selected for improvement in the programme until the allocated budget is spent.

The main strengths of the approach are that in attempting to meet the main objectives it combines economic and social benefits together with community participation. In direct addressing the problems of road passability and traffickability the main feeder road accessibility constraints are addressed. Value for money is directly incorporated into the procedure. The procedure can help with addressing appropriate engineering design. An innovation in the approach, compared with other feeder road ranking procedures, is that both social and economic benefits are calculated to be directly dependent upon the change in road condition and transport costs. If there is little or no change in transport costs there will be little or no social benefits.

The main weaknesses of the approach are the common problems of all ranking criteria. Double counting inevitably remains a problem. The social weighting factors, although subject to community consultation and professional debate, are essentially subjective. Likewise some of the cost weighting factors used to estimate the benefits are, at present, not well researched; although, in principle, further research data could be used to improve their validity.

The procedure was successfully trialed in Nanumba District. At the public hearing the clear advantage of maintaining basic access standards, rather than more expensive full rehabilitation approach and using a benefit cost ratio approach was demonstrated. Initially District representatives (at a workshop) had given priority to roads involving relatively expensive interventions. It was pointed out that with the planned budget the District Workshop ranking would provide for three roads to be constructed giving

55.4 km of improvements, benefiting approximate 8400 people and giving annual index benefits of $423,000. If the same budget is spent using the Prioritisation Index then five roads would be built, giving 95 km of roads and benefiting approximately 17650 people and giving annual index benefits of $649,000. Despite this, at the public hearing there was still concern that a road section might not be built that involved people wading through water for about half a kilometre of water. (This issue was not given a high priority at the earlier District Workshop). It was agreed that this issue would be dealt with separately and might be addressed by saving money through reducing road widths.

The general approach was follows:

- Local consultants were trained and recruited to engage the local communities in the District to identify roads that they wanted improving.
- Identified roads were presented to works subcommittee of the Area councils to nominate two roads for each Area (approximately ten 10 Areas to each District).
- The nominated roads from each Area were then investigated by an engineer to identify the current state of the road or track, the measures needed to provide firstly basic access (i.e. all year road accessibility by vehicle) and secondly to bring the road up to a full gravel road standard.
- For the nominated existing road and the improved alternatives the engineer estimated road roughness and the period in the year the road suffers from absolute impassability and the period it suffers traffickability problems.
- Traffic surveys were undertaken on each road to measure both motor vehicle traffic and pedestrian and other non-motorised traffic movement.
- The adjacent population for each road was estimated from census returns and maps.
- A prioritisation index benefit cost ratio was developed which has a benefit component (including both transport economic benefits and social benefits), modified engineering costs represented the cost component of the index.
- It is proposed that for the DFID funds to the nine districts half the money is initially allocated evenly to each district and that those roads in each district with the highest benefit cost ratios are selected for inclusion in the programme until the available funds are "spent". In a second round the prioritisation index data is pooled together with all remaining funds and that those remaining roads with the highest scores are selected until all the remaining funds are spent. The process ensures that each district gets some road investment.
- In order to make the selection process as open as possible a district workshop is held for district representatives to make their own prioritisation list. This is then discussed together with the results of the technical analysis at an open public forum to agree the final programme.

For each road an index is constructed from traffic, population and engineering cost data. Costs and benefits are estimated for both full upgrading and spot improvements. To achieve the greatest value for money, it is essential that unnecessarily high standards are avoided and that road widths (including formation, carriageway and structures) are kept to a sensible minimum in relation to traffic volumes.

In order to address the issue of appropriate road standards (in this case between basic all year round access and full gravel standard road) it is necessary to compare the incremental benefit cost ratio (i.e. the difference in benefits divided by the differences in costs) with the established cut off benefit cost ratio of the whole programme. If the incremental benefit cost ratio is greater than the programme cut off ratio the higher cost intervention (i.e. full rehabilitation) should be undertaken; if it less than the cut off ratio then the lower cost project (i.e. basic access improvements) should be undertaken.
The selection process is budget limited, however in order to ensure that completely uneconomic roads are not selected for the programme sensitivity analysis was carried out in order to define a minimum cut off ratio. This was also reinforced by a community participation exercise to address the same issue, i.e. circumstances in which road improvement were felt to be worthwhile.

The benefits components of the index include:

- Motorised traffic benefits
- Non-motorised traffic benefits
- Social benefits.

Total transport benefits are calculated for a calendar year. In order to ensure that longer lasting improvements were valued more highly in the analysis in constructing the benefit cost ratio the costs of structures were divided by a factor of two. The benefits were calculated as follows:

Motorised traffic benefits. The procedure identifies three main areas where motorised transport benefits from improved access.

- Benefits associated with improved levels of road roughness using the conventional relationships between road roughness and vehicle operating costs (VOC). Table 9 shows the main parameters for different levels of road roughness.
- Benefits from infrastructure improvements that improve the traffickability of a road. In this context, it is defined that a road has traffickability problems when the percentage of wet season traffic falls below 50% of the dry season traffic.
- Benefits from infrastructure improvements that improve the passability of a road. In this context, it is defined that a road has passability problems when the road is completely closed to motorised traffic for either all or part of a year. This will generally be a problem during the wet season. Table 10 contains the multipliers associated with traffickability and passability. For consistency of definition, if a road has a passability problem at a certain times of the year then it is deemed not to have a traffickability problem at the same time. If there is doubt, passability problems are more severe and take precedence. Hence:

  Days with no problems + Days with traffickability problems + Days with passability problems = 365

Table 9: Motorised transport Benefits from Roughness Reductions

Infrastructure quality	Infrastructure code	VOC per km (cents)
Good Gravel (IRI 6)	G	45
Average (IRI 9)	A	52
Poor (basic access) (IRI 12)	P	57
Extremely poor (IRI 17)	E	75

Table 10. Factors Associated with Seasonal Access Constraints to Motorised Transport

Seasonal access constraint	Factor x VOC
Impassability	7
Traffickability	2

Non-motorised transport benefits. Many prioritisation techniques ignore benefits to non-motorised transport (NMT's) but research has shown that a considerable proportion of the transport burden is carried by NMT's and that they benefit from improved infrastructure, particularly when modal change takes place. The parameters shown in Tables 11-13 show that substantial benefits are assigned to NMT's where there is no existing transport services reducing to very small benefits where basic access is already established.

The largest benefits are associated with extremely poor quality access where there are no transport services. Infrastructure improvements in these situations are most likely to lead to a change of transport mode i.e. from bicycle to truck. This type of modal change has the potential to deliver large transport cost savings.

The inclusion of NMT's, particularly headloading, allows gender inequalities in the transport burden to be addressed. In many parts of Ghana women carry the overwhelming proportion of headloads. This procedure recognises this and gives benefits to the increased probability of modal shift and/or the time savings associated with walking on improved infrastructure.

