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Management and Financing of Roads

An Agenda for Reform

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CONTENTS

FOREWORD

Road transport grew rapidly after the second world war. It carries 80 to 90 percent of the region's passenger and freight transport and provides the only form of access to most rural communities. To handle this traffic, African countries expanded their road networks considerably during the 1960s and 1970s and also built new roads to open up more land for development. By the end of the 1980s, there were therefore nearly two million km of roads in Sub-Saharan Africa. These roads are some of the region's largest assets, with replacement costs amounting to nearly $150 billion. In terms of assets, employment and turnover, these roads are truly *big business*.

In spite of their importance, most roads in Africa are poorly managed and badly maintained. The poor state of the road network is reflected in the large backlog of deferred maintenance. During the past 20 years African countries have spent far too little on routine and periodic maintenance and, as a result, nearly a third of the $150 billion invested in roads has been eroded through lack of maintenance. Africa has been living off its assets. To restore only those roads which are *economically-justified*, and to prevent further deterioration, will now require annual expenditures over the next ten years of at least $1.5 billion. The balance of the network requiring restoration will either have to receive minimal maintenance, or be handed over to lower levels of government.

Experience gained under the Road Maintenance Initiative (RMI), suggests that the key concept required to overcome the above problems is *commercialization*: bring roads into the market place, put them on a *fee-for-service* basis, and manage them like any other business enterprise. However, since roads are a public monopoly, and ownership of most roads will remain in government hands for some time to come, commercialization requires complementary reforms in four other important areas. These are referred to as the *four basic building block*s. They focus on: (i) creating **ownership** by involving road users in management of roads to win public support for more road funding, to control potential monopoly power, and constrain road spending to what is affordable; (ii) stabilizing road **financing** by securing an adequate and stable flow of funds; (iii) clarifying **responsibility** by clearly establishing who is responsible for what; and (iv) strengthening **management** of roads by providing effective systems and procedures, and strengthening managerial accountability.

The RMI is a component of the Sub-Saharan Africa Transport Policy Program (SSATP), which is a collaborative framework set up to improve transport policies and strengthen institutional capacity in the Africa region. SSATP papers are addressed to public and private sector policy-makers, and to managers and staff attempting to improve the performance of the transport sector in Africa. They also attempt to facilitate dialogue among the donor community to build consensus on the key policy reforms required to achieve the above objectives.

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ABSTRACT

Road transport is the dominant mode of transport in Sub-Saharan Africa (SSA), carrying close to 90 percent of the region's passenger and freight transport, and providing the only access to rural communities where over 70 percent of Africans live. Despite their importance, most of the region's nearly 2 million km of roads are poorly managed and badly maintained. By 1990, nearly a third of the $150 billion invested in roads had been eroded through lack of maintenance. To restore only those roads that are economically justified and prevent further deterioration will require annual expenditures of at least $1.5 billion over the next ten years, or more than double the requirements of regular maintenance.

To find sustainable solutions to these problems, the United Nations Economic Commission for Africa (UNECA) and the World Bank launched the Road Maintenance Initiative (RMI) as part of the Sub-Saharan Africa Transport Policy Program (SSATP). With support from a number of bilateral donors, the Initiative has spent the last six years working with African countries to identify the causes of poor road maintenance policies and to develop an agency for reforming them.

The key concept to emerge from the debate on how to strengthen financing and management of roads is *commercialization*; bring roads into the marketplace and put them on a fee for service basis. However, since roads are and will largely remain a public monopoly, commercialization requires complementary reforms in four important areas called the *four basic building blocks*: (i) create ownership by involving road users in management to win public support for adequate funding and control of the agencies; (ii) secure an adequate and stable flow of funds; (iii) clarify who is responsible for what; and (iv) strengthen management by adoption of private sector management practices.

A number of Sub-Saharan African countries are in the process of implementing reforms towards the commercial management of their roads. These reforms include involving road users in management through road management boards, securing an adequate and stable flow of funds through road tariffs/road funds, and increasingly commercializing/privatizing the execution of engineering services and road works.

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ABBREVIATIONS

General:

AADT	=	Average annual daily traffic
GHA	=	Ghana Highway Authority
HDM III	=	Highway Design and Maintenance Model, Version Three
ICB	=	International Competitive Bidding
ILO	=	International Labor Organization
IMF	=	International Monetary Fund
IMSC	=	Inter-Ministerial Steering Committee
LCB	=	Local Competitive Bidding
MOF	=	Ministry of Finance
MOW	=	Ministry of Works
PER	=	Public Expenditure Review
PS	=	Permanent, or Principal Secretary
SATCC	=	Southern Africa Transport & Communications Commission
SLRA	=	Sierra Leone Roads Authority
SRMC	=	Short Run Marginal Costs
SSA	=	Sub-Saharan Africa
SSATP	=	Sub-Saharan Africa Transport Policy Program
UNECA	=	United Nations Economic Commission for Africa
VOCs	=	Vehicle Operating Costs

Country Abbreviations:

CAR	=	Central African Republic	RW	=	Rwanda
CM	=	Cameroon	TA	=	Tanzania
KE	=	Kenya	UG	=	Uganda
MAG	=	Madagascar	ZA	=	Zambia
UNI	=	Nigeria	ZIM	=	Zimbabwe

***Units of Measurement**:*

$	=	US Dollars
CBR	=	California Bearing Ratio
EIRR	=	Economic Internal Rate of Return
ESAL	=	Equivalent standard axles
ESAL-km	=	Equivalent standard axles times distance traveled
GDP	=	Gross domestic product
GNP	=	Gross national product
GVW	=	Gross vehicle weight
IRI	=	International Roughness Index
km	=	Kilometer
m/km	=	Meters per kilometer
NPV	=	Net Present Value
SNC	=	Modified Structural Number
vpd	=	Vehicles per day
veh-km	=	Number of vehicles times distance traveled

OVERVIEW

Road transport grew rapidly after the second world war and is now the dominant form of transport in Sub-Saharan Africa. It carries 80 to 90 percent of the region's passenger and freight transport and provides the only form of access to most rural communities. To handle this traffic, African countries expanded their road networks considerably during the 1960s and 1970s, and they also built new roads to open up more land for development. Therefore, by the end of the 1980s, there were nearly two million km of roads in Sub-Saharan Africa, including 610,000 km of main roads. These roads are some of the region's largest assets. Their replacement costs amount to nearly $150 billion, and required annual expenditures on routine and periodic maintenance to keep them in a stable long-term condition are between $1.5 and $2.0 billion. In terms of assets, employment, and turnover, these roads are truly *big business*.

However, in spite of their importance, most roads in Africa are poorly managed and badly maintained. Almost without exception, they are managed by bureaucratic government roads departments. The poor state of the road network is reflected in the large backlog of deferred maintenance. It would take nearly $43 billion to fully restore all roads requiring immediate rehabilitation or reconstruction. African countries have spent far too little on routine and periodic maintenance during the past 20 years and, as a result, nearly a third of the $150 billion invested in roads has been eroded through lack of maintenance. Africa has been living off its assets. To restore only those roads that are *economically justified* and to prevent further deterioration will require annual expenditures over the next ten years of at least $1.5 billion. This amounts to nearly one percent of regional GDP. The balance of the network requiring rehabilitation or reconstruction will either have to receive minimal maintenance or be handed over to lower levels of government and local communities.

The economic costs of poor road maintenance are borne primarily by road users. In rural areas, where roads often become impassable during the rainy season, poor road maintenance also has a profound effect on agricultural output. When a road is not maintained — and is allowed to deteriorate from good to poor condition — each dollar *saved* on road maintenance *increases* vehicle operating costs by $2 to $3. Far from saving money, cutting back on road maintenance *increases* the costs of road transport and raises the net costs to the economy as a whole. It is estimated that the *extra* costs of insufficient maintenance in Africa amount to about $1.2 billion per year or 0.85 percent of regional GDP. About 75 percent of these costs are in the form of scarce foreign exchange. It is no wonder that road user organizations, particularly those in Tanzania, Zambia, and Zimbabwe, have expressed a willingness to pay for road maintenance *provided* the money is spent on roads and the work is done efficiently.

The Africa Road Maintenance Initiative, launched by the United Nations Economic Commission for Africa and the World Bank, has spent the past six years working with African countries to identify the underlying causes of poor road maintenance policies and develop an agenda for reforming them. What has emerged is that poor road maintenance policies are attributable to the institutional framework within which roads are managed. They are not managed as part of the market economy and this biases managerial incentives. There is no clear *price* for roads, road expenditures are financed from general tax revenues, and the road agency is not subjected to any rigorous market discipline. Roads are managed like a social service. Poor terms and conditions of employment create further difficulties, as do lack of clearly defined responsibilities, ineffective and weak management structures, and a lack of managerial accountability. Road agencies are unlikely to

operate efficiently until they are faced with some form of competition, or a competition surrogate. Competition is the primary factor that motivates managers to cut waste, improve operational performance, and allocate resources efficiently.

One of the first lessons to emerge from the Road Maintenance Initiative was that attempts to improve road maintenance policies cannot focus on maintenance alone. Poor road maintenance policies are a subset of the wider issues of managing and financing roads as a whole. This insight quickly led to a wider debate about what might be done to strengthen the management and financing of roads. The key concept that emerged from this debate was *commercialization*: bring roads into the marketplace and put them on a *fee-for-service* basis. However, since roads are a public monopoly, and ownership of most roads will remain in government hands for some time, commercialization requires complementary reforms in four other important areas. These are referred to as the *four basic building block*s. They focus on: (i) creating **ownership** by involving road users in management of roads to win public support for more road funding, to control potential monopoly power, and constrain road spending to what is affordable; (ii) stabilizing road **financing** by securing an adequate and stable flow of funds; (iii) clarifying **responsibility** by clearly establishing who is responsible for what; and (iv) strengthening **management** of roads by providing effective systems and procedures, and strengthening managerial accountability.

These four building blocks represent the core of the reforms. They are interdependent and ideally should be implemented together. Without all four, the reforms may achieve only part of their objective. You cannot solve the financing problem without the strong support of road users. And you cannot win the support of road users without taking steps to ensure that resources are used efficiently. And you cannot improve resource use unless you control monopoly power, constrain road spending to what is affordable, and increase managerial accountability. And you cannot hold managers accountable unless they have clearly defined responsibilities. There is nevertheless scope for flexibility. The reforms can be introduced in different ways, and the content of each building block may differ, depending on country circumstances. They can move sequentially or in parallel, and both sequencing and the pace of reform can vary. Furthermore, since the *message* emerging from the Road Maintenance Initiative is still evolving, the reforms need to be monitored and the results used to modify the message as new information becomes available.

Ownership. Major policy reforms in the road sector are unlikely to succeed without the active support of road users. They are the people who use the road network and also pay for it. Given that current allocations for road maintenance are erratic and well below the levels needed to keep the road network in a stable long-term condition, the first building block thus involves winning public support for more road funding. However, support for more road funding through user charges requires that steps be taken to ensure that road agencies do not operate as public monopolies, and that no more is spent on roads than the country can afford. The key step to be taken is thus to involve road users in road management, since this is generally an essential precondition for getting them to willingly pay for roads on a fee-for-service basis. At the national and regional level, road users are generally involved in management through road management boards. These are fairly common in Africa, and there are at least eight functioning boards in Benin, Central African Republic (CAR), Mozambique, Rwanda, Sierra Leone, South Africa (the oldest, originally established in 1935), Tanzania, and Zambia. The Board of the Ghana Highway Authority, originally established in 1974 but suspended by the military government in 1981, is about to be reinstated. The Boards in Benin, Rwanda, Sierra Leone, South Africa, Tanzania, and Zambia include private sector representatives (two, one, three, three, four and seven respectively), while that in Mozambique is currently exploring ways of including private sector representatives. Ghana intends to have three private sector representatives when the Board is reinstated.

Financing. The second reform aims at establishing an adequate and stable flow of funds. All governments in Africa are seriously short of fiscal revenues. Budget allocations for road maintenance rarely exceed 30 percent of requirements, and it is simply not feasible for governments to increase these allocations under present fiscal conditions. Improved revenue mobilization is essential. Several African countries are addressing this issue by introducing an explicit road tariff consisting of vehicle license fees and a fuel levy. The tariff is collected independently from government sales and excise taxes and, in the best examples of collection arrangements (CAR, Ghana, and Zambia), the fuel levy is collected on an agency basis and deposited directly into a Road Fund. This prevents the proceeds from being siphoned off and spent on other public programs. The intention is (i) to create a clear market signal to encourage road users to demand value for money and (ii) to link revenues and expenditures to impose a hard budget constraint on the road agency, so that more road spending means a higher tariff, while a lower tariff means less road spending. The tariff is generally set to eventually cover all costs of maintaining main roads and part of the costs of maintaining urban and rural roads. The remaining costs of maintaining urban and rural roads are financed by local taxes. Most of the countries with Road Funds have agreed procedures for allocating funds between different road agencies. Some use simple formulas (Ghana and Mozambique), others use formulas that are modified in relation to needs (Tanzania and Zambia), while others base them on a complex assessment of needs (South Africa).