Table 11: Benefits Assigned to NMT's where Infrastructure is Impassable or there is Extremely Poor Access and No Useable Transport Services

	Benefits in cents per km			
	Headload (>10kg)	Walk	Cycle (load)	Cycle (no load)
Good Gravel	11.4	2	5.4	0.5
Average Condition	11.3	1.9	5.3	0.4
Basic access	11.2	1.8	5.2	0.3

Table 12: Benefits Assigned to NMT's where there is Extremely Poor Access and Some Existing Services

	Benefits in cents per km			
	Headload (>10kg)	Walk	Cycle (load)	Cycle (no load)
Good Gravel & Average Condition	2.2	0.5	1.1	0.1
Basic access	2.1	0.4	1	0.1

Table 13: Benefits to NMT's where infrastructure is improved from basic access

	Benefits in cents per km			
	Headload (>10kg)	Walk	Cycle (load)	Cycle (no load)
Average condition	1.0	0.2	0.5	0
Good Gravel	1.1	0.2	0.5	0

Social Benefits. Many low volume rural roads are impossible to justify on purely economic grounds. However, many of the roads will provide an essential social and economic service in enabling communities to reach health facilities, markets, education and to visit friends and relatives. Problems with access to these services are very often greatest with the poorest communities and where physical access is extremely poor. To build these factors into the prioritisation procedure four parameters have been included as shown in Table 14.

- A social access benefit component has been included which gives a greater weighting to roads in high population areas. The social access benefit is calculated by multiplying the population index by the population that depend on the road by the average distance travelled along its length and by the change in transport costs for motorised transport (per km). It is recognised that both the adjacent population to the road section and the populations adjacent to other road sections (that also depend on the road) need to included.
- A poverty benefit component has been included which gives a greater weight to roads which run through the poorest one third of districts (as listed by the Common Fund Allocation Procedure). The poverty benefit component is calculated through the use of a poverty weighting factor that is multiplied by the social access benefit component.
- A benefit component for isolation from health facilities has been included. As with social access and poverty this benefit component is population dependent. The benefit component is calculated through the use of isolation from health facility weighting factor and that is multiplied by the social access benefit component. Where communities have identified isolation from markets as a key factor and where the mean road distance is further than 10 km from a hospital would qualify.
- An index for isolation from markets has been included. Isolation from markets was highlighted through consultation with the communities as being of highest

concern. Where communities have identified isolation from markets as a key factor and the mean road distance to an urban market is more than 10 km would qualify. In this case the isolation from markets index will be multiplied by the sum of motorised, and non-motorised transport benefits.

Table 14: Social Criteria Indices

Social criteria	Social index With characteristic	Social index Without characteristic
Social Access (Population)	1	1
District Poverty (Yes/No)	0.5	0
Isolation from health facilities (Yes/No)	0.5	0
Isolation from markets (Yes/No)	0.1	0

8.2 Formal Road Planning Procedures in Indonesia

Different formal planning procedures are applied for different types of road investment. Examples of the different procedures are listed below.

8.2.1 Interurban Road Improvement and Widening.

The main form of economic benefits from improving road surfaces is taken to be the reduction in vehicle operating costs (VOCs) resulting from a reduction in road roughness. An investment in road pavements (e.g. an overlay) will also reduce the rate of road deterioration and hence the need for more routine maintenance expenditure. Road widening will increase the capacity of the road and result in an increase in vehicle speeds which will also change VOCs and generate passenger time savings. For interurban roads traffic forecasts are largely based on long term trends of existing traffic volumes using growth factors. The Interurban Road Management System (IRMS) contains a detailed database of road pavements, road roughness and traffic volumes. Economic benefits are calculated using the Network Analysis Model (NAM) together with the IRMS database. NAM calculates vehicle operating cost savings based on the HDM III vehicle operating cost model.

8.2.2 Major New Interurban Road Investment and Capacity Improvement.

The benefits from new interurban investment are similar in composition to interurban road improvement and widening however the economic analysis will need to cover the additional costs of new land purchase and any associated resettlement costs. In view of the likelihood of comparatively large changes in transport costs more attention is given to “generated traffic” resulting from new trips induced by the investment. In general a new detailed feasibility study is undertaken in which both an economic analysis is undertaken together with an environmental appraisal.

In order to produce a final ranking of different options a multi-criteria approach is used in which a number of different factors (including economic benefits) are ranked using an ordinal ranking procedure, as illustrated in Table 2. (Section 4.4)

8.2.3 District Road Improvements.

The main forms of economic benefits identified from improving local and rural district roads are assumed to be reduced vehicle operating costs, passenger time

savings, changes in maintenance costs, reduced transport costs as non-motorised traffic switches to vehicle transport and increased travel. Rural (mostly identified as agricultural) development benefits are also often identified as a separate benefit category although guidance on this component is very limited. The economic traffic benefits of rural road investment are calculated manually, at the local level, using the SK77 "Manual of Procedures". Non-standard procedures are recommended for: traffic diversion, major bridge works, road widening, agricultural development projects and urban road project. The Kabupaten Road Management System (KRMS) contains a database of Kabupaten roads. The associated model Kabupaten Roads Economic Evaluation Model (KREEM) is used to assist general policy on the appropriate design and evaluation of these roads.

8.2.4 Urban Road Maintenance and Betterment.

The Urban Road Management System (URMS) is currently under development to assist with the evaluation of urban road improvements. It will include a database of road conditions in urban areas. The predicted change in vehicle operating costs is based on work in the IRMS. Data on many urban roads are included within the IRMS and KRMS databases.

8.2.5 Bridge Maintenance, Widening and Replacement

The benefits of bridge widening are usually identified in terms of passenger time savings and reduced VOCs associated with the reduced traffic delays forecast from the widened bridge. The Interurban Bridge Management System (IBMS) contains a database of most bridges (longer than 6 m) on interurban roads and is used as a guide to replacement, rehabilitation and widening.

8.3 South Africa: Allocating Funds Between Different Road Authorities

In South Africa, the Department of Transport advises the Ministry of Finance on the allocation of funds to individual road authorities. It currently does so using a simplified procedure which assumes that the standards of all maintainable features within the individual road authorities are approximately the same. In the medium term, it plans to introduce an inspection system so that maintenance needs can be adjusted to take account of actual road conditions. In the longer term, this will be replaced by a maintenance management system enabling each road authority to base its maintenance requests on a series of nationally accepted maintenance standards based on objectively measured road conditions.

For purposes of estimation, maintenance is divided into two main categories, namely:

- Routine maintenance (patching and sealing cracks, maintaining gravel shoulders, maintaining drainage, attending to the road reserve, and maintaining road signs and markings);
- Periodic maintenance (maintenance of bridges, resealing, and minor road safety improvements).

A matrix of unit maintenance rates (for each type of road, traffic condition, and activity group) is then applied to all the roads under the jurisdiction of each road authority to arrive at the total *essential* maintenance requirements (see Table 15). For this purpose, roads are classified as freeways, conventional four-lane roads, surfaced

two-lane roads (roads with ADT greater than 12,000 vehicles per day, primary roads with ADT greater than 4,000 vehicles per day (vpd), other roads with ADT greater than 4,000 vpd, and other roads with ADT less than 4,000 vpd), and gravel and dirt roads (roads with ADT greater than 1,200 vpd, roads with ADT greater than 500 vpd and less than 1,200 vpd and secondary roads with ADT less than 500 vpd, and all other roads with ADT less than 500). In the case of local access roads, where no traffic figures are available and very low maintenance standards are applied, a flat figure of $70 per km is used.

Finally, the above figures are adjusted to account for environmental conditions and restricted funding levels. Average maintenance costs are assumed to apply to all areas which are dry or have moderate rainfall. An adjustment is only made for areas with heavy rainfall. The environmental adjustment factors are applied to each item of maintenance and vary from zero (road safety improvements), through 25 percent increase (gravel shoulder maintenance) to 30 percent increase (blading gravel roads). The above calculations provide an estimate of essential maintenance levels (the level required to keep the road network in stable long-term condition) and these are then supplemented by estimates of the minimum funding level (the level which will not compromise road safety, but where the infrastructure may start to deteriorate) and the danger funding level (the level where road safety is compromised and maintenance is confined to essential work). The minimum funding level is about 22 percent lower that the necessary level, while the danger level is about 32 percent lower.

Table 15: Maintenance Unit Rates Per Carriageway km (US$ 1992)

Surfaced roads						Gravel		
Activity	*Freeway*	*4-Lane*	*Primary (ADT>4,000)*	*Other (ADT>4,000)*	*Other (ADT<4,000)*	*Activity*	*ADT>500*	*ADT<500*
Routine maintenance:						*Routine maint.:*		
Patching and crack sealing	300	260	525	420	350	Blading (Grading)	35 + 1.75 ADT	
Gravel shoulders	35	52	210	315	160	Drainage	123	88
Drainage	160	140	195	175	160	Road reserve	877	420
Road reserve	890	420	525	350	195	Signs and markings	456	350
Road signs and markings	455	350	350	315	280			
Sub-Total	1,840	1,222	1,805	1,575	1,145	Sub-Total	n.a.	n.a.
Periodic maintenance:						*Periodic maint.:*		
Bridges	122	88	105	88	70	Bridges	26	18
Resealing	6,030	2,495	2,495	2,495	2,495	Regravelling	525 + 2.8 ADT	
Road safety improvements	-	425	170	496	63			
Sub-Total	6,152	3,008	2,705	3,079	2,628	Sub-Total	n.a.	n.a.
Grand Total	8,384	4,492	4,957	4,987	4,016	Grand Total	n.a.	n.a.

Source: Planning Committee for Road Financing, South Africa, 1992.

8.4 TANZANIA: PROCEDURES FOR ALLOCATING FUNDS BETWEEN DISTRICT COUNCILS

In Tanzania, 20 percent of the road fund receipts are allocated to support maintenance and rehabilitation of district roads. There are 84 rural and 17 urban districts outside Dar es Salaam (which currently receives its own road fund allocation), and the task of the Prime Minister's Office (PMO), which administers this part of the road fund, is to decide how to allocate this money to individual districts in an efficient and equitable manner. Previous attempts to allocate these funds, using general guidelines issued by the PMO, were not satisfactory. Key weaknesses were that:

- Three-quarters of the funds went to urban district councils (they simply prepared better road programs)
- About one-quarter of the rural districts received no funds at all
- There was no consistency in the amounts allocated to individual districts (some received a fraction of what they asked for, while others received all or more than they asked for).

The PMO therefore decided to develop a formula-based allocation system for which reasonable data were available and which would be based on needs, simple, transparent and fair. A major consideration was the lack of accurate data. This meant the system not only had to satisfy the above criteria, but also had to be robust. It was therefore decided to use an index-based system in which districts would score between three and nine points on a scale, entitling them to receive three possible allocation levels from the road fund as follows (note that there are 101 districts entitled to draw from the road fund so that each, on average, would receive 1.0 percent of road fund revenues):

8-9 points	High allocation equal to 1.3 percent of road fund revenues;
5-7 points	Medium allocation equal to 1.0 percent of road fund revenues;
3-4 points	Low allocation equal to 0.7 percent of road fund revenues.

The formula which determines the allocation index contains three elements:

Index = population density + road density + PMO rank.

Population density is there to measure trip generation rates, while road density is primarily a separation parameter to differentiate between urban and rural districts. The PMO rank, which is a grading system used to decide budget subventions, grades districts according to their stage of development. It thus measures the level of commercial activity (i.e. it also measures trip generation). The index runs from one to seven, corresponding to 'least' to 'most' developed. Points are allocated on the following basis:

Population density:

High	more than 100 persons per sq. km	3 points
Medium	more than 27 and less than 100 persons per sq. km	2 points
Low	less than 27 persons per sq. km	1 point.

Road density:

High	more than 120 m per sq. km	3 points
Medium	more than 30 and less than 120 m per sq. km	2 points
Low	less than 30 m per sq. km	1 point

PMO rank:

High (active)	rural, 6-7; urban, 5	3 points
Medium (moderate)	rural, 3-5; urban, 3-4	2 points
Low (inactive)	rural, 1-2; urban, 1-2	1 point

The highest possible score is 9 (a commercially active district with high population and road densities), while the lowest is 3 (a commercially inactive district with low population and road densities).

8.5 Zambian Assessment Framework for Feeder Roads

This approach to feeder road assessment considers three main areas, network considerations, social factors and economic factors. The initial screening process examines the road network in each district. Roads to be included for upgrade consideration must satisfy basic network criteria, including links with national roads, non-duplication, access to large populations. (see National Road Board, Ministry of Communications and Transport 1998)

The social and economic factors are summarised in Table 16 and Table 17 respectively.

Table 16 Social Factors and Data Requirements

Social Factors	Data Requirements	Measurement Unit
Population served by road	Population per km of road Area influenced by road	Number of people Road distance Size of area
Presence and intensity of social infrastructure	Types of facilities Number of facilities	Description Number
Potential increase in traffic volume and mobility of people	Existing type and traffic volumes. Potential and type of traffic volume	Numbers of current vehicles on road segment. Potential number and type of vehicles
Employment creation potential	Number of both direct & indirect jobs to be created. Potential wages and incomes.	

Table 16 Economic Factors and Data Requirements

Economic Variables	Data Requirements	Measurement Unit
Historical and current agricultural production	Value of marketed products	Current production levels (marked quantity x price)
Potential agricultural production	Arable agricultural area (ha) Area under cultivation (ha)	Potential tonnage of crops Potential livestock tonnage
Production facilities and services	Storage depots Extension centres/camps Retail trade services	Number of facilities Capacity of facilities Presence of centres
Planned future development activities	Type of planned future developments	Number of ongoing projects

Road projects are ranked by their score on the Social Economic Justification Index (SEJI), the higher the score the greater the justification.

The SEJI is derived as follows:-
Each social and economic factor is given a corresponding rating:-
0 – 2.0 (low)
2.1 – 6.0 (medium)
6.1 – 10.0 (high)

Table 18 shows how the different rating classifications are derived.

Table 18. The Classification of Different Factors

Characteristic	Low	Medium	High
Population	< 2000	2001-6000	.> 6000
Social Facilities	no facility	up to 3 facilities	more than 3 facilities
Potential increase in traffic	none expected	more than 50% increase	more than double
Employment and income generation	no change	50% of project labour from local community	more than 50% of project labour from local community
Current agricultural production	0-249 bags/yr transported	250-1000 bags/yr transported	more than 1000 bags/yr transported
Potential marketed production	area over populated increase only possible with high inputs	significant increases if input and output constraints removed	significant increases by improving infrastructure and storage
Storage and marketing processes	no facilities	up to 3 production facilities	more than 3 facilities
Planned future development	no proposed developments	at lease one development being implemented	more than three private and community based projects planned but take off hindered by lack of infrastructure

From the classification and ratings an average Social Dimension Index (SDI) and an average Economic Dimesion Index (EDI) are estimated . The SEJI is the average of the sum of the SDI and the EDI.