Responsibility. The third building block concentrates on creating a consistent organizational structure for managing different parts of the road network. This requires two things: (i) clear assignment of responsibility among different government departments and different levels of government and (ii) clear assignment of responsibility among the individual road agencies. The arrangement needs to be based on an accurate road inventory, functional classification of roads, designation of appropriate road agencies, formal assignment of responsibility to each road agency, and clarification of the relationship between the road agency and the parent ministry. Responsibilities to be assigned include those for operation, maintenance, improvement, and development of the road network; for traffic management and for road accidents caused by the road agency's own negligence; and for the adverse environmental impacts associated with roads and road traffic.

At the community level, where roads are generally managed by village councils, higher-level road agencies may provide technical advice but usually leave the local communities to do most of the work on a self-help basis. Financial support from the center is generally limited to meeting the costs of *bought-out* materials. Rural roads under the jurisdiction of central governments are generally managed by central government feeder roads departments. Those under the jurisdiction of local governments are generally managed by district councils. Since district councils have limited technical and financial capacities, they are usually encouraged to have their roads managed under contract or to merge with other district councils to create sufficient scale economies to enable the combined network to be managed by a larger road agency. Urban roads are usually managed by urban district councils, while the main trunk road network is generally managed by a central government road agency. International transit routes are critical for Africa and sometimes deserve special treatment. They may either be managed by a dedicated section at the main road agency, as is effectively done in Zambia, or as separate toll roads, as in South Africa. The main road agency usually has responsibility for overall regulation of road traffic, including enforcing axle-weight regulations, which is sometimes done in conjunction with the road transport industry (as in Zambia). Urban road agencies normally oversee activities that affect urban areas, for example, parking control and routing of heavy vehicles in cities. Road agencies should take charge of examining the potential environmental impacts of new road schemes.

Management. The final building block focuses on creating a more business-like road agency. Once road users are involved in management of roads, they generally press for the introduction of sound business practices to ensure that their constituents get value for money. They expect clear management objectives, competitive terms and conditions of employment, consolidated budgets, commercial costing systems, and effective management information systems. The most important issue requiring attention is the wide gap between terms and conditions of employment in the public and private sectors, and the impact that this has on staffing and staff morale. An engineer in the private sector in Cameroon normally receives a total remuneration package twice as large as his public sector counterpart (the ratio is five in Tanzania and nearly nine in Zambia). As a result, several road agencies have lost most of their staff or are being managed by expatriates earning international salaries paid by international donor agencies. You cannot manage a road agency on a sustainable basis with expatriates or with demoralized local staff who spend most of their time supplementing their incomes. Any serious reform program must address these issues. Tanzania is now trying to define a competitive remuneration package for road agency staff that can be provided within existing civil service regulations.

Once staff are adequately paid, other reforms should concentrate on giving each road agency a clear mission and effective management structures, including appropriate management information systems, good accounting systems, and more managerial autonomy so that managers can act commercially. The Ghana Highway Authority has made great progress in this direction by streamlining staffing and disciplinary procedures and introducing a road management system. It has also developed a corporate plan that forms the basis of an annual contract plan between the Authority and the government. These reforms improve market discipline, provide managers with the freedom to operate commercially, and strengthen managerial accountability. They also encourage a more objective approach to setting priorities, comparing in-house to contract work, and evaluating labor-based work methods. Finally, auditing procedures also need to be improved to ensure that the public gets value for money from road spending. The aim is to ensure that funds allocated for roads are spent on road works and that the work is carried out according to specification. Where possible, both financial and technical audits should be carried out by independent auditors. Technical and financial audits are now being used on the rural access roads program in Kenya and on road maintenance programs in Burkina Faso and Senegal. The technical audit usually covers all contract work as well as work done though force account on a sample basis.

PART I

Preliminaries

1 INTRODUCTION

This report follows up on the World Bank's policy study, *Road Deterioration in Developing Countries,* published in 1988. This study showed that, in the eighty-five countries that had received World Bank assistance for roads, allocations for road maintenance had been so low that nearly 15 percent of the capital invested in *main* roads — roughly $43 billion, or about 2 percent of GNP — had been eroded by the lack of maintenance. The specific figure for the Africa region was $5 billion, or about 3.3 percent of GNP. As a result, a quarter of the main paved road network, together with a third of the main unimproved network, needed to be reconstructed or would have to receive minimal maintenance. Reconstruction — which would cost $40 to $45 billion world-wide — could have been avoided by spending a mere $12 billion on preventive maintenance. The study also argued that if countries did not improve road management, the eventual costs of restoration would increase by two- to three times and the vehicle operating costs (VOCs) by even more.

The study listed several reasons for this sorry state of affairs. Road authorities were not directly affected by road deterioration and came under no immediate pressure to do anything about it. Road users, on the other hand, were slow to see the link between poor road conditions and higher VOCs and, even when they did, were rarely sufficiently organized to do anything about it. The cause of the problem was lack of public accountability. Additional financial resources could not, by themselves, solve the problem of road deterioration. What was needed was reform of the institutional base of the road sector. The organization, staffing, and performance of the institutions responsible for roads had to be improved.

The study offered few specific solutions but did give some direction. It pointed out that road agencies were usually public monopolies and had too many responsibilities. They were responsible for planning, controlling, *and* executing construction and maintenance programs. Furthermore, they devoted too many staff, funds, and facilities to the execution of road works. Too much work was being done through force account. In most countries it would be desirable to separate these functions and transfer the execution of road works to the private sector or to a specialized government construction agency. This would clarify responsibilities, improve incentives, and strengthen accountability. Road agencies also needed better management information systems to improve the planning of investment and maintenance programs. Finally, the study argued, every effort had to be made to increase internal accountability, perhaps by mobilizing the media and nongovernmental organizations to help politicians and the public become aware of the high costs of insufficient maintenance.

The study was an important milestone in the debate on road maintenance policies and gave impetus to a number of initiatives designed to better understand the underlying causes of poor road maintenance policies. It also encouraged road agencies to address these institutional issues through a clearly articulated reform program. The Road Maintenance Initiative (RMI), a major component of the Sub-Saharan Africa Transport Policy Program (SSATP), was one of these initiatives. The RMI dialogue has now reached the point where tentative conclusions can be drawn about the most effective way to promote road policy reforms and the broad outline of the reforms themselves. The present report therefore summarizes the lessons learned from the RMI program since its inception in 1988, and uses them to develop an agenda for reform. However, since the conclusions are tentative and the RMI *message* is still evolving, the lessons emerging

from the program need to be monitored. The results of the monitoring can then be used to modify the proposed policy reforms as new information becomes available.

The report is written for a nontechnical audience and is directed at African policy makers, Bank management, Bank staff, officials in other development agencies, and senior officials in Africa — both public and private — interested in improving the performance of the road sector in Sub-Saharan Africa (SSA).

2 BACKGROUND

This chapter examines the current state of the road sector in SSA. It looks at the economic and financial importance of roads and shows that, in spite of their importance, most roads are poorly managed and badly maintained. It then examines the economic impact of poor road maintenance policies, reviews past attempts to reform them, and concludes by outlining the scope and purpose of the RMI program.

2.1 IMPORTANCE OF ROADS AND ROAD TRANSPORT

Road transport grew rapidly after World War II and is now the dominant form of transport in SSA. Roads carry 80 to 90 percent of the region's passenger and freight transport and provide the only form of access to most rural communities. To handle this traffic, African countries expanded their road networks considerably during the 1960s and 1970s. They also built new roads to open up more land for development. The result was that, by the end of the 1980s, there were nearly two million km of roads in SSA, including 610,000 km of main roads, 938,000 km of rural roads, and 143,000 km of urban roads. These roads are some of the region's largest assets. Their replacement costs amount to over $150 billion, and required annual expenditures on routine and periodic maintenance to keep them in stable long-term condition are between $1.5 and $2.0 billion.[1] In terms of assets, employment, and turnover, particularly with maintenance fully funded, Africa's roads are truly *big business*. They are generally far larger than railways or national airlines (see Table 2.1 and Figure 2.1).

The main road network includes about 5,000 km of freeways and dual carriageways, 190,000 km of paved two-lane roads and 414,000 km of gravel roads. These roads carry modest volumes of traffic; no more than 10 percent carry over 1,000 vehicle per day (vpd). Motorization levels are low and more than 25 percent of traffic consists of heavy vehicles. Since a number of African countries are land-locked, the main road network also includes several heavily trafficked international transit corridors. Toll roads are uncommon, although ten continuous roads in South Africa are operated as toll roads under private sector management contracts (see Box 2.1). Ghana is examining the option of operating five trunk roads under private sector concession agreements. Mauritius is examining a similar arrangement for a major trunk road in Port Louis, and Mozambique is planning a build-operate-transfer (BOT) toll road between Komatipoort on the South African border and Maputo. Although tolls are collected on high-density roads in some other countries, toll revenues are generally treated as general tax revenues (as in Nigeria). Only rarely, as in Chad, Ghana, and Rwanda, are road toll revenues used to support road maintenance.

The rural road network comprises over 938,000 km of classified roads and an unknown length of unclassified roads. These roads carry light traffic, usually less than 100 vpd, and consist mainly of two-lane, all-weather gravel roads and seasonal earth tracks. They connect the main agricultural areas to local market towns and the main road network. These roads play a particularly important role in Africa, since agriculture accounts for 33 percent of Africa's GDP, 66 percent of its labor force, and 40 percent of its exports. About 70 percent of Africa's population lives in rural areas.

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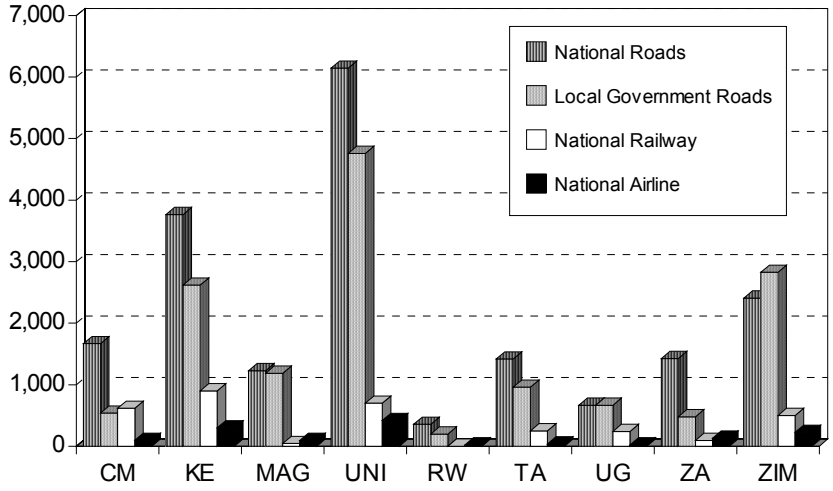
[1] Replacement costs are based on road lengths included in Appendix 1. Replacement costs are assumed to be $500,000 per km for a dual carriageway, $250,000 per km for a paved road, and $50,000 per km for a gravel road. No allowance has been made for the cost of replacing structures.

Table 2.1 Assets, Employment, and Turnover for Roads, Railways, and Airlines in Selected Countries, Early 1990
($, million and number)

	CM	*KE*	*MAG*	*UNI*	*RW*	*TA*	*UG*	*ZA*	*ZIM*
Main Road Agency									
Total assets[a]	1,850	3,766	1,228	6,205	358	1,417	666	1,426	2,410
Staff	8,683	14,931	2,531	3,580	8,488	8,479	4,515	4,261	5,815
Turnover[b]	53	107	34	191	11	46	17	48	52
National Railway									
Total assets[c]	617	900	46	700	-	250	240	350	500
Staff	4,300	21,000	4,875	26,000	-	12,000	6,357	8,500	17,654
Turnover	74	70	8	low	-	63	10	27	122
National Airline									
Total assets[c]	96	300	95	420	22	37	20	132	227
Staff	1,758	2,720	1,230	4,540	216	1,062	na	2,300	2,000
Turnover	130	168	93	118	11	32	na	172	68

Note: For country name codes, see inside front cover.
- Not applicable.
a. Based on replacement costs, less maintenance backlog.
b. Annual maintenance requirements (from Table 3-4), plus 20 percent for new investment (the figure of 20 percent was recommended as a guide for budgeting purposes during the course of the RMI Phase I seminars). Country variations are mainly due to variation in the length of roads that are paved.
c. Based on the replacement costs of total fixed assets, or the replacement costs estimated from historic costs.
Source: Appendix 1 and 2, World Bank sector and project reports, and World Bank task managers.

Figure 2.1 Replacement Costs of Transport Infrastructure in Selected African Countries, 1990
(million dollars)



Note: Values are current replacement costs. Forty percent of local government roads are assumed to be in poor condition.

Source: Table 2.1

Box 2.1 Toll Roads in South Africa

South Africa currently has 10 continuous toll roads totaling 685 km in length. The roads are either completely new, or have been significantly rebuilt. The legislation under which these roads are tolled requires, among other things, that (i) a free alternative parallel route should be available for motorists who do not wish to pay the toll and that (ii) the Ministry of Transport determine the amount of the road toll, based on recommendations submitted by the South African Roads Board. The toll rate is set at a percentage of the savings expected to accrue to motorists as a result of the road (i.e., it is generally set to capture 75 percent of the benefits), and is increased periodically to account for inflation (but is never raised higher in real terms than the initial calculated toll rate). The toll system operates on an open basis (i.e., motorists can use sections of road between toll plazas without paying the toll) to reduce the impact on local residents, and commuters who regularly use the routes enjoy substantial discounts by using frequent-user cards.