The transfer of actual numbers of facilities, tonnage of output etc. into the qualitative bands is somewhat subjective as it is up to the discretion of the researcher. Local consultation with stakeholders is suggested to identify if any weightings should be applied to the indices. Again this adds a subjective element into the analysis.

A major problem with the method is how to measure and predict the potential output and increases in variables due to the upgraded road.

9 Maintenance and Pavement Management

Historically, road executive agencies have been responsible for:

- Implementation of the government approved road investment programme
- The management of the network (including enforcement of highway regulations, monitoring road performance, traffic signing and other advice to users, etc.)
- Planning and design of roads, based on traffic surveys and design guidelines

The traditional organisation has been structured to accomplish all of these tasks 'in-house', and has included a range of professional and administrative skills (engineering, planning, contract management, legal, financial, etc.), as well as the capacity to undertake all types of construction and maintenance through parastatal construction companies and force-account labour forces. With the increase in private participation in public activities, much of this work is being market-tested and contracted out; some parts of the organisation are also the subject of privatisation schemes. All aspects of construction and maintenance works, engineering supervision, contract management, and planning and design services have come within this process. As a result, many of the executing bodies are becoming smaller in size, as more of their work is passed to the private sector. This commitment to down-sizing is seen in many of the case-study examples (e.g. Ethiopia and Ghana)

The establishment of a road condition monitoring system makes possible a regular effective assessment of the road network condition. The system also provides a basis for monitoring the improvement in the surface condition of the road network through regular intervention with routine and periodic maintenance and reconstruction works. Although Pavement Management Systems (PMS) are not new to the developing world very few are used to their full potential.

9.1 Operations and Maintenance in Ghana

Ghana Highway Authority's (GHA) maintenance programme is carried out through the 10 regional offices, 32 districts across the country, two mobile maintenance units and two bridge maintenance units. Each of the regions and districts has equipment maintenance workshops and stores operations. The maintenance department at the GHA headquarters is headed by the Deputy Chief Executive (Maintenance) and assisted by Directors at the regions and the Director of maintenance at HQ. The districts are responsible for routine maintenance by both contract and direct labour. In each district there is an engineer assisted by one works superintendent and some administrative staff. At present 50% of routine maintenance is done by contract through the Single Man Contractors (SMC) and Local Private Contracts (LPC). The remaining 50% is by direct labour. The supervision of routine maintenance works is done by the foremen located at the district offices. The regional offices are run by regional directors and a maintenance engineer. The district engineer should visit the his area regularly to monitor progress before recommending payment approval to the director.

The plan is to reduce direct contract labour to 10% over the period 1995-2000. This will involve a major review of the skilled and unskilled workforce, and reduction or total elimination of equipment, equipment operators and maintenance personnel at the regions and districts.

Routine maintenance is planned at the beginning of each year by the district engineers, who prepare their work programmes and materials needs. This information is reviewed and collated at the regional offices for submission to GHA maintenance department at HQ. After reviewing and consolidating the work programmes from the regions, GHA presents these estimates to Ministry of Roads and Transport (MRT) as part of the budget process (see above). Work plans inevitably have to be modified as a

result of the budget approval process. The district engineers prepare the revised implementation schedules in line with available funds.

The Department of Urban Road's (DUR) programme is undertaken through the five MMA District Roads Units (DRU). These were created as part of the process of decentralising central Government activities to district local level, and are part of (or are in the process of being incorporated into) the MMA organisation. They are still staffed by DUR, and funding is channelled through the DUR vote. Work schedules and budgeting for routine maintenance are estimated by the DRU's Road Engineer, and compiled by DUR for submission to MRT in the same way as GHA.

Over the past few years the MRT has made considerable progress in promoting the greater use of private sector contractors for road maintenance with a view to reducing the scope of "force account" activities. Currently, 90% of periodic maintenance activities are performed by private contractors while 60% of most routine maintenance is also undertaken by private contractors.

DUR plans to put in place, measures that will expand further the involvement of private sector contractors. Routine maintenance activities such as pothole patching and drain cleaning have been privatised. DUR intends to reach 100% routine maintenance by contract by the year 2000.

The Department of Feeder Road's (DFR) routine maintenance is similarly being decentralised, initially on a pilot basis at selected District Assemblies. Progress on this is slow, because of the institutional limitations at district level.

Ghana's domestic construction capacity has developed significantly over the past decade. At present there are about 270 road works and 700 bridge and drainage contractors classified by MRT in eight categories. Contractors renew their registration annually, when they are evaluated by MRT on the basis of size, equipment, past experience, and financial standing.

The majority of contractors are capable of undertaking contracts ranging from US$150,000 to US$500,000 at a time within 12 months, while the largest can tackle contracts of several million dollars. Training has been provided by MRT to over 80 labour-based contractors each capable of undertaking 25km of feeder roads rehabilitation per annum. This domestic capacity, with some strengthening, can handle most of the gravel trunk and feeder road programmes. For paved trunk roads there is still a need to improve capacity.

Similarly, the consulting industry has developed rapidly, and there are now a number of highly successful local firms which are capable of undertaking road feasibility and detailed design studies, as well as providing supervision services. The road agencies contract out most of these tasks, which are increasingly going to local firms.

9.2 Pavement Management in Ghana

Under the Highway Sector Investment Programme, which focuses on further arresting road deterioration and establishing institutional capacity for sustainable, effective, and

efficient development and management of the road network, the Government of Ghana is obligated to an annual assessment of condition of the road network.

The road condition is reported using a 'condition score' calculated for each homogeneous segment. The condition score is calculated by subtracting points for each distress present on the road. A condition survey manual has been developed for this purpose. The manual gives descriptions and definitions of the severity and extent of the various distresses. A series of colour photographs showing the distresses and various severity levels are included in the manual. Besides the distress data, roughness measurements are collected using a response type road roughness device, RIDEMATE roughness values at 250m intervals are collected for all sections of the road network.

The survey includes a listing of all the road segments in the network for the various surface types. The road segment listings are grouped based on their present condition. Also listed is the priority ranking for each road segment and the proposed programme for maintenance, rehabilitation and reconstruction alternatives.

However, since the Pavement Maintenance Management Package (PMMP) software has not yet been modified to calculate the condition score, the condition of the gravel network is obtained using the IRI roughness values with the following boundaries:

- Road sections in ‘Good Condition’ have IRI roughness less than 10m/km;
- Road sections in ‘Fair Condition’ have IRI roughness greater or equal to 10m/km and less or equal to 13m/km;
- Road sections in ‘Poor Condition’ have IRI roughness greater than 13m/km.

The information from the PMMP is used to develop the programme for periodic maintenance.

The DFR's Road Condition Study is still under development and is to be carried out through the installation of a road condition reporting and management system. The project’s main objectives stem from the DFR’s need to integrate itself with the road management systems already developed at GHA and DUR. The aims are:

- Develop the procedures and train DFR personnel on collection of surface condition, roughness, and inventory data for the road network.
- Direct the field data collection of the DFR’s maintainable road network. Implement at the DFR, the Pavement Maintenance Management Programme (PMMP) software being used at GHA.
- Develop a Road Condition Report for DFR which will be compatible with those GHA and DUR

A feature of the work is to develop a condition survey manual for the visual classification of gravel roads defining levels of the severity and extent of conditions. As for GHA, the PMMP needs modification to accommodate gravel roads. DUR is also investigating a Maintenance Performance Budgeting System (MPBS), to support detailed planning and budgeting.