The Department of Transport, on behalf of the South African Roads Board, manages and controls the road loans and employs contractors to operate and maintain the roads on three to five year contracts. The private sector companies were set up at the invitation of the Department of Transport and there are now four companies operating the ten toll roads (one company manages five roads, one manages three roads, and the remaining two companies each manage one). None of the roads is wholly self-financing. The concept applied in designing the financing schemes is called the *loan supportable by revenue* (LSR) approach. The LSR is determined by calculating the project's present worth over a period of 30 years at a 4 percent discount rate. This determines the size of the loan that could be repaid from toll revenues over 30 years at a borrowing rate 4 percent above the rate of inflation. The balance of the capital is provided in the form of National Road Fund loans, which bear no interest until the toll road has met its commercial money market obligations. Since traffic is growing, and tolls are indexed for inflation, toll income grows faster than operating costs. Although the toll roads start off making losses, they are expected to break even after seven to nine years, pay off the accumulated deficit during the next seven to nine years, and then pay off the principal amount of the loan and make profits during the remaining twelve to sixteen years of the project's life.

There were three sources of finance: (i) the Department of Transport floated capital market loans carrying a government guarantee, with repayment periods that varied between 3 and 20 years (with a pronounced concentration on loans shorter than 10 years); (ii) potential private sector concessionaires borrowed short-term money in the form of money-market loans (responsibility for these loans was taken over by the Department of Transport in April 1991); and (iii) the National Road Fund made *soft* long-term loans on which interest was payable on a flexible basis. As of 31 March 1992, the loan portfolio included $206 million in capital market loans (on which the average financing charge during 1992 amounted to 9.8 percent), $286 million in money market loans (on which the average financing charge during 1992 was 15.6 percent), and $460 million in loans from the National Road Fund (on which the average interest paid during 1992 was 2.2 percent). The Department is currently in the process of converting short-term money market loans into long-term debt.

Overall income for all toll facilities during 1992 amounted to $53.1 million ($51.5 million in toll revenue), while overall expenditures were $101.4 million (running costs, $16.7 million; audit fees and depreciation, $6.3 million; and financing costs, $78.4 million). The overall deficit for the year was thus $48.3 million. Since the overall deficit carried forward from the previous year was $71.0 million, the overall deficit at the end of 1992 (to be carried forward into 1993) was $119.3 million.

There are also about 143,000 km of urban roads. They consist mainly of paved two-lane roads, although some of the larger urban areas contain some dual carriageways. Most countries contain less than 1,000 km of urban roads, and only Nigeria and South Africa have large urban networks (Nigeria has about 22,000 km and South Africa has 60,000 km). Traffic volumes in urban areas are higher than on the main road network and traffic congestion is a serious and growing problem in some cities (e.g., Abidjan, Accra, Cape Town, Durban, Johannesburg, Lagos, Port Elizabeth, Pretoria, and Nairobi) and is an emerging problem in others.

The importance of roads in SSA is reflected by the fact that road spending typically absorbs 5 to 10 percent of the government's recurrent budget and 10 to 20 percent of its development budget. Total road expenditures currently account for over one percent of regional GNP. Furthermore, in many countries, a significant proportion of the central government's disbursed and outstanding debt is attributable to road loans. The road sector also absorbs a great

deal of grant finance, mainly for procurement of construction and maintenance equipment. Even a relatively small national road agency often owns $25 to $50 million worth of plant and equipment.

2.2 IMPACT OF POOR ROAD MAINTENANCE

In spite of their importance, most roads in Africa are poorly managed and badly maintained. Almost without exception, they are managed by bureaucratic government roads departments. The poor state of the road network is reflected in the large backlog of deferred maintenance. It would take nearly $43 billion to fully restore all roads classified as being in poor condition (i.e., requiring immediate rehabilitation or reconstruction).[2] In other words, African countries have spent far too little on routine and periodic maintenance during the past twenty years. As a result, nearly a third of the $150 billion invested in roads has been eroded through lack of maintenance. Africa has been living off its assets. Restoring only those roads that are *economically justified* and preventing further deterioration will require additional annual expenditures over the next ten years of at least $1.5 billion. This amounts to nearly one percent of regional GDP and would increase current road spending from one percent to nearly two percent of regional GDP. The remaining roads in poor condition will have to receive minimal maintenance or be handed over to lower levels of government and local communities.

The economic costs of poor road maintenance are borne primarily by road users. In rural areas, where roads often become impassable during the rainy season, poor road maintenance also has a profound effect on agricultural output. When a road is not maintained — and is allowed to deteriorate from good to poor condition — each dollar *saved* on road maintenance *increases* VOCs by $2 to $3.[3] Far from saving money, cutting back on road maintenance *increases* the costs of road transport and raises the net cost to the economy as a whole. It is estimated that the *extra* costs of insufficient maintenance in Africa amount to about $1.2 billion per year, or 0.85 percent of regional GDP. About 75 percent of these costs must be paid with scarce foreign exchange. During preparation of the Integrated Roads Project in Tanzania, it was estimated that the annual economic costs of poor road maintenance were between $100 and $150 million. Likewise, during an RMI workshop in Kenya, it was estimated that the $40 million annual shortfall in road maintenance expenditure increased VOCs by about $150 million per year. In general, road maintenance and rehabilitation projects produce economic rates of return of over 35 percent.[4]

The impact of low road maintenance expenditures on vehicle operating costs is illustrated in Box 2.2. It compares the costs and benefits of several road maintenance strategies:

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[2] The length of the main road network in poor condition is given in Appendix 2. It is estimated that 50 percent of the rural network and 30 percent of the urban network is in poor condition. The cost of rehabilitating/ reconstructing roads is assumed to be $230,000 for paved roads and $36,000 for gravel roads.

[3] A paved road in good condition, carrying about 500 vpd, requires resealing or light overlays, costing about $23,600 per km, every seven years to keep it in good condition. This has a net percent value (NPV), discounted at 12 percent over twenty-five years, of $17,688 per km. Without maintenance, the road will deteriorate from good to poor condition. This will increase vehicle operating costs by about $5,000 per km, which has an NPV, when discounted over twenty-five years, of $39,200 per km (Thriscutt and Mason 1989, p. 29-30). The benefit/cost ratio of a fully-funded road maintenance program is thus between 2 and 3.

[4] A recent analysis of the Operations Evaluation Department (OED) database, covering 341 road projects evaluated between 1961 and 1988, found that the average economic internal rate of return (EIRR) for pure road maintenance projects was 38.6 percent. The analysis was carried out for the 1994 *World Development Report*.

patching, surface-treated reconstruction, and asphalt-concrete overlays. It then calculates their average annual cost-effectiveness and overall NPV, discounted over twenty years. It shows all maintenance strategies to be highly cost-effective, with annualized benefit/cost ratios which vary from 3.4 to 22.1. In other words, on an annualized basis, each dollar spent on patching saves at least $3 and can save as much as $22. Each dollar spent on road maintenance pays for itself several times over in reduced VOCs.

The above analysis, though based on the roughness of the road pavement, does not fully reflect pothole damage. Most vehicles are not designed to deal with the sharp and repeated shocks caused by potholes. This is particularly true of loaded freight vehicles, and trucking companies are well aware of the extra costs that poor roads impose on road transport operations (see Box 2.3). One of the trucking associations in Zambia has recently carried out a small survey to try to estimate the additional costs associated with potholes. It concluded that they added over $14,000 per year to the cost of operating a large truck and trailer combination. It is no wonder road transport associations keep pressing for better road maintenance and express a willingness to pay for it.

Poor road maintenance also raises the *long-term costs* of maintaining the road network. Maintaining a paved road for fifteen years costs about $60,000 per km. If the road is not maintained and allowed to deteriorate over the fifteen-year period, it will then cost about $200,000 per km to rehabilitate it. In other words, rehabilitating paved roads every ten to twenty years is more than three times as expensive, in cash terms, as maintaining them on a regular basis, and 35 percent more expensive in terms of NPVs discounted at 12 percent per year.

The same is true of gravel roads. Maintaining a gravel road for ten years costs between $10,000 and $20,000 per km, depending on climate and traffic volumes. On the other hand, leaving it without maintenance for ten years will require rehabilitation costing about $40,000 per km. Rehabilitating gravel roads every ten years is thus twice as expensive, in cash terms, as regular routine and periodic maintenance, and between 14 and 128 percent more expensive in terms of NPVs discounted at 12 percent per year.

Two factors have contributed to the above short-sighted policies. First, lack of market discipline has encouraged governments to minimize their own (road maintenance) expenditures, disregarding the impact that this has on total road transport costs (road maintenance costs plus VOCs). Second, maintenance is normally financed under the recurrent budget, and recurrent revenues are nearly always in short supply. Since donors have been willing in the past to finance rehabilitation under the development budget (often on a grant basis), governments had every incentive to capitalize road maintenance and charge it against the development budget. Rehabilitation, rather than recurrent maintenance, became the optimal solution. Donors quickly recognized this mistake, and most will no longer finance rehabilitation programs until sustainable road maintenance policies have been introduced.

Box 2.2 Impact of Road Maintenance on Vehicle Operating Costs (VOCs)

The following example analyzes the impact of road maintenance on VOCs. It compares a limited number of potential road maintenance strategies aganinst a base case which consists of routine maintenance only at a cost of $322 per km (i.e., off-carriageway work). The five maintenance strategies evaluated in this example include:

(1) patching;
(2) surface-treated reconstruction (flexible pavement with a crushed stone base and double bitumen surface treatment), initiated when surface roughness reaches 7 IRI (m/km), with patching;
(3) surface-treated reconstruction as above, without patching;
(4) asphalt-concrete overlay, initiated when surface roughness reaches 5 IRI, with patching;
(5) asphalt-concrete overlay, initiated when surface roughness reaches 5 IRI, without patching.

The analysis examined these strategies over a twenty-year period during which traffic was assumed to grow at 3 percent annually. The net present values of each option were calculated using a 12 percent discount rate.

The results are summarized below for roads in both *poor* and *fair* condition for initial average daily two-way traffic volumes (AADTs) of 500 and 1,000 vpd. Seventy percent of the traffic consists of trucks. To make the tables understandable to a wider audience, expenditures on maintenance and VOC savings have been expressed as annualized *cash* outlays and savings. The benefit/cost ratios likewise show the annualized cash payoff from each strategy. The tables also include the NPV for each strategy.

Road maintenance is shown to be highly cost-effective, with benefit/cost ratios varying from 3.4 to 22.1. When roads are in fair condition and there is no budget constraint, an asphalt concrete overlay produces the highest NPV. When roads are in poor condition, surface-treated reconstruction produces the highest NPV. The incremental benefit/cost ratios illustrate the optimal sequencing of maintenance strategies when the budget is constrained. Patching is always cost-effective, particularly when traffic flows are high. When roads are in fair condition, overlay strategies are more cost-effective than reconstruction strategies. When they are in poor condition, reconstruction strategies are more cost-effective than overlay strategies.

	Poor condition, AADT = 500 vpd					*Poor condition, AADT = 1,000 vpd*				
Strategy	*1*	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
Increased maintenance [a]	568	9,278	9,276	5,978	5,977	628	9,295	9,268	6,254	6,252
VOC savings [b]	2,291	31,507	31,477	27,872	27,872	6,039	66,680	66,171	60,886	60,866
B/C ratio [c]	4.0	3.4	3.4	4.7	4.7	9.6	7.2	7.1	9.7	9.7
NPV, $ mill [d]	16.8	216.3	216.0	211.1	211.1	53.1	561.6	556.9	532.6	532.4
Incr. B/C	4.0	1.1	1.1	4.7	4.7	9.6	1.9	1.8	9.7	9.7
Sequencing [e]	1	3	-	-	2	1	3	-	2	-

	Fair condition, ADT = 500 vpd					*Fair condition, ADT = 1,000 vpd*				
Strategy	*1*	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
Increased maintenance [a]	546	1,799	2,370	2,868	2,866	606	3,011	4,677	3,399	3,520
VOC savings [b]	3,310	8,259	9,348	13,259	13,228	13,371	31,976	36,141	40,418	40,947
Benefit/cost [c]	6.1	4.6	3.9	4.6	4.6	22.1	10.6	7.7	11.9	11.6
NPV, $ mill [d]	27.0	62.8	67.8	99.8	99.4	125.2	283.7	307.9	361.0	364.8
Incr. B/C	6.1	4.0	3.3	4.7	4.7	22.1	7.7	5.6	21.8	17.6
Sequencing f	1	2	-	3	-	1	2	-	3	-

a. Annualized expenditures in addition to routine maintenance, dollars per year.
b. Annualized savings attributable to above maintenance spending, dollars per year.
c. Item b divided by item a.
d. Per 1,000 km.
e. The preferred incremental options are going from 1 to 4 or 5, and then from the best of these to 2 or 3.
f. The preferred incremental options are going from 1 to 2 or 3, and then from the best of these to 4 or 5.

Source: Annex 1.

Box 2.3 How Potholes Affect Vehicle Operating Costs

Potholes cause immense damage to vehicles. To better understand the additional costs associated with potholes, the Federation of Zambian Road Hauliers interviewed truckers to compare the running costs of a truck and trailer combination on a road with potholes with those on a road without potholes. The vehicle considered was a combination tractor and trailer with twenty-two wheels. The costs estimated are those over and above normal running costs.