The urban road maintenance programme (administered by DUR) is designed to address needs or problems in three categories: structural maintenance which includes the protection and repair of the pavements, sidewalks, drainage, and bridges; operational or functional maintenance which includes the restoration of signs, traffic signals, and pavement markings; the cleaning of drainage systems; and the removal of litter and debris from the street and sidewalk surfaces; roadside maintenance which includes maintaining the aesthetic characteristics of turf and landscaped areas, litter removal, sweeping, graffiti removal, and similar activities.

The new DUR MMS, which is still not fully operational, is a maintenance management process aimed at systematically and objectively determining road network quality and programming maintenance actions (routine and periodic) in response to observed conditions, budgetary constraints and DUR's maintenance policies. The new system is a tool which provides assistance to the Metropolitan Road Engineers and their Maintenance Engineers for maintenance programming, implementation and monitoring.

The system now provides from live data entries:

- Information on the current state of pavement and road features;
- Objective alternatives for routine and periodic maintenance;
- Effectiveness of management decisions;
- Objective, rapid and repeatable system for decision making;
- Savings in expenditure through alternate strategies choices;
- Economic and managerial framework for deciding the optional level of maintenance funding (using HDM III)
- Sound method for developing annual works programme and budget requirements.

The MMS provides the basic information needed to plan, schedule, perform, control, and evaluate maintenance programmes. The systems permit managers to compare alternative procedures, equipment and materials for costs and productivity. Periodic reports, usually monthly, can monitor the progress of work programmes, compare that progress with scheduled work and the costs with budget allocations.

When maintenance activity reports include location information, the processed data can show the locations with high levels of maintenance required, the locations where repairs are repeated, and the locations where maintenance activities correlate with safety (accident) records.

The MMS does not use economic inputs to determine priorities. Rather it uses a rating system based on both measurement and visual estimation.

9.3 Maintenance and Pavement Management in Ethiopia

The Planning of maintenance in Ethiopia used to be based on the Roy Jorgensen approach where large volumes of performance reports covering all maintenance activities were produced and sent back to head office. However, because little action was taken on these a breakdown of communication occurred between Head Office

and the Districts. Gradually the system deteriorated and so much of the reporting became fictitious.

There is a long term plan to move towards contracting out all maintenance however in the short term there is insufficient capacity by force account to do the necessary work. Plant tends to be cannibalised and there are problems with the purchase of spare parts. Overall there is a need for plant, training and a responsive reporting system. Periodic maintenance is done by force account. Priorities are set by Head Office and largely depend upon road condition.

A lengthman system for road maintenance of the Federal road network was introduced in 1998. However because of payment problems, rates and a lack of interest by engineers it was later abandoned. It is now planned to revive the system to cover 5000 km of roads in the next five years.

A PMS branch has been established in Ethiopian Roads Authority. HDM III has been used on a sample basis to predict road deterioration. A road condition survey covering 7,000 km was undertaken using the DESYROUTE system. However the Bump Integrator (BI) survey that went with this to measure road roughness may have calibrated wrongly. A MERLIN was used for calibration but it is believed it had the wrong dimensions.

Currently maintenance budgets are not allocated on logical economic grounds so no optimal maintenance policy has been developed so far. A proper working PMS system should be able to provide this. Condition surveys have been very subjective depending on particular engineers. Existing maintenance manuals will suggest how to perform particular tasks but they do not give advice on optimal treatment frequency for different traffic levels. The HDM planning tool is believed to be too complex for use at the District level a simpler tool (e.g. RTIM3 or RED) may be more appropriate to help indicate maintenance priorities.

9.4 Pavement Management in Finland

The pavement management process is based on 3 different decision-making levels: the Ministry of Transport & Communications (MTC); the Central Administration of FINNRA, and the 9 regions of FINNRA. The management of the process is realised by using the following management methods:

- Policy guidance
- Management by objectives
- Product/activity-based management
- The Pavement Management System
- The road asset value

The main stages of the process are as follows:

- Financing and setting the administrative-level objectives
- Budgeting and setting regional-level objectives
- Work programming
- Procurement of works

- Measuring and follow-up

The pavement management process is on a 2-year cycle which has to be connected with the financial year of the administration. Although the management process is an ongoing activity, it is formed of consecutive and overlapping portions in the course of time.

According to Saarinen et al (1998), the best practices in road management can only be based on good data and good analytical procedures. The road reference system, road classification and administrative data form a basis for road management and for the use of data management, data banks, and management systems. Equally relevant is the basic data on road and traffic. This data has to be supplemented with other data from external sources and various interest groups of the road administration.

The requirements and standards for the contents and accuracy of data are defined at the administrative level for management by objectives, product-based budgeting, and resource allocation among products and Regions. Detailed data is specified at the regional level for programming purposes.

Comprehensive and inexpensive measuring procedures and techniques are essential. The measuring methods and devices have to be sufficiently similar to each other to ensure comparability of different Regions. A fully automated data storage and data transfer is necessary for serviceability, and to make it possible to collect and update data frequently. FINNRA has the following data banks and databases at its disposal:

- Road Data Bank (RDB) - general, real-time data, on road and traffic
- Road Condition Data Bank (KURRE) - current road condition, historical condition, and predicted condition
- Bridge Data Bank (BDB) - general bridge damage data
- Traffic Data Bank - type of vehicle, vehicle speed, passing time, direction and lane
- Road Accident Database - detailed information on traffic accidents on public roads, reported by the police

PART C: DISCUSSION AND CONCLUSIONS

10 ISSUES

This report has attempted to take a broad view and draw together and comment on a range of diverse aspects of road planning, funding and management.

The process of translating broad objectives and funding into preparing an investment or maintenance work programme for a particular road is inevitably complex involving a wide range of intermediate steps and a variety of procedures, models, data, different personnel and organisational structures. The procedures are, of course, different for each country.

Despite the complexity there are a range of common problems. These have been identified as follows:

- Stated and unstated goals and multiple objectives from both donors and government that often cannot be easily translated in action
- An in-built bias towards treating road investment as a simple answer to high transport costs, poor mobility and inaccessibility
- Conflicts within planning, funding, funds allocation and maintenance management procedures
- A shortage of maintenance funding, high maintenance costs and unachievable maintenance targets
- Inefficiency by in-house construction and maintenance units
- Poorly paid and often poorly motivated staff leading to a shortage of good quality engineers, economists, planners and administrators in key institutions
- Inappropriate road design standards
- Inappropriate road programmes that are maintained with donor support
- Very complex and uncertain road planning models, that cannot easily be used by local staff
- A high rate of institutional change that coupled with staff shortages create heavy demands upon the remaining local senior staff
- A decentralisation process that is very difficult to implement and may lead to a further loss of efficiency

A number of authors have commented upon the huge wastage of road investment resources that has been experienced in developing countries over the last thirty years. However, given the above, in many ways it is surprising how well local management and their road networks perform - against the odds! Nevertheless the situation is not static; many of the problems identified above have been and are being addressed by a variety of agencies, researchers and programmes.

For some years there has been a world-wide trend towards the commercialisation of road construction and maintenance. There is every reason to believe that this process has and will lead to greater efficiency in the provision of road works. Similarly the shortage of maintenance funding has received a lot of publicity and the evidence we have suggests that the introduction of the new road funds has lead to greater resources going to road maintenance.