On a road with bad potholes, a driver can either pursue a defensive strategy or ignore the potholes and carry on as usual. If he follows a defensive strategy, he first slows down and changes gears. He then has to negotiate the loaded truck and trailer, weighing between 44 and 50 tons, through the potholes. This causes extra stress on the tires, wheel bearings, spring assemblies, spring hangers, chassis, cross-members, engine mountings, gear box mountings, brakes, steering assemblies, and shock absorbers. Having negotiated the potholes, he accelerates and changes gears again. On the other hand, if he ignores the potholes, he will drive through them at his regular speed, resulting in more damage to the vehicle and tires and increasing the risk of accidents. The axle pressure now increases by at least three times.

The survey resulted in the following annual expenditures over and above normal running expenditures. It ignores extra fuel consumption, damage to goods, down-time of trucks under repair, and accidents caused by potholes and sharp pavement edges.

Quantity	*Item*	*Unit price (dollars)*	*Annual cost (dollars)*
10	Extra tires and tubes	595	5,952
1	Extra clutch and pressure plate	1,071	1,071
4	Extra wheel bearing	201	803
1	Extra set of brake shoes	1,050	1,050
1	Extra set of springs	1,667	1,667
4	Extra spring hangers and bushes	113	452
-	Welding, electrodes/oxyacetylene for: body, chassis and cross member damage engine, gearbox, and cabin mountings	952	952
1	Extra steering assembly	1,874	1,874
4	Extra shock absorbers	128	510
	Total annual costs attributable to potholes		14,333

Source: Federation of Zambian Road Hauliers Ltd., February, 1992.

On the assumption that each truck travels 70,000 km per year, the above expenses raise VOCs by over $0.20 per veh-km. Since the average cost of operating a large articulated truck on a good road is about $1.20 per veh-km, potholes thus increase VOCs by at least 17 percent, since the additional costs of fuel, down-time, and damage to goods are not included. Furthermore, with virtually all the needed spare parts imported from abroad, the extra costs must be entirely foreign exchange.

2.3 PAST EFFORTS AT REFORM

During the past twenty years, the donor community has made strenuous efforts to improve the operation and maintenance of roads. To help overcome the maintenance backlog, it has supported substantial road rehabilitation programs and has attempted to reform road maintenance policies through dialogue and technical assistance. Between 1975 and 1986, external funding for road projects amounted to about $6.5 billion, and annual commitments are currently running at about $1.0 billion per year. The World Bank is providing about $350 million per year, other donors $450 million, while the remaining $200 million is coming from local budgets.

Most reform efforts concentrated on strengthening management of roads, improving user-charging policies, and increasing allocations for road maintenance. The initiatives nevertheless lacked a comprehensive vision, focused on technical rather than institutional solutions, and were generally implemented in a piecemeal fashion.

Although some attempts were made to rationalize and decentralize management of roads, little effort was made to deal comprehensively with weaknesses in the road agency's organizational structure, low pay scales, shortages of qualified staff, lack of staff motivation, and lack of managerial accountability. Instead, most initiatives concentrated on reducing force account work, introducing maintenance management systems, and restructuring government equipment pools. These initiatives were accompanied by complementary efforts to simplify government procurement procedures to facilitate the use of local contractors, strengthen the local construction industry, introduce maintenance and equipment management systems, and strengthen axle-weight enforcement to reduce damage to road pavements caused by over-loaded vehicles. The most successful initiatives dealt with reducing force account work, simplifying procurement procedures, and strengthening the local construction industry (for examples of such initiatives, see Box 9.1). The remaining initiatives had little lasting impact due to shortages of qualified staff, managerial indifference, and resistance from strong vested interests.

Efforts to reform user-charging policies focused on encouraging governments to adopt user charges based on short-run marginal costs (variable road maintenance costs, plus the costs of road congestion).[5] The aim was to encourage best use of the road network and ensure that heavy vehicles covered the costs of the damage they did to the road pavement. These efforts were partly successful. Taxes paid by heavy vehicles were often increased following studies of road user charges, but no countries proved willing to accept strict short-run marginal cost pricing for roads. Governments could not see the point of using short-run marginal cost pricing on uncongested roads, saw no reason why road users should be subsidized by other sectors of the economy, and were not persuaded that the proposed arrangements made fiscal sense.[6]

Attempts to improve financing of roads concentrated on increasing allocations for road maintenance and attempting to use earmarking to secure a stable flow of funds. The government was asked to set aside part of its general tax revenues (usually specified as a percentage of overall fuel tax revenues), deposit the money into a *Road Fund,* and use the proceeds to finance maintenance of the core road network. However, apart from pointing out the economic costs of deferred maintenance and suggesting reallocation of funds from construction to maintenance, little advice was offered on where the additional revenues might come from and how the Road Fund should function. The International Monetary Fund opposed earmarking on grounds that it undermined unified budget management and Ministries of Finance also objected to Road Funds. As a result, most Road Funds suffered from systemic problems: (i) deposits were erratic; (ii) withdrawals were frequently delayed; (iii) governments borrowed money to finance other public

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5 A pricing practice in which price is made equal to short-run marginal costs (i.e., the costs of producing the last unit sold, plus a mark-up to clear the market). The rationale was that, subject to certain assumptions about production costs and other matters, such a pricing rule would maximize economic welfare. See, for example, Churchill, A., *Road User Charges in Central America*, World Bank Staff Occasional Paper No. 15, Johns Hopkins University Press, Baltimore, 1972; and Walters, A., *The Economics of Road User Charges,* Johns Hopkins University Press, Baltimore, 1968.

6 With little road congestion, such charges would be set equal to variable road maintenance costs which would only cover about half the costs of operating and maintaining the road network.

programs; and (iv) expenditures were loosely controlled. Therefore, most Road Funds failed to provide an adequate and stable flow of funds.

2.4 THE ROAD MAINTENANCE INITIATIVE

Against this background the RMI was launched by the United Nations Economic Commission for Africa (UNECA) and the World Bank under the auspices of the Sub-Saharan African Transport Policy Program (SSATP), in an effort to identify the underlying causes of poor road maintenance policies and develop an agenda for reforming them. The program is administered by the Africa Technical Department in the World Bank and is financed by the governments of Denmark, Finland, France, Germany, Norway, Sweden, Switzerland, and the EEC. Finland, France, and Norway provide three senior staff to work on the program.[7]

The initial phase of the RMI program focused on raising awareness of the need for sound road maintenance policies and on identifying why current policies were ineffective and unsustainable. The second phase then moved on to country initiatives in nine target countries: Cameroon, Kenya, Madagascar, Nigeria, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe. The country programs initially focused only on main roads and concentrated on promoting reforms in three main areas: (a) planning, programming, and financing; (b) operational efficiency; and (c) institutional and human resource development.

During the initial stages of the policy dialogue, RMI staff urged stake-holders to identify the underlying causes of poor road maintenance, suggested possible ways of dealing with them, shared experiences from other parts of Africa and the rest of the world, and employed consultants to prepare background papers on different aspects of the road maintenance problem. This quickly led to three important insights.

First, it had always been assumed that the Ministry of Finance (MOF) would play a key role in developing sustainable road maintenance policies. So strong was this belief, some of the initial country initiatives sought to interest the MOF in road maintenance by exploring the basic financial issues through Public Expenditure Reviews (PERs). However, it quickly became apparent that the MOF did not hold the key and that the secret to success lay in involving the private sector. Futhermore, these are the people who use the roads and also pay for them. Their representative organizations — chambers of commerce, road transport associations, and farmer organizations — are strong and influential. Their support will often overcome otherwise insurmountable bureaucratic resistance, whether it comes from the Ministry of Works (MOW) or the MOF.

Second, many of the systemic problems associated with poor road maintenance policies — weak programming and budgeting, undue emphasis on force account work, and inefficient plant pools — were symptoms of a deeper problem. The real causes were weak or unsuitable institutional arrangements for managing and financing roads, and the impact this has had on staff incentives, staff motivation, and managerial accountability. Until the institutional framework is improved, it is almost impossible to overcome the numerous technical, organizational, and human resource problems which hamper sound road maintenance policies.

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[7] Finland withdrew from the program in mid-1993.

Third, it showed that attempts to improve road maintenance policies cannot focus on maintenance alone, nor can they focus only on the maintenance of main roads. Poor road maintenance policies are a sub-set of the wider issues of managing and financing roads as a whole. In fact, the problems are most acute at the regional and district levels, where institutional weaknesses are greater and finances in shorter supply.

These insights automatically caused the two-way country dialogue to evolve into a wider debate about the institutional arrangements for managing and financing all types of roads. The following chapters describe the work of the RMI program, the way it handled the process of policy reform, and the resulting agenda for reform now being implemented in the nine target countries and elsewhere.

3 THE BASIC ISSUES

This chapter concentrates on diagnosis. Why have governments in SSA been pursuing ineffective and unsustainable road maintenance policies? Although there is no simple answer, there are some common threads. The main problems are of an institutional nature and this affects incentives. They include: serious human resource constraints (as pointed out in the road deterioration policy study), inadequate financing arrangements, lack of clearly defined responsibilities, inefficient management structures, and weak management systems. These cause road agencies to be inefficient. This chapter looks at these problems and tries to understand *what went wrong* and *why*.

3.1 INSTITUTIONAL FRAMEWORK

Part of the reason for poor road maintenance policies is attributable to the institutional framework within which roads are managed. They are not managed as part of the market economy and this biases managerial incentives. There is no clear *price* for roads, road expenditures are financed from general tax revenues, and the road agency is not subjected to any rigorous market discipline. Roads are managed like a social service. Road users pay taxes and user charges, and the proceeds are nearly always treated as general tax revenues. Instead of being financed through user charges, roads are thus financed through budget allocations determined as part of the annual budgetary process. These allocations bear little relationship to underlying needs (i.e., to the cost-effectiveness of road expenditures at the margin) or to road users willingness to pay. Revenues and expenditures are completely delinked. There is no *hard budget constraint* (i.e., there is no direct link between revenues and expenditures), no price to ration demand (do we want more or less of particular road services?), and expenditures are not subjected to the rigorous tests of the market place (how much road spending can we really afford?).

The above framework biases managerial incentives and affects the way roads are managed. First, since road users do not directly pay for roads, they are not forced to choose whether and how to make the journey or to hold the road agency accountable for the way it spends its budget. Second, the absence of a firm link between revenues and expenditures encourages road users to demand more road spending *because* it is financed from general tax revenues and does not affect payments for road use. Third, without a hard budget constraint and pressure from road users, the road agency does not have to manage resources efficiently. The government rarely provides clear objectives (in practice, road agencies are often required to employ too much labor and to build roads which are uneconomic), managers face few incentives to cut costs (major cost reductions may simply lead to reduced budget allocations), there are few sanctions, staff cannot easily be disciplined, and managers are rarely penalized for poor performance.

3.2 HUMAN RESOURCE CONSTRAINTS

Human resource constraints are the single most important issue facing most road agencies. They suffer from an acute shortage of technically qualified staff and still employ far

too many unskilled workers.[8] The scale of the problem with technical staff is clearly illustrated in Table 3.1. Of the nine road agencies included in the table, one has collapsed (Zambia), two are close to collapsing (Malawi and Mozambique), and four are heavily dependent on expatriates (Botswana, Lesotho, Namibia, and Tanzania). Salaries in some road agencies are so low that daylighting has become part of the status quo.[9] Salaries are not only well below those in the private sector, but are frequently below the living wage (the minimum salary needed to feed and clothe a family). Annual median salaries vary from an adequate $10,000+ in Botswana, Lesotho, Namibia, and Swaziland to $6,000 in Zimbabwe (the road agency is just about holding its own, but 75 percent of its engineers and 60 percent of its technicians are under the age of 34), $4,000 in Malawi, $2,200 in Mozambique, $950 in Tanzania, and $650 in Zambia. This has caused "a rapid exodus ... of experienced and competent technical staff to the private sector and parastatals ... The main reason has been offers of far better compensation ... and *more generous* fringe benefits."[10]

The situation is similar, or is rapidly becoming so, in most other African countries, (see Table 3.2). This table, which covers the nine countries participating in the RMI program, shows that vacancies at the professional and managerial levels are major problems in Kenya, Uganda, and Zambia. It also shows that road agencies in Rwanda, Tanzania and Zambia are heavily dependent on expatriate engineers paid international salaries by multilateral and bilateral donors ($35,000+, plus allowances).[11] The shortage of technical staff, together with the incidence of daylighting and moonlighting, are entirely attributable to the growing disparity between civil service salaries and those for comparable positions in the private sector (see Table 3.3). An engineer working in the private sector generally earns more than twice as much as his public sector counterpart (in Tanzania and Zambia, it is five and nine times respectively). Real salaries have also declined sharply. A young engineer in Tanzania earned about $250 per month in 1970. His real salary now is a mere $20 per month. The same is true in Nigeria. Until about five years ago, a young engineer earned about $1,000 per month. This has now fallen to $150 per month.

Roads departments paying qualified technical staff a fraction of the going market wage either end up with high vacancy rates (as in Kenya, Malawi, Mozambique, Uganda, and Zambia), employing expatriate road managers paid through donor-financed technical assistance programs (as in Botswana, Lesotho, Namibia, Rwanda, Tanzania, and Zambia), or with part-time staff forced to supplement their incomes by moonlighting, daylighting, manipulating allowances, and pilfering.[12] Daylighting is now a systemic problem in Africa. Too many technical staff hold second jobs and owe their loyalty to another employer. And this problem cannot be solved through training, bonded studentships, and improved allowances. There is no point training staff who only spend a fraction of their time on the job. Likewise, bonded graduates have no interest

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8 After independence, most governments systematically expanded the civil service, often by a factor of two or three, to deliver on electoral promises and reduce unemployment. Road agencies were a key target for employment programs, and many now have two to three times the required number of laborers on their books.

9 Daylighting refers to the practice of doing another full-time job during regular working hours.

10 SATCC, (1993).

11 Some countries, like Botswana and Lesotho, also recruit regional expatriate engineers, who are paid annual salaries of about $15,000, plus allowances.

12 "We want them to come to work. We want them to work five days a week. We want them to work 40 hours a week. We don't want them to have to do something else in order to survive and we want them to keep their hand in their own pocket." Comments by E.V.K. Jaycox, Vice President, Africa Region, at a conference on *Capacity Building: The Missing Link in African Development*, Reston, Virginia, USA, May 20, 1993.

in making a career in the roads department and simply count the days to the end of their bonding period. Improved allowances are equally ineffective since they are discretionary, subject to change and are not bankable (i.e., cannot be used as security for mortgages and other loans). You cannot manage a road agency with a demoralized, part-time staff.

Table 3.1 Number of Staff and Salary Scales in SATCC Countries, 1991-92

Country	*Number of staff*				*Road Length (km)*	*Kilometer per staff*[c]	*Annual salary range (1992/93 dollars)*
	Local	*Expatriates*[a]	*Vacant*	*Total*[b]			
Botswana					8,328		
Engineers	6	15	15	36		231	8,076 - 18,811
Technicians	78	5	1	84		99	8,076 - 14,702
Lesotho					3,076		
Engineers	10	11	11	32		96	8,076 - 18,811
Technicians	24	0	2	26		118	8,076 - 14,702
Malawi					14,145		
Engineers	19	9	27	55		257	1,873 - 6,195
Technicians	42	0	1	43		329	132 - 2,953
Mozambique					29,175		
Engineers	10	1	34	45		648	2,070 - 2,283
Technicians	35	0	78	113		258	869 - 1,781
Namibia					39,516		
Engineers	2	10	6	18		2,195	12,440 - 21,925
Technicians	16	1	16	33		1,197	9,415 - 21,925
Swaziland					2,800		
Engineers	3	1	1	5		560	8,746 - 10,383
Technicians	18	0	4	22		127	3,905 - 6,155
Tanzania[d]					28,030		
Engineers	211	37	0	248		113	928 - 957
Technicians	270	0	0	270		104	n.a.
Zambia[d]					20,783		
Engineers	1	6	24	31		670	481 - 820
Technicians	3	1	22	26		799	305 - 596
Zimbabwe[d]					18,400		
Engineers	56	6	3	65		283	3,977 - 7,973
Technicians	65	0	0	65		283	3,850 - 7,196

a. Expatriates are foreign engineers paid international salaries by donors. Some countries also recruit regional expatriates.

b. Total refers to total number of approved posts.

c. Length of network divided by total approved posts.

d. Number of engineers in Tanzania, Zambia, and Zimbabwe from Table 3.2.

Source: SATCC, (1993)

Table 3.2 Number of Road Agency Staff by Category and Source: Selected Main Road Agencies

	CM	*KE*	*MAG*	*UNI*	*RW*	*TA*	*UG*	*ZA*	*ZIM*
Professional and managerial									
Local	203	215	51	335	44	211	72	1	56
Expatriate	5	2	2	-	14	37	5	6	6
Vacant	-	26	-	-	5	-	19	24	3
Subtotal	208	243	53	335	63	248	96	31	65
No./1,000 km	6	4	5	6	11	9	12	2	4
Technicians									
Local	693	381	287	419	86	949	225	4	250
Vacant	-	154	-	-	12	-	94	61	-
Subtotal	693	535	287	419	98	949	319	65	250
No./1,000km	21	8	20	7	17	34	40	3	14
Other regular staff									
Local	7,782	10,892	2,191	2,828	8,327	7,282	4,100	4,178	5,500
Vacant	-	3,261	-	-	-	-	-	-	-
Subtotal	7,782	14,153	2,191	2,828	8,327	7,282	4,100	4,178	5,500
No./1,000km	236	224	150	48	1,425	260	508	201	298
Grand total	8,683	14,931	2,531	3,580	8,488	8,479	4,515	4,261	5,815

- Not available

Notes: For country name codes, see inside front cover.
Other regular staff include laborers and casuals. No./1,000 km is based on number of approved positions.

Source: RMI Country Coordinators.

Table 3.3 Incomes of Public and Private Sector Engineers: Selected Countries, 1993 (dollars per month)

	CM	*KE*	*MAG*	*UNI*	*RW*	*UG*	*TA*	*ZA*	*ZIM*
Public salary	377	170	-	154	186	99	70	70	370
Private salary	777	465	-	334	661	360	350	600	600
Public/private	2.1	2.7	n.a.	2.2	3.6	3.6	5.0	8.6	1.6

- Not available.

n.a. Not applicable.

Note: Comparisons are of salaries and allowances for graduate engineers with three to four years practical experience. Conversion to dollars at January 1994 exchange rates, after CFAF devaluation.

Source: RMI Country Coordinators.

3.3 INADEQUATE FINANCING ARRANGEMENTS

Financing arrangements are crucially important. Without an adequate and stable flow of funds, road maintenance policies will not be sustainable. That is an important part of the problem in Africa. Road maintenance expenditures in virtually all countries are well below the levels needed to keep the road network in stable long-term condition. In most countries, they are less than half the estimated requirements and, in some, less than a third (see Table 3.4). Furthermore, the flow of funds is erratic. Budget allocations are often cut at short notice in response to difficult fiscal conditions, funds are rarely released on time, and actual expenditures are often well below agreed budget allocations. As a result, roads throughout the region continue to deteriorate, rural roads regularly become impassable during the rainy season, and the large backlog of road rehabilitation continues to increase. Between one quarter and one half of the main road networks included in Table 3.4 are in poor condition and need to either be rehabilitated or downgraded to roads which receive minimal maintenance.

The main reason why road maintenance is underfunded is that road users pay very little for the use of the road network (see Table 3.4). They pay the usual import duties, excise taxes and sales taxes, but so does everyone else. Road user charges — in the form of vehicle license fees, a specific surcharge added to the price of fuel (the fuel levy), and international transit fees — rarely cover more than 50 percent of expenditures on maintenance and, in some countries, barely cover 25 percent (see Box 3.1 for an explanation of how to separate road user charges from general tax revenues). Most road expenditures are still financed from general tax revenues (listed in Table 3.4 as *government grants*) and donor-financed loans and grants. This is not necessary. Roads can be commercialized, put on a fee-for-service basis, and treated like any other public enterprise.

An added complication is that funds for road maintenance are allocated as part of the annual budgetary process. Under this arrangement, each ministry must compete for funds during the annual budget negotiations and, at least in theory, funds are allocated to finance those expenditures with the highest economic return. However, if that were true, road maintenance would not be underfunded. As Table 3.4 and Box 3.1 clearly show, allocations for maintenance are well below the optimal requirements (defined as a maintenance strategy which produces an EIRR of over 12 percent), even though the economic return at the margin is frequently well over 100 percent. The budget allocation process is flawed and politicized, and funds are unfortunately not allocated to finance expenditures with the highest return. Large spending ministries, particularly those spending large sums on maintenance, nearly always lose out in the budget debate. Maintenance can always be postponed in the hope that better fiscal conditions are around the corner. They rarely are, and road maintenance continues to be cut or deferred. Given this inherent structural problem, it is no wonder that both Japan and the U.S. — both generally considered successful economies with well-developed budgetary systems — use earmarking to secure a stable flow of funds to support their road expenditure programs (see Box 3.2).

Another reason road maintenance is underfunded is that some countries still spend too much on new investments (mainly upgrading existing roads and construction of feeder roads). A review of nineteen SSA countries has shown that, between 1986 and 1988, 58 percent of road expenditures were devoted to new construction or improvement, 17 percent to reconstruction and rehabilitation, and a mere 25 percent to routine and periodic maintenance. Countries continue to upgrade existing roads and build new ones even when there are no funds to maintain them. One of the reasons for preferring construction over maintenance is that maintenance is financed under

the recurrent budget, while investment is financed under the development budget. Since donors are willing to support the development budget, development funds are less constrained than recurrent funds, which are mainly financed from domestic revenue sources. However, a more important reason for favoring new construction is that contracts tend to be larger (hence offering greater opportunities for gratification payments) and are politically more visible and glamorous.

Table 3.4 Main Road Expenditures, Financing, and Actual and Required Maintenance in Selected Countries

	CM	*KE*	*MAG*	*UNI*	*RW*	*TA*	*UG*	*ZA*	*ZIM*
	1991/92	*1991/92*	*1991/92*	*1991/92*	*1991/92*	*1991/93*	*1991/92*	*1991*	*1990/91*
	CFAF (bill)	*K£ (mill)*	*FMG (bill)*	*Naira (mill)*	*FRW (mill)*	*TSh (bill)*	*USh (bill)*	*Kwacha (mill)*	*Z$ (mill)*
Road expenditures[a]	16.5	112.4	100.0	750.0	1,000.0	11.3	32.0	935.0	247.0
Financed by									
Road users[b]	0.6	23.0	20.0	24.0	500.0	2.8	5.3	105.0	45.0
Government Grants	12.2	40.5	10.0	656.0	n.a.	5.0	21.0	522.0	187.0
Donors	3.7	48.9	70.0	70.0	n.a.	3.5	5.7	308.0	15.0
Maintenance expenditures									
Required[c]	12.0	132.9	52.3	2,167.8	1,137.8	11.6	13.5	2,468.0	123.6
Actual	7.5	29.1	15.0	570.0	550.0	4.8	4.4	305.0	89.7
Maintenance shortfall	4.5	103.8	37.3	1,597.8	587.8	6.8	9.1	2,163.0	33.9
Actual/required (percent)	63	22	29	26	48	41	33	12	73

n.a. Not applicable

Note:

a. Road expenditures are generally below requirements because of shortfalls in regular road maintenance allocations.
b. Includes license fees, international transit fees, and fuel levies (where applicable).
c. Maintenance requirements based on: paved = $4,000 per km; gravel = $1,000 per km.

Source: World Bank Sector and Project reports and World Bank Task Managers.

3.4 LACK OF CLEAR RESPONSIBILITIES

A lack of clearly defined responsibilities adds to the above problems. It is often unclear which agency is responsible for managing different parts of the road network, controlling overloading, managing urban traffic, intervening to improve road safety, or intervening to reduce the adverse environmental impacts associated with road traffic.

Responsibility for roads is often spread among half a dozen central government ministries and a whole range of local government agencies. For example, in Ghana during the early 1970s, construction and maintenance of trunk roads was handled by the Public Works Department; feeder roads construction fell under the Department of Social Welfare and Community Development (maintenance was left to regional organizations); the Cocoa Marketing Board, Volta River Authority and timber companies constructed roads to serve their own needs; and city and municipal councils dealt with city and town roads. The departments of agriculture,

tourism and wild life, and lands also build roads in Botswana, Kenya, Tanzania, Zambia, and Zimbabwe. Moreover, traffic regulation and enforcement, is often handled by a separate transport ministry and the police. The fragmentation of responsibility, together with the separation of responsibility for construction from that of maintenance, leads to duplication, confusion, and a lack of coherent management policies.

Box 3.1 Separating Road User Charges from General Tax Revenues

The taxes and charges paid by road users are either: (i) clearly identifiable as specific charges for use of the road network (e.g., tolls, fuel levies paid into a road fund, and vehicle license fees); (ii) clearly identifiable as general revenue taxes (e.g., value added taxes, corporate income taxes, and trade protection taxes); or (iii) may be used to both collect user charges and general tax revenues (e.g., import duties, excise taxes, and sales taxes). Since it is fairly easy to identify the taxes/charges which fall into categories (i) and (ii), this box concentrates on ways of dealing with category (iii).

When road user charges are combined with other general taxes, they are added to existing indirect taxes (e.g., taxes on goods and services and import duties). Indirect taxes generally differentiate between consumer luxuries, other consumer goods, intermediate goods (including raw materials), and capital goods. Within each category, items are treated in a fairly consistent way, although there are exceptions since tax rates also reflect other fiscal objectives (e.g., promoting domestic vehicle assembly, energy conservation, and protection of local industry). The following four-step procedure is suggested as a means of separating road user charges from general revenue taxes.

- First, examine the tax code to see whether transport services are exempted from general taxation. The tax code usually states how services are to be treated and will usually list exempted items. If not, examine the various revenue headings to see whether transport is *de facto* exempted. For example, if aviation kerosene and aircraft spare parts bear general taxes, then the presumption is that transport is not exempted.