Besides the increase in resources, the road funds also seem to be able to increase the efficiency of disbursement process because they are not tied to the annual government accounting year. Coupled with the drive towards commercialisation has been a trend towards better staff remuneration. There is evidence to suggest that for a number of countries there are now much better pay scales (compared with the early 1990's) for professionals.

Less progress has been made in the other areas. The new HDM-4 road planning programme does have the in-built capacity to integrate road investment and maintenance planning, and to help logically prioritise investment and maintenance under a budget constraint; hence the potential for conflict between different procedures is reduced. However, the move towards the use of HDM-4 will to little to improve the funds allocation and planning procedures of low volume feeder roads where a different approach is now demanded. Over the last two years considerable efforts have been made to sensitise and train highway engineers and planners from many countries in its use. Despite this the model is extremely complex and subject to considerable uncertainty.

A variety of different feeder road planning procedures (often involving both proxys for economic as well as social benefits, and various ranking procedures) have been used in different countries for many years. Inevitably they reflect a range of different objectives and for these reasons they are not so easy to compare. However, there is a need for the procedure to take account of the change in condition that is being planned (as in the Ghana Feeder Road Prioritisation procedure) and not just assume that all interventions are equivalent, even if account is taken of the different costs involved.

The question of inappropriate design standards has been raised by a number of donors and some studies have been undertaken. But it seems that this is an area of very considerable inertia when it comes to accepting new standards in everyday activities. The move towards basic access and the full acceptance of the "spot improvement" approach to rural access infrastructure is a difficult message for many engineers and most donor representatives to accept even though it may represent the most efficient use of resources. The natural inclination of most professionals is to undertake to do a high standard job that visibly "looks good" and is not likely to cause any subsequent complaints. In contrast the basic access approach involves spreading resources thinly, taking some risks and accepting the fact that the road may not look uniform in quality.

The Kenyan Roads 2000 approach is an attempt to help address the problem of high maintenance costs, unachievable maintenance targets and the problem an unbalanced road network. In this approach road maintenance for the lowest traffic volume roads was assigned to lengthmen after the road had been brought up to a specified “maintainable” condition. Full regravelling was not undertaken for roads of less than 200 vehicles per day.

Although a number of authors have stressed the problem of road bias and the need to include additional non-infrastructure measures to address transport problems in comparison with the amount spent on roads interventions in this area have been pitifully small. Huge problems remain with inefficient transport industries at the national, regional and local level as well as very poor mobility and access to transport

services, for many countries, at the village level. These problems cannot be addressed by infrastructure measures alone.

The new moves towards decentralisation have been on the basis that it would improve decision making through improving accountability and transparency. The assumption has been that road management is a simple task that can be handled satisfactorily at the local level with limited resources. One of the key lessons of this report is that road planning and management is very far from being simple. Although there is a need to introduce participation and local democracy into the rural road planning process, unless sufficient resources are made available at the local level decentralisation is likely to fail and the current moves in that direction are, if anything, likely to make matters worse.

11 SECTORAL ORGANISATION

Roads infrastructure provision and management is both a national and a local issue. As such, ministerial responsibility for roads may be divided between sector ministries: that responsible for the national road network, and that responsible for local and urban roads. There are also a few examples of a third sector ministry involvement, where another sector ministry may have developed a highly targeted and localised network (e.g. agricultural roads).

Government policy towards the national roads infrastructure provision and management is the responsibility of a sector ministry that may be solely responsible for roads, or may have a wider remit across the whole transport sector (i.e. including transport operations, ports, airports, railways, etc.) and, sometimes, allied sectors like telecommunications. Organisation at this level is very much a political consideration, but on grounds of efficiency in transport policy development (taking account of inter-modal issues), there is much to recommend an all-embracing transport ministry. As indicated above, local and urban roads may come under a separate ministry that has responsibility for local government and regional development.

The responsible sector ministry (or ministries), through Cabinet and Parliamentary process, determines policy issues and funds allocation towards roads. This role covers such tasks as investment prioritisation, sector restructuring programmes, budget negotiations (with both the finance ministry and donors), legislative initiatives, etc. Allocating monies between national and local roads programmes is always problematic, and perhaps more so where separate ministries are involved and where part of the funding comes form a common source (e.g. a road fund).

The extent to which the ministry is involved in the detailed planning and execution of roads programmes depends on local organisation. For the national roads programme, there is a trend towards the establishment of autonomous roads agencies that act with varying degrees of freedom from the parent ministry. However, there are still many examples of roads administrations that are departments of the sector ministry. There may be separate departments to deal with different categories of road (e.g. trunk, urban, feeder). Where the local government ministry has the remit for local roads, it may nominally devolve responsibility for execution of the roads programmes to district and urban councils. However, few such councils have the capacity to undertake this work, and must depend on outside support from either the local

government ministry (which may be equally deficient in relevant expertise) or the ministry responsible for national roads.

While a road department is an extension of its parent ministry, a roads agency is the subject of specific legislative underpinning that specifies its (the agency) aims and objectives, responsibilities and powers, funding and accountability, as well as its organisation, administration and board composition. Accountability will usually be to Parliament, though the sector ministry inevitably continues to play a prime role in the affairs of the agency through its sector policy remit, key positions on the board, and over-riding responsibility for budgets. However, separating the executive agency from the sector ministry has several advantages:

- An agency is not bound by the restrictive practices of the civil service, particularly relating to staff terms and conditions, the sourcing of capital investment, etc.
- An agency may be less prone to political pressure and interference
- Direct accountability and financial transparency of an agency should encourage a greater degree of efficiency in the organisation.

The financial transparency of an agency also supports the development of a road fund, though the one is not a necessary condition for the other.

Despite the trend towards agency status, there is no evidence that this has had any positive effect on rural roads development per se. Fund allocation between roads remains (irrespective of organisational model) essentially an economic, and perhaps more importantly (since few rural road development projects show a good economic return) a policy issue. It is also not clear whether giving responsibility for rural roads to the local government ministry (where this has happened) has improved funding allocations. While giving rural roads a separate, and perhaps higher profile voice, scarce rural development funds will be competed for by sectors other than roads. However, road funds may have improved funding to rural roads where the road fund specifies a fixed percentage allocation to different road types (as is the case in Zambia).

12 Funding

Historically, the source of funds for the administration, development and maintenance of roads has been government general revenues. Annual budgets were negotiated (by the sector ministry with the finance ministry) for the allocation of funds to cover the costs of ministerial and departmental (and/or highways agency) staff and their operations, as well as contract suppliers of road maintenance and construction services. Typically there would be an establishment budget (to cover staff salaries and wages, departmental operational costs, and routine road maintenance costs) and a development budget (to cover new works, road rehabilitation and periodic maintenance).

Where roads are the responsibility of local government, funding must come through either the central ministry vote, or through local taxation. Because local government tends to have a weak revenue base, there continues to be dependence on the central vote for many local roads. An interesting example of a localised road-user charge is

the octroi tax imposed on hauliers, usually at state boundaries in the Indian sub-continent. This is a major source of general revenue for state governments.

Under this system there is no transparent or intended relationship between the levels of revenues raised from the road sector users and the levels of expenditure on road infrastructure. The finance ministry views road users as simply another source of general revenue that is, as such, available for any of its public sector commitments and priorities. Indeed, fuel duties (the main user tax) are a particularly efficient tax, since they can be relatively easily collected (from the oil companies) with little leakage, and are not overly price sensitive.