- Second, there will usually be prior information available to show how the overall tax rate has been built up and, within the overall rate, how much represents the road user charge. For example, in China, the purchase tax on new vehicles includes an *added vehicle purchase fee*, which is credited to a special fund to support road construction. Such prior information often enables road user charges to be separated from general revenue taxes.

- Third, when there is no prior information, examine the tax code to see how the taxes levied on road users compare with the taxes levied on other goods and services. For example, trucks are usually classified as *plant and equipment*. If the tax schedule levies the same tax rate on trucks as it does on all other plant and equipment, then there is no road user charge added to the tax rate. On the other hand, if the rate is clearly higher than on other plant and equipment, the difference may represent a road user charge (the difference represents the *maximum* amount which can be considered a road user charge since the additional element may reflect other fiscal objectives).

- Fourth, when it is not possible to identify the tax rate applicable to road users, the analysis has to rely on the average tax rate for all similar goods. For example, the rates applicable to individual items of plant and equipment may vary widely, and in such cases there may be no alternative but to use the average rate to represent the rate applicable to that category. This is calculated by dividing the tax revenue collected from that group (e.g., general sales taxes, excise taxes, and import duties on plant and equipment) by the base value of these items. The difference between the tax levied on road users and the average tax rate on the group as a whole can then be treated as the user charge (again, the amount represents the *maximum* amount which can be considered a road user charge).

A recent study has applied the above method to eight countries (Argentina, Bangladesh, Bolivia, China, Indonesia, Mexico, Tanzania, and Turkey) and showed that import duties, sales taxes, and excise taxes rarely include an additional element representing a road user charge. Indirect taxes are nearly always general revenue taxes and play no part in mobilizing revenues to support spending on roads.

Box 3.2 Earmarking in Japan and United States

Japan introduced a special funding system for roads in 1954, and the United States did so in 1956. Both involved earmarking certain road-related taxes and depositing them into a special account, or road fund. The Japanese special funding system was introduced to meet the needs of the post-war road improvement program and was "based on the concept that road users who enjoy the benefits of improved roads should bear the burden for their improvement." The United States special account was introduced to finance construction of the interstate highway network and was based on the user-pay concept. The concept involves two elements: first, the user pays, and second, the government credits the user fees directly to a highway special account.

Earmarking in Japan:

Japan has an elaborate system of earmarking *national* and *local* taxes to finance the maintenance, improvement and construction of roads. At the national level, earmarked tax revenues consist of all the gasoline tax and half of the tax on liquid petroleum gas (LPG). One quarter of the gasoline tax is paid directly into the Road Improvement Special Account, while the remainder passes through the government's General Account before being deposited into the Special Account. At the local level, earmarked tax revenues consist of: (i) tax revenues collected by the national government and then passed on to the local government and (ii) tax revenues collected by the local government itself.

Item (i) includes the other half of the tax on LPG (spent on roads in the Tokyo Metropolitan Area, Hokkaido, prefectures, and designated cities), one quarter of the motor vehicle tonnage tax (spent on roads in cities, towns, and villages), and a local gasoline tax (43 percent spent on roads in the Tokyo Metropolitan Area, Hokkaido, prefectures, and designated cities; 57 percent spent on roads in cities, towns, and villages). Item (ii) includes a local diesel fuel tax (spent on roads in the Tokyo Metropolitan Area, Hokkaido, prefectures, and designated cities) and the motor vehicle purchase tax (30 percent spent on roads in the Tokyo Metropolitan Area, Hokkaido, and prefectures, 70 percent spent on roads in cities, towns, and villages). Earmarked revenues at both the national and local levels are supplemented by general tax revenues and, in the case of the national government, are also deposited into the Road Improvement Special Account to ensure comprehensive management of the funds.

The tax rates are set during the preparation of the Five Year Road Improvement Programs. The Ministry of Construction prepares the programs in consultation with the local government and then submits them to the Ministry of Finance for approval. After consultations, new tax rates are agreed upon and these are then written into a new *proper tax law,* which remains in force for the next five years.

Earmarking in the United States:

The US Federal Highway Trust Fund exists only as an accounting mechanism. The taxes earmarked for the Trust Fund are deposited into the general fund of the US Treasury and a paper transfer of these taxes is made to the Trust Fund as needed. Earmarked tax revenues in excess of those required to meet current expenditures are invested in public debt and interest earned is credited to the Trust Fund. The Trust Fund finances the federal-aid highway program, administered by the Federal Highway Administration (since 1982 a portion of the Fund has also been used to finance mass transit projects administered by the Urban Mass Transportation Administration). Revenues from the highway portion of the Trust Fund are used to reimburse states for expenditures on *approved* projects. These include periodic maintenance, road improvement, new construction, road safety programs, studies, and other highway related expenditures. The Trust Fund does not finance routine maintenance.

Trust Fund revenues are derived from a variety of highway user taxes, including: (i) motor fuel taxes on gasoline, diesel, and gasohol; (ii) a graduated tax on tires weighing 40 lbs or more; (iii) a 12 percent retail tax on selected new trucks and trailers; and (iv) a heavy-vehicle use tax on all trucks with a gross vehicle weight (GVW) over 55,000 lbs. Tax rates are adjusted as part of the regular budgetary process.

The user-pay concept is well established in the United States. All but six states and the District of Columbia now dedicate their user-fee revenues to special highway or transportation accounts.

In addition, individual road agencies rarely have clearly defined responsibilities. For example, it is often unclear whether trunk roads in urban areas are a responsibility of the main

road agency or the urban municipality. In the latter case, it may also be unclear which agency is meant to pay for the maintenance of these roads. This has created problems in Zambia, where such roads are under the jurisdiction of local authorities but are meant to be financed through the central government budget. The lack of clearly defined responsibilities is even more acute in rural areas. Few rural roads built during the past twenty years have been formally assigned to a legally-constituted highway authority. Many were financed on a grant basis by multilateral and bilateral donors, using funds channeled through central government departments dealing with agriculture, fisheries, and tourism. In many cases, there were no set arrangements for transferring managerial responsibility to an established road agency and clarifying responsibility for maintenance. Local road agencies may therefore not know which roads they are supposed to maintain, and a significant number of rural roads thus go unclaimed and unmaintained. The reverse is also true. Some gazetted[13] roads have reverted to bush and the designated road agency *can no longer find them*! This has happened in both Uganda and Zambia.

Most road agencies are likewise unclear about what their responsibilities are regarding axle-weight enforcement (this usually being left to the police). Should they actively intervene to manage urban traffic (and enforce parking and other traffic regulations)? Should they willingly accept civil liability for accidents caused by defective design and maintenance policies? Should they seek compensation from third parties for damage done to road infrastructure (usually by road accidents)? Do they have a responsibility to identify and mitigate the environmental impacts associated with roads and road traffic? Although many of these problems are aggravated by a shortage of technical staff and underdeveloped legal and administrative systems, the core problem is the lack of clearly defined responsibilities. Which ministry is responsible and to which agency has it assigned that responsibility?

3.5 INEFFECTIVE MANAGEMENT STRUCTURES

These problems are worsened by the curious management structures under which most roads are managed (they are not really managed, but administered). At the central government level, the main road network is usually managed in one of three ways. It is either managed: (i) as part of a combined Ministry of Works, Transport and Communications (Botswana, Uganda, and Tanzania); (ii) as part of a more narrowly focused Ministry of Works or Transport (Madagascar, Rwanda, Sierra Leone, Zambia, and Zimbabwe); or (iii) under a sharply focused Ministry of Roads and Highways (Ghana). Local government roads may either be handled directly through a central road agency (Sierra Leone), through a separate department forming part of a central road ministry (Ghana), or through a ministry of local government, which usually delegates most day-to-day operations to the local authorities themselves. The typical structure for a combined ministry is illustrated in Figure 3.1. A more focused ministry is similar, but simpler, while a special-purpose ministry provides the simplest model of all.

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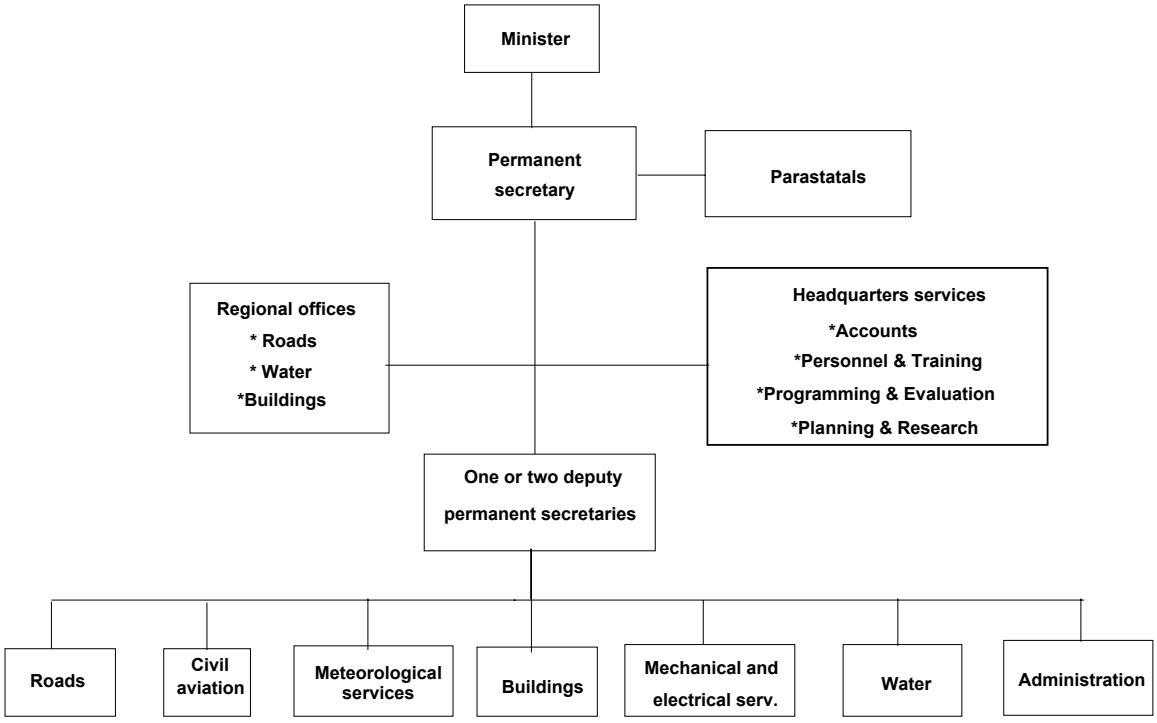
[13] The process of gazetting assigns responsibility for operating and maintaining the road to a legally constituted highway authority.

Figure 3.1 Typical Management Structure of a Ministry of Works and Transport



The model illustrated in Figure 3.1 is cumbersome and largely ineffective as a framework for promoting a more commercial approach to the management of roads. Reporting lines are long and tortuous, regional engineers often report directly to the permanent secretary (PS) (instead of through the director of roads), numerous support services are shared (and hence suffer from conflicting priorities), and the entire structure is lopsided. The road function typically accounts for about 70 percent of the ministry's budget (particularly with maintenance fully-funded), and yet the roads department is usually placed alongside other functions which are small (meteorological services) or being contracted out (mechanical services). This distracts the attention of the deputy PS, through whom roads must report. The director of roads is also way down in the hierarchy, occupying the position of a line manager rather than chief executive of a large and important department.[14] This contrasts with the position of parastatals which have a board, chief executive, and several line managers. The parastatals report directly to the PS. The present management structure is thus an anachronism and dates back to the time when expenditures on roads were roughly the same as they were on public buildings and government plant and equipment.

The more focused ministry overcomes some of the above problems, since reporting lines are more direct. Furthermore, in a more narrowly focused transport ministry, there is better

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[14] In Tanzania, the total remuneration package (including all allowances) of the director of roads is two-thirds that of the managing director of Air Tanzania and 40 percent that of the managing director of Tanzania Railways. In Zimbabwe, the ratios are 70 percent and 50 percent, respectively. The managing directors of the airline and railways also have more tax-free allowances and other perks. Even more inconsistent, in Tanzania, the head of the former Ministry of Works plant pool now receives a total remuneration package 10 times higher than the drector of roads.

intermodal coordination, but the ministry remains lopsided, the management structure remains weak, and the director of roads remains a line manager. The special purpose ministry in Ghana provides the simplest model, although the same objective could be achieved by restructuring a larger, heterogeneous ministry. Roads in Ghana are managed through three line agencies which all report directly to the permanent secretary. The Ghana Highway Authority, which has a commercial management structure, manages main roads, and the Departments of Urban Roads and Feeder Roads manage urban and rural roads respectively.

Finally, there is the question of the local government ministries which handle local authority roads. They vary enormously. At one extreme, there are large force account agencies like the District Development Fund (DDF) in Zimbabwe, which manages a large road network on behalf of local councils (the DDF is part of the Ministry of Local Government), while at the other extreme there may be a few people in the Ministry of Local Government who liase with local authority roads departments, but do very little for them. At the local authority level, it tends to be even more confused. There is often no such thing as a roads department (new roads often fall under the Development Committee and road maintenance under the Finance Committee), making it difficult to identify who is responsible for what. At the local level, management structures are therefore weak or nonexistent.