A universal problem with this funding system is that the monies voted for roads have been insufficient to cover the planned roads development programme. Furthermore, in times of economic stress, development budgets are particularly vulnerable to cuts; thus even the voted monies are not necessarily all available. The shortfall in the development programme is to some extent filled by donor funds, though the evidence is that road maintenance expenditures are still insufficient to keep the network in a good state of repair.

A trend that is gathering momentum is the development of a Road Fund. Many countries have either implemented or are considering the creation of this funding mechanism. Such schemes identify and dedicate (or hypothecate) certain road user charges (that may currently be part of government's general revenues) to the development of roads. In this way, the charges are seen as a proxy for road pricing. A Road Fund is partly based on the principle that the roads sector is a major service industry that needs to be administered on commercial lines in order to achieve efficiency. As such, a Road Fund requires its own (independent) administrative organisation; it is supported by (and supports) the parallel creation of an autonomous roads executive or highways agency, though this is not a necessary condition for its success as is evident in both Zambia and Ghana.

There is yet another form of charging for roads which is highly localised and targeted; this takes the form of area road pricing (particularly applied to road-users in congested central urban areas) and the imposition of toll charges for specific roads (often inter-city roads, but also some urban arterial roads). The revenues from these charges may be used for the direct benefit of the facility being used.

13 Management, Planning and Local Capacity

Road infrastructure has for long been administered from the centre, though with varying degrees of regional devolvement. In more decentralised countries (like India), the regions (or states) will have their own sector ministries and roads executives which focus on regional or state highways, while the centre handles the national trunk network and other strategic roads.

A typical roads executive agency (i.e. ministerial department or highways agency) has a central headquarters handling most of the management, personnel, accounting and planning functions. The centre promotes standards and procedures. The centre may undertake some feasibility and design work, although this work may be more usually

contracted out to local and international consultants. Local consultants are increasingly competent in this work, as well as in providing supervisory services.

The centre is also likely to provide a centralised contracts management facility, although tenders may be adjudicated through regional tender boards. It is the centre that deals (through its sector ministry) with budget negotiations at government level and also with donors. Major road and bridge development projects are likely to be planned, designed and project managed from the centre. Contracts for high value projects (particularly those funded by the donor community) will be awarded on the basis of international competitive bidding (ICB).

Regional or district offices (and perhaps sub-regional offices in some cases) represent the organisation at the local level. These offices are staffed by professional and support staff, largely mirroring the centre. The regional or district road engineer has an important role in monitoring his area road network; on the basis of this, the regions prepare their plans, programmes and budgets for routine and periodic maintenance, as well as establishment costs. These are submitted to the centre for collective processing and prioritisation. The regional engineer must work within the final budget that the centre negotiates.

Regional offices have traditionally employed their own labour (force account), with associated materials and equipment, to undertake basic maintenance tasks. They are also deployed for more complex maintenance tasks, although this work is also contracted out to private contractors. Local private contractors may be registered with the regional office (or centre), and are given a certain grading of competency dependent on their size (manpower and equipment), experience and financial status. Tender bidding documents will specify the grade of contractor eligible to bid for the advertised work. The quality and competency of local contractors is improving over time, and some of the larger companies are capable of competing on ICB projects.

Where local government is responsible for rural and urban roads, and where they do not have the required expertise (which is often the case), they may still rely on the regional road engineer for support in undertaking their responsibilities. Alternatively, the centre may second staff to local government for the same purpose.

14 Key Principles for Future Development

14.1 Planning

In order to make the road planning process more efficient governments and donors need to make their goals and objectives more explicit. Clear mission statements and statements of objectives that cover areas such as: national economic development, regional balance, poverty reduction, social access, gender, environment, labour intensive solutions are important for decision makers in the sector. There is a clear need to develop a planning framework and planning tools and models so that multiple objectives can be met in a consistent manner.

In each country there is scope for a holistic look at the consequences and resource allocation decisions involved in the initial selection of programmes, funding, planning (including ranking procedures) funds allocation, design standards and maintenance management. Too often resource allocation issues are only addressed within the

framework of the conventional cost benefit analysis of an individual road investment project.

The conventional main road planning tools such as HDM-4 is relatively well developed in order to meet economic objectives. However there are a diversity of approaches employed in prioritising rural access or feeder roads. Currently their biggest weakness is perhaps the fact that for most of them the change in road condition is not identified or separately valued. This need to be rectified and it would help if there was a critical look what the new road investment was actually achieving in terms of its affect on seasonal accessibility and road roughness reduction.

14.2 Design standards and basic access

There is a very good case for countries and donors to review design standards . Where changes in standards are likely to substantially affect users then benefits and consequences of the approach should be explained. During the Ghana feeder road prioritisation programme the local population only agreed that the basic access approach was a sensible solution (compared with high standard gravel surfaced roads) when the consequences were explained to them in terms of the total distance improved and the size of the population that would benefit, for the budget available.

14.3 Non-road interventions

Road investment should be seen as just one measure that can be used to lower transport costs and improve accessibility and mobility. Prominence must be given to other forms of intervention. There is plenty of evidence to suggest that the market alone will not solve the problems of high transport costs and poor service frequency. Similarly the problems of village transport also need to be addressed. Where road investment is made alternative measures may also be required to ensure that the benefits of lower transport costs are passed on to the users and the wider population.

Initiatives such as the Rural Travel and Transport Program (RTTP) (part of the of the Sub-Sahara African Transport Program) and the International Forum for Rural Transport Development (IFRTD) are well placed to initiate interventions and provide advice in this area.

14.4 Organisation

There is probably no ‘correct’ organisational model; choice must take account of political realities and preferences, institutional capacities and professional capabilities. In this way, a ministry department dedicated to rural feeder roads (as in Ghana) may be a more effective way of administering rural roads than say through local government channels (as currently exist).

Devolving the responsibility for rural and urban roads to district councils has several merits:

- It ensures that roads are planned and developed in a local context, and subject to local concerns and developmental priorities
- Consequently, it provides the opportunity for bringing the development process closer to the communities that are served.

However, to effect this devolvement requires strong institutional support at the local level, together with the requisite professional expertise. These requirements could, in principle, be 'bought in' through the contracting out of services; but this may not be a sustainable approach while district council revenue bases are weak, which is often the current situation. It is also unlikely that there is currently sufficient in-country expertise to service all the separate needs of each district. In these circumstances, a central or regional based advisory service (to district councils) may be a first step towards full district responsibility for rural road development.

14.5 FINANCIAL REFORM

14.5.1 Political Considerations.

Clearly, a Road Fund can only be implemented with the consent of government, and in particular the approval of the finance ministry. This approval is not always easily won, if won at all. Finance ministries world-wide are reluctant to yield any of their revenue sources, and are notoriously conservative on issues of hypothecation. In the face of such opposition, it is unlikely that any headway can be made in the establishment of a Road Fund.

Area road pricing and toll charges are additional to existing road-user charges, and hence do not have any negative impact on general government revenues from road-users. As such, the finance ministry can have little concern about this form of charging, particularly if the revenues earned reduce the burden on roads expenditure from general revenues. These charges may, however, present a greater political risk to government, since they have road-use equity implications. The political 'fallout' of these charges may be mitigated if the revenues are used for public transport (as well as roads) projects.

14.5.2 Sources for a Road Fund

Any of the generally accepted road-user taxes and charges can be dedicated to a Road Fund. These include fuel duties, vehicle registration and road tax, vehicle inspection fees, and driver licence fees. Fees (for example, for inspection of vehicles) ought to be net of the costs for providing the designated service. Road toll charges and area licence revenues could also be included, though might be better dedicated to the road/area from which they are collected. Local user-charges like the octroi would need separate treatment, perhaps dedicating them to a localised Road Fund (though there are no known examples of such a fund); local government would be very unlikely to cede these monies to a national Road Fund.

An important consideration for the administrators of a Road Fund is that the revenue yield from all sources is sufficient to meet the maintenance requirement. There may be no further recourse to government general revenues once the Road Fund is in place.

Ideally, too, the tax incidence should reflect the amount of use and road-damage impact that individual users impose. Meeting this condition is likely to require significant changes to road tax and fuel duty rates to reflect the high damaging impact of heavy goods vehicles.

14.5.3 Allocation of Funds

For efficient and consistent allocation of monies, prioritisation should be on the basis of economic cost-benefit principles, selecting those projects that demonstrate the highest economic rates of return. In practice the task is not that simple. Political interests may impose certain regional allocations, and rural roads need to be justified on the basis of other criteria because their economic case will inevitably be weak. The process of allocating monies between types (trunk, district, urban and rural or feeder) is a continuing problem that has not been satisfactorily been resolved. Some Road Funds are committed to a fixed percentage allocation (e.g. Zambia), but this is not necessarily the best solution, and cannot always be effected anyway.

14.5.4 Organisation of a Road Fund.

The effective and efficient administration of a Road Fund requires an independent board and secretariat, with nominated representatives from the key stakeholders (sector ministry or ministries, highway agency or department, transport industry). Their role is to administer the collection and allocation of monies. The independence of the board from the sector ministry and the roads executive provides a check on quality, efficiency and cost-effective use of monies in the sector. To work well, however, requires that the secretariat has its own appropriate expertise to call upon.

The creation of a Road Fund and its administration will usually require the underpinning of new legislation. The status, objectives, responsibilities, functions and accountability of the board and its secretariat have to be prescribed, as well as the mechanisms by which the fund is created and administered.

14.5.5 Donor's Role.

Donor funds continue to be an important component of the roads development programmes of many countries. Clearly this will continue until a sustainable road funding mechanism has been established. The development of a Road Fund is perhaps the best opportunity for achieving this condition. Inevitably, however, the viability of rural roads (which are difficult to justify on economic grounds) will create a 'drag' on a Road Fund. The extent to which monies are available to 'cross-subsidise' from high (urban and inter-urban road-users) to low (rural road-users) revenue generating 'roads' will govern this future need for external support.

14.5.6 Private Funding.

Private investment in roads is usually for a specific project, most notably a toll road or toll bridge. The investor (typically a large contractor backed by a consortium of banks) negotiates the franchise for designing, constructing and operating the toll road. The consortium retains the franchise for a fixed period (say 20 years), when ownership of the road reverts to government.

14.6 MANAGEMENT OF ROADS

14.6.1 Decentralisation of Responsibility

Building the capacity of local government is a key policy of many countries. This is advocated as a means of empowering local interests, weaning the regions away from state support and dependence, and as a generally sustainable and democratic approach. The approach relies upon strengthening and developing the local institutions, and underpinning them with necessary legislation and funding. Establishing a strong local revenue base is a pre-requisite for this process.

Undoubtedly, devolved responsibility is well developed and long established in many countries, but is still a goal yet to be achieved in many others.

Decentralisation of responsibility for roads is part of this process. To some extent the management of roads has always had some element of regionalisation through regional roads engineers (see above), though the centre has always retained overall control. Under the new approach the decentralisation is more radical in that districts and urban centres are being given total responsibility for all roads (other than designated trunk and strategic roads) within their area. This development can put an enormous strain on local government that has neither the funds nor the professional expertise to meet this brief. As an interim solution, the centre continues to provide these resources. The longer-term solution depends on the development of sustainable local revenue sources, and a recognised local cadre of professional expertise. The latter, in turn, will also depend on appropriate educational moves that encourage the teaching of engineering (and related subjects), and the acceptance of these qualifications (at all levels) within local government. Professional and technical organisations have an important role to play in promoting this process.

14.6.2 Private Participation.

Private, rather than public enterprise is generally held to be the most efficient means of organising business and commerce. This principle is being increasingly applied successfully in the roads sector. Private participation can take many different forms from outright control of an organisation to providing consultancy and contractor services.

At the national level, the establishment of a highways agency is a first step towards running roads organisation on commercial lines. Part of this process usually involves the streamlining of staff numbers, taking a particularly critical view of force account labour. 'Market testing' is a competitive mechanism for comparing the costs of employing private contractors in place of force account; this often leads to the retrenchment of force account labour, and the down-sizing of the organisation.

Some agencies now contract out complete maintenance package programmes; in effect the contractor takes a franchise for managing and operating the roads within his care. This is also a mechanism for developing new roads using BOT schemes.. For example, the Indonesian toll roads have been privately funded and maintained, with revenues being retained by the developer; ultimately (in say 20 years) ownership of the road reverts to government (who could then re-franchise its operation).

Private participation may be a particularly attractive proposition for local government, which has very limited existing expertise. Using consultants to provide local road engineering design and planning services is a well-recognised model in many developed countries. Clearly, however, it requires that funding is available, and that local government has some mechanism for supervising the services.

There is no doubt that the scale of private participation will increase in all aspects of roads management and operations. This trend is supported by the growing strength of both the contracting and consultancy sectors. Some sector ministries and highways agencies are taking positive steps to encourage this by organising their own training

programmes for the private sector, to promote a common understanding of the design, contracting and supervisory processes and expectations.

14.7 The Need for Future Research

As mentioned above there is need to develop and improve the general planning framework in order to deal with multiple objectives so that economic criteria may be combined with various social and environmental objectives. Such a planning framework does not specifically need to relate just to roads and transport.

The shortcomings of the road planning model HDM-4 have been identified in several places and, despite the research effort that has already been put into developing relationships for the model there is still scope for further work in helping to reduce both the uncertainties of road deterioration and improving the prediction of vehicle operating costs.

More research needs to be done in predicting the behaviour of earth roads and tracks and predicting the performance of interventions to increase seasonal accessibility and traffickability. Together with improving the performance of infrastructure research is also needed in helping to predict how users will respond to different opportunities of both physical infrastructure and of transport services. The biggest changes of both costs and mobility occur when users switch mode. There is very little understanding about the circumstances (e.g. income and fare levels, load carried, journey distance) that influence when modal shift takes place.

The value of time is another key issue that is important in urban and rural transport appraisal. The new research based on stated preference techniques has shown that the old approaches based on a fixed proportion of income are both misleading and wrong. The values will vary from country to country and so specific studies are needed that cover both urban and rural situations.

The wider benefits of transport investment need to be more fully explored, both with regard to the distribution of benefits to different groups of the population and the wider multiplier effects. Coupled with this work is a need to identify how cartels, monopolistic practices and poor information distort and change the distribution of transport benefits. Computable General Equilibrium Models might be able to provide new useful insights in this area. Further work also needs to be done in the are of transport and trade.

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Case study evidence which has been presented in this report may no longer be valid; institutional structures and processes are continually changing. The materials are presented to illustrate approaches which have been adopted, and the experiences gained, though it is understood that these approaches may not now be relevant in the context from which they were taken.

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