3.6 WEAK MANAGEMENT SYSTEMS

The above confusion and poor management structures provide managers with little incentive to introduce and develop effective financial accounting systems and management information systems. Current financial accounting systems provide little information to support informed management decisions. There is no revenue account (hence no cash flow statement), accounts are kept on a cash basis, investments are written off as a cash expense as soon as they are incurred (i.e., road agencies do not depreciate assets or keep a balance sheet), and the accounting system uses very broad cost headings which involve a great deal of aggregation. Items like *Administration* and *Electrical and Mechanical* frequently cover several functions, and there is no simple way of identifying the specific expenditures attributable to roads. Most road agencies therefore cannot tell how much they spend on routine and periodic maintenance costs (some periodic maintenance costs being charged to the recurrent budget and some to the development budget); the breakdown of costs between overheads, labor, and equipment; and the unit costs of shoulder repairs, regraveling and cleaning drains. Such poor accounting systems make it difficult, if not impossible, for managers to establish consistent spending priorities

Likewise, there is a dearth of effective management information systems. Numerous attempts have been made to introduce such systems, but with little success. Many fail as soon as the consultants who have installed them leave. A recent review has shown that a mere 10 percent of countries in Africa compile basic traffic count and road inventory data, while data on pavement condition, surface roughness, and pavement strength are virtually nonexistent.[15] No more than 10 percent of African countries have functioning routine-maintenance management systems and pavement management systems to determine network-wide maintenance priorities. Even fewer supplement such physical planning tools with performance budgeting systems. The remaining countries have neither the data nor the mechanisms and staff needed for analysis. You

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[15] This is based on a sample of eleven countries. Of these, only one kept valid and complete inventory data, one had a functioning maintenance management system, and one had a functioning pavement management system.

cannot manage a large road network efficiently without some form of management information system.

3.7 INEFFICIENT WORK METHODS

These problems all lead in the same direction: toward road agencies which do not operate efficiently. Few road agencies in Africa manage resources aggressively enough to achieve maximum value for money. Instead, they deliver poor quality services based on their (usually inadequate) annual budget allocations. This is clearly exhibited in the undue emphasis on force account work, inefficient operation of government plant pools, and lack of interest in labor-based work methods. These are characteristics of agencies which face no market discipline and have poorly motivated managers who are not held accountable for results.

A great deal of maintenance, particularly routine maintenance, is still carried out by force account. This continues in spite of its variable quality and (usually) higher cost. Although cost comparisons are often inconclusive, in-house work exposed to private sector competition nearly always results in dramatic increases in efficiency, with costs falling by as much as 30 percent. Contract maintenance can also improve quality. It is easier to control and helps to develop the local construction industry. However, it will only work effectively when procurement procedures are straight-forward, and there is a healthy local construction industry and a stable flow of funds to pay the contractors. The road agency must also have enough qualified staff to process contracts, supervise the work, and deal with arbitration issues. Contract maintenance is not a panacea.

Inefficient government plant pools are another symptom a of lack of market discipline. Most road agencies own millions of dollars worth of heavy plant and equipment, much of it procured under World Bank loans or furnished on a grant basis by well-meaning bilateral donors. Even a relatively small road agency may own plant and equipment worth $50 million or more. Utilization rates for this equipment rarely exceed 20 to 30 percent, compared with 80 to 90 percent in the private sector, and the economic losses associated with these low utilization rates can amount to over $23 million per year.[16] The superficial reasons for such low utilization rates include poor management systems, lack of standardization, shortages of fuel and spare parts (or shortage of foreign exchange to purchase them), and shortage of trained equipment operators and mechanics (mainly due to poor terms and conditions of employment). However, the real reasons are related to lack of a stable work load (i.e., inadequate road maintenance allocations and an erratic flow of funds), lack of transparent management systems (i.e., costing systems which clearly spell out the costs of low utilization levels) and lack of managerial accountability. No one knows, or cares, that equipment is underutilized.

Lack of interest in labor-based work methods is also symptomatic of lack of market discipline. Not only are labor-based methods often much cheaper (in Tanzania and Ghana labor-

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[16] The calculation is based on a plant pool worth $50 million, with an average utilization rate of 25 percent instead of 85 percent. The equipment is depreciated over 8 years, using straight line depreciation, a 12 percent interest rate, and maximum utilization of 1,250 hrs per year.

based contracts are coming in at about 30 percent below traditional contract prices),[17] they are often more reliable because government plant pools are in such disarray. Labor-based work methods nevertheless face some genuine difficulties. Government procurement procedures often discourage the letting of small contracts, particularly to one-man contractors who cannot be expected to follow standard bidding procedures. Donor policies, with their emphasis on international competitive bidding (ICB) and preference for financing foreign exchange expenditures, add to the bias against labor-based work methods. However, there are other reasons: labor-based work methods offer less scope for gratification payments (equipment and workshops offer ample scope for supplementing incomes), and management is under no direct pressure to find the cheapest and most effective way of getting the work done.

Road agencies are unlikely to operate efficiently until they are faced with some form of competition or a competition surrogate (i.e., until they are subjected to some form of market discipline). Competition is the primary factor which motivates managers to cut waste, improve operational performance, and allocate resources efficiently.[18]

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17 Accurate cost comparisons are difficult since they are dependent on the costing system used, market conditions and the government's reputation as a reliable payer. Contractors often add a surcharge to contract prices to cover expected late payments.

18 Shirley. (1989).

4 APPROACH TO REFORM

This chapter focuses on the way the RMI program set about identifying the causes of poor road maintenance policies and how it developed an agenda for reforming them. In other words, it is about the *process* of policy reform, specifically, how to promote major policy reforms when the answers are neither straight-forward nor known in advance. The chapter examines the regional approach adopted during RMI Phase I, the lessons learned from the country approach adopted during Phase II, the value of sharing experiences between participating partners and the role of the donor community in facilitating the process of policy reform.

4.1 REGIONAL APPROACH

During Phase I, the RMI held regional seminars in six main centers (Harare, Accra, Addis Ababa, Dakar, Libreville, and Antananarivo) to discuss the importance of road maintenance, the main problems contributing to poor road maintenance policies, and possible solutions to these problems. All countries in SSA participated, and each sent a small government delegation, consisting of civil servants and ministers, to participate in the seminars. A great deal of effort went into securing participation by ministries of finance. Nearly all the key resource papers were presented by non-African authors, each country delegation presented a country issues paper, all seminars were moderated by African personalities, and African specialists participated as resource persons. Each seminar concluded with discussion sessions facilitated with the aid of the Policy Action Planning (PAP) method developed by a German training institute.[19] The PAP method was used to help participants prepare action plans for reforming road maintenance policies in their own countries.

An evaluation of Phase I showed that it succeeded in raising awareness of the need for better road maintenance policies. It also helped to develop a consensus among donors of the need to radically rethink their approach to road rehabilitation programs. On the other hand, Phase I led to few, if any, concrete actions on the ground. This came as no surprise. It takes time to develop a realistic agenda for reform and even longer to build a broad-based consensus on the need for such reforms. In this context, the PAP methodology led to action plans which emphasized clear technical solutions but vague and unconvincing financial and institutional reforms. For example, they argued convincingly in favor of network-based planning and programming, introducing performance budgeting systems, reducing force account work, increasing the use of local contractors, increasing the use of labor-based work methods, and reducing publicly-owned equipment fleets. However, on the important issues of financing and institutional and human resource development, they simply repeated the need to deal with these issues without saying how. In many respects, they fell into the traps outlined in Boxes 4.1 and 4.2. They started dealing with systems and procedures before reforming the institutional framework and incentive systems.

Part of the problem was attributable to the PAP methodology itself. It can be a useful device for facilitating discussion and developing a consensus on action plans when there are *known solutions*. However, when there are no obvious solutions, it simply forces participants to agree to impractical solutions which carry no conviction or commitment. This applied both to the financing issue and to institutional and human resource development issues. Discussions of financing sometimes led to absurd suggestions — for example, that vehicle insurance companies

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[19] Carl Duisberg Gesellschaft, Cologne, Germany.

should pay for road maintenance — and to consistent pressure to establish autonomous road agencies, with little idea of what that meant and what benefits it might produce. Nevertheless, experience with Phase I was sufficiently encouraging to persuade the donor community to design a second phase based on individual country initiatives.

Box 4.1 Sequencing Institutional Development Strategies

Recent case studies in Africa have shown that institutional development of government transport agencies needs to follow a logical hierarchy, starting with overall strategic goals and moving toward more specific reform of management systems and procedures. Unless the reforms follow a natural progression, they will conflict with each other and be ineffective. The case studies arrived at the following hierarchy of interventions:

- Define the role of the organization;
- Develop commitment to the new role;
- Develop an appropriate policy framework;
- Undertake strategic reforms and restructure the relationship with government;
- Strengthen leadership by improving top management;
- Ensure that sufficient resources are available;
- Reorganize staffing structures and improve management control;
- Strengthen management systems, processes, and procedures.

The disappointing results of many institutional development programs are largely attributable to the fact that they deal with lower level issues before, or instead of, attending to those at the top of the list. This leads to predictable problems:

- Improved systems and procedures have a negligible impact unless better organizational structures and adequate management controls are in place;
- Organizational structures and controls will only be effective if sufficient resources are available;
- Improved resources will have little impact unless top management is improved;
- Improved management depends on strategic reform and restructuring the relationship with government;
- Commitment to change will only develop if both government and the road agency have a clear conception of the new role, which must generate more benefits than costs.

The above hierarchy can only serve as a conceptual framework since many of the issues are interrelated and may require simultaneous interventions at several levels.

Source: P. Moeller (1993).

4.2 COUNTRY INITIATIVES

The switch from a regional to an individual country approach had a dramatic effect on the process of policy reform. For the first time, the initiative started to generate a genuine policy dialogue. It turned out that the regional seminars lacked an important dimension as did the initial country dialogue. Participants were predominantly from ministries expecting to benefit from increased road spending. Their attitude was thus one of actively supporting increased road spending and creation of an autonomous road authority (which would enable them to raise their salaries), while showing little enthusiasm for the types of reform which might cause them inconvenience: contract maintenance, labor-based work methods, and reform of government plant pools. The dialogue focused on getting *more money* to continue doing *business-as-usual*. Nor was the ministry of finance much help. All sectors asked for more money, and the ministry of finance simply turned a deaf ear, even when the issue of road financing was explored in the context of a PER, which dealt with the issues from their point of view. Genuine policy dialogue

requires at least two parties: one party must want something, and the other must have something to give.

Box 4.2 Sequencing Human Resource Development Strategies

Recent case studies in SSA have pointed to the importance of human resource development and have also shown that reforms designed to improve human resources will be ineffective unless properly sequenced. As with institutional development, the reforms should start by setting the overall strategic framework and then progress to lower objectives in an orderly fashion. The case studies suggested the following general hierarchy:

- Define the human resource strategy;
- Improve the terms and conditions of employment and the quality of management;
- Adjust employment to needs;
- Strengthen accountability, incentives, and sanctions;
- Improve manpower utilization and job resources;
- Develop managerial and supervisory skills;
- Improve personnel systems;
- Improve training.

Successful reform at one level is generally dependent on the success of reforms carried out at other levels. For example:

- Without adequate terms and conditions of employment and competent management, no human resource development strategies will work;
- Most transport sector organizations need to adjust current manpower levels to those required to run an efficient organization;
- To run an efficient organization, staff need to be well paid and motivated; their motivation depends on strengthening incentives, accountability, and sanctions;
- Manpower utilization needs to be improved to support staff motivation, but this cannot usually be done until managerial and supervisory skills have been upgraded;
- Accountability cannot be strengthened without improved manpower utilization and sufficient resources;
- Improved personnel systems and procedures are needed to support manpower planning, manpower utilization, and performance evaluation;
- With the above reforms in place, training will have greater impact, and more attention will need to be given to the planning and programming of training.

The above ordering of human resource development strategies only represents a conceptual guide to action. Many of the above interventions are interrelated and may need to be implemented simultaneously. Human resource development strategies will only be effective if they address all of these needs in a comprehensive and properly sequenced manner.

Source: P. Moeller (1993).

The real breakthroughs came unexpectedly during country seminars and workshops in Zimbabwe, Zambia, and Tanzania. The breakthrough consisted of involving the private sector in discussions on road maintenance (the private sector consisted of participants from the chamber of commerce, consultant organizations, road transport associations, and the farming community). Their participation changed the entire chemistry of the discussions. For once, there were two sides to the dialogue. Road users expressed willingness to pay for roads (over and above all preexisting taxes), provided the proceeds were spent on roads and the work was done efficiently. The road agency, on the other hand, saw a genuine opportunity to improve its position, provided it was willing, in return, to reform the way it did business. Bringing the two sides together, however, was not always easy. Except in Zambia and Zimbabwe, civil servants distrusted the private sector, and the private sector couldn't see the point of talking to the road agency. However, once the ice was broken, the relationship became instantly beneficial, with the private sector offering help and support, and the public sector showing surprising willingness to listen and respond.

Three other important insights emerged from the country initiatives. First, it became clear that solutions had to be home-grown. Studies on improving management and financing of roads turned out to be more effective when prepared by African resource persons than by outsiders. Local consultants somehow have more credibility, are available for follow-up action and have a better understanding of what does and does not work in the local country context. Furthermore, since local consultants tend to be leaders of opinion in their own countries, their ideas spread quickly and soon become part of the local conventional wisdom. On topics like financing, it was also found expedient to involve staff from the ministry of finance. This helped to make the studies more insightful and also helped to internalize the results. The best example was a paper on financing prepared for a seminar in Zambia. It was jointly authored by a senior official from the ministry of finance and led to a heated debate within the ministry before the paper was released.

Second, it was found that several small studies were usually more effective at achieving a consensus on major policy reforms than were large, integrated studies. Most organizations in Africa, whether government departments or local business associations, have limited capacity to think through the potential consequences of major policy reforms. A large, comprehensive study simply over-taxes their limited technical capacity. This is why so many studies end up on the shelf. Given the limited absorptive capacity available in Africa, it is much better to divide the problem into its component parts, and then to use individual consultants to tackle each part separately over a two- to three-year time horizon. This turns the wrenching change of direction implied by a large, comprehensive policy study into a series of smaller, sequential changes which can be more easily understood and absorbed by key policy makers.

Third, major policy reforms take time and cannot be rushed. It takes time for people to reorient their mind-set and absorb a new way of thinking. Gradualism is of the essence. Incremental change is more easily absorbed than root and branch transformation of existing institutions. It is thus better to work within existing institutions and the framework of existing laws and legislation until major changes in the institutional structure are unavoidable. This minimizes bureaucratic resistance, allows time for testing and adaptation, and provides a sounder basis for preparation of the final legislation, which then consolidates reforms that are already *de facto* in place. The other consequence of gradualism is that major policy reforms cannot be directly linked to donor operations. Policy reform programs can work in parallel with donor operations but cannot be tied to them since, to be successful, the reform process must move at its own pace.

4.3 SHARING EXPERIENCE

During the course of Phase II, the RMI found that *sharing experience* was one of the most successful ways of introducing new ideas and building consensus. This is particularly true in the African context. Africans consider their problems unique and are unimpressed by textbook solutions or experience gained in industrialized countries. They are more interested in African solutions, developed and tested in an African context. RMI Phase II therefore placed great emphasis on sharing experience among the nine participating target countries. This was partly achieved through visits by RMI staff, who gave regular presentations on experience gained under the RMI program in other countries. This process turned out to be so successful that the sharing of experience is now in the process of being formalized through the establishment of a Sub-Saharan Africa Road Information Network (SSARIN). This is a fax-based network designed to facilitate exchange of information among RMI countries, associated countries that have expressed a desire to share in the RMI *message*, and selected resource countries outside the RMI family which have noteworthy lessons to share (see Box 4.3). The sharing of experience has also been supported through the preparation of regular newsletters and reports[20] and annual meetings between RMI staff, RMI Country Coordinators, and those members of the donor community interested in roads. The annual meetings have been a particularly effective way of sharing experience and have encouraged a healthy element of competition among the nine target countries: if you can do it, so can we.[21]

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[20] These include the SSATP Newsletter published twice a year (carrying articles about the RMI), the RMI annual work program, reports from the Country Coordinators prepared for the annual meeting, and a recent paper, *Commercializing Africa's Roads: Transforming the Role of the Public Sector*, which summarizes the initial experience gained under the RMI program.

[21] The RMI makes an annual award to its Country Coordinators for "outstanding services in the field." Awards have so far been made to Country Coordinators in Cameroon, Tanzania, and Uganda. A special award has also been made to the Executive Officer of Fedhaul, Zambia, in recognition of the outstanding contribution it made to controlling over-loading and improving collection of international transit fees.

Box 4.3 The Sub-Saharan Africa Road Information Network (SSARIN)

During the final stages of RMI Phase II, it became clear that the sharing of experience on the various initiatives taken to improve the management and financing of roads would benefit from being formalized. It was not cost-effective for the RMI staff to spend too much time acting as channels of communication between the different RMI countries. It would be better if these countries spoke to each other directly. For example, instead of Zambia asking the RMI Unit in Washington how Tanzania opened their Road Fund, the Zambians should be encouraged to ask the Tanzanians directly about such matters. This was the incentive which led to establishment of SSARIN.

The network has three types of members: (i) RMI *core* countries, (ii) other *resource* countries, and (iii) *associate* countries. The RMI core countries all have some experience to share and are connected to each other by fax through the respective RMI Country Coordinators. However, there are also countries outside the RMI network which also have valuable experience to share. At the present time, they include Sierra Leone, Ghana, and Botswana. They are included in the network to ensure their experience is readily accessible to the rest of the network. Finally, there are a group of countries wishing to participate in the RMI program but cannot be accommodated due to shortage of resources. They include Malawi and Mozambique, and this group is likely to increase substantially during the course of the next few years. They participate in the network to share in the experience already gained by the core and resource countries.

The network is simple and unpretentious. Each participating country must have two things: a working fax connection and a formally designated Country Coordinator. The RMI Unit in the World Bank has prepared the initial network directory, which lists the contact person, fax address, alternative contact arrangements when the fax link is inoperative, and the list of noteworthy features which other countries might be interested in. The first formal meeting of Country Coordinators is due to take place in October 1994. It is expected that the meeting will elect a Secretary from among their number, and that SSARIN will thereafter be an African affair with its own African agenda.

The other instrument used to share experience has been the guided study tour. The format has been for 6 to 8 selected individuals, including both civil servants and representatives of the road transport industry, to visit other countries to study how they deal with the management and financing of roads. Although some visits have been made to Malaysia and Korea, those to other African countries — mainly Ghana and Sierra Leone — have had the greatest impact. The study teams are usually accompanied by a local consultant who makes notes on subjects studied and prepares a report on the study team's conclusions. On return to their home country, the study team's report is discussed at a workshop in order to share experience with others and agree on what to do next. These reports have turned out to be surprisingly insightful and have been an important catalyst for new ideas.

4.4 ROLE OF THE DONOR COMMUNITY

The development assistance strategies pursued by individual donors also have an important impact on the overall policy reform process. They support the policy reform process when donor strategies are coordinated, but tend to undermine it when donors support contradictory policies, mainly serving their own narrow national interests. For example, the best laid plans to reform government plant pools can be completely undone when one individual donor decides to donate a large amount of new equipment. Coordination is thus at the heart of effective policy reform programs.

The RMI, and indeed the whole of the SSATP, has played an important role in donor coordination. The ten bilateral, multilateral, and regional organizations supporting the RMI program started off sharing a common vision about the need for sound road maintenance policies but did not know how to establish them. The initial regional seminars and subsequent country initiatives served as a learning experience and led to a broad measure of agreement between

donors on a number of key policy issues. Regular consultations between RMI staff and donors, supplemented by regular annual meetings between RMI staff, donors, and Country Coordinators, served to reinforce this consensus. That does not mean there were no disagreements. Coordination invariably involves some give and take. Donors accept some restrictions on their development assistance strategies in return for a more effective country development program as a whole. Indeed, the RMI donors are so serious about coordination that, following the 1991 Conference on Road Maintenance in Africa held in Brussels and organized by the EEC, they invited the EEC to draft a *Code of Conduct* to guide future donor involvement in the road sector (see Box 4.4). The Code is now in the process of being signed by all members of the development community.

Another important function of the donor community is to collectively support policy reform programs like the RMI. Such programs are always more effective when supported by a coalition of development institutions, rather than by a single institution with its own traditions, outlook, and vested interests. The policy reform programs nevertheless have to operate at arm's-length to avoid the impression of *ganging up*, to ensure that they can move at their own pace (rather than that of the donor processing cycle), and to ensure the independence of their staff. Independence is particularly important. Policy dialogue is built on trust and understanding. It is difficult to diagnose the real reasons for poor road maintenance policies unless people are willing to talk openly about their problems. It took the RMI about three missions, spread over at least a year, before the RMI staff were fully accepted as trusted friends, working wholly in the interests of the target countries (and often disagreeing with the donors themselves). The arm's-length relationship has encouraged more openness and candor and has resulted in a more deep-seated understanding of the underlying issues affecting road maintenance.

Box 4.4 Donor Code of Conduct for Promoting Sound Road Maintenance Policies

The Donor Code of Conduct emerged from the technical conference on maintenance and rehabilitation of roads in Sub-Saharan Africa held in Brussels on 25-26 November 1991. The conference resulted in a number of conclusions which were unanimously approved by participants. They included the following objectives:

- To introduce an appropriate legislative and administrative framework;
- To redefine the role of the private sector, increase private sector involvement, and increase decentralization of responsibilities;
- To rationalize programming and budgeting procedures;
- To introduce coherent taxation and cost recovery policies;
- To increase efficiency by promoting contract maintenance, reducing state-owned equipment pools, and increasing labor-based work methods;
- To promote development of the local construction industry;
- To strengthen road sector administration and human resource development policies.

The Code itself is a two-page document which, after a preamble, declares the full consent of the signatories to:

1. Apply in a rigorous and concerted manner the principles which were jointly developed and approved in the framework of the RMI, in accordance with the recommendations of the Second UN and Communications Decade (UNTACDA II).
2. Reinforce consultation and coordination between donors, development agencies, and beneficiary states through:

- Exchanging general information at the central level and at the local level;
- Informing and coordinating before each financing decision and holding regular meetings at the local level with the aim of:
  - assessing the potential of using local resources and employment-intensive methods for road rehabilitation

and maintenance;

- developing a joint analysis of priorities concerning road maintenance in each country and of capacities of the countries in question to organize and manage the relevant support services;
- informing each other of the implementation of current road programs;
- evaluating the application of the principles and recommendations of UNTACDA II/RMI;
- making an annual report to the relevant authorities of the RMI project.

3. Undertake the necessary steps, whether individually or through the inter-African regional organizations, to invite all the countries of Sub-Saharan Africa to subscribe to these principles and recommendations, and to implement them in terms of resources and legal measures.

4. Contribute actively to the preparation of a restructuring and investment program for the road sector and, whenever possible, to the adoption of Transport Sector Reform Programs.

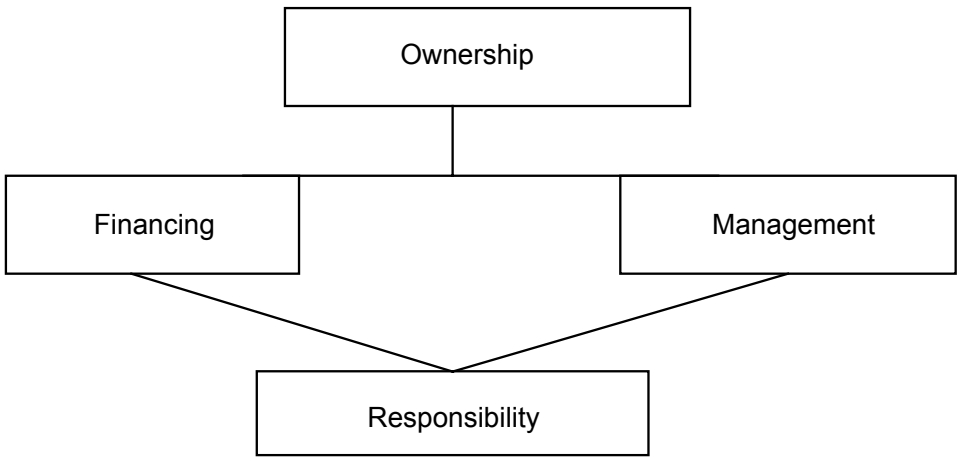
PART II

Agenda for Reform

5 BASIC BUILDING BLOCKS

Part II of this study builds on previous chapters dealing with the background and underlying causes of poor road maintenance policies and moves on from there to develop an agenda for reform. It asks, what can be done to improve road maintenance policies and, more generally, to strengthen the management and financing of roads as a whole? The key concept behind the reforms is *commercialization*: bring roads into the market place, put them on a *fee-for-service* basis and manage them like any other business enterprise. However, since roads are a public monopoly, and ownership of most roads will remain in government hands for some time, commercialization requires complementary reforms in four other important areas. These will be referred to as the *four basic building block*s. They focus on: (i) creating **ownership** by involving road users in the management of roads to win public support for more road funding, to control potential monopoly power, and to constrain road spending to what is affordable; (ii) stabilizing road **financing** by securing an adequate and stable flow of funds; (iii) clarifying **responsibility** by clearly establishing who is responsible for what; and (iv) strengthening the **management** of roads by providing effective systems and procedures and strengthening managerial accountability (see Figure 5.1).

Figure 5.1 Commercialization of Roads: The Four Basic Building Blocks



1. *Ownership*: Involve road users (and other interested parties) in the management of roads to win public support for more road funding, to strengthen market discipline, and to constrain spending to what is affordable.

AND THEN

2. *Financing*: Establish an adequate and stable flow of funds and secure arrangements for channeling them to each road agency.

3. *Responsibility*: Establish a clear organizational structure and assign responsibilities to clarify who is responsible for what.

4. *Management*: Establish a more business-like road agency by introducing sound business practices and strengthening managerial accountability.

The four basic building blocks represent the core of the reforms. They are interdependent and should ideally be implemented together. Without all four, the reforms may only achieve part of their objective. You cannot solve the financing problem without the strong support of road users. And you cannot win the support of road users without taking steps to ensure that resources are used efficiently. And you cannot improve resource use unless you control monopoly power, constrain road spending to what is affordable, and increase managerial accountability. And you cannot hold managers accountable unless they have clearly defined responsibilities. There is nevertheless scope for flexibility. The reforms can be introduced in different ways, i.e., the content of each building block may differ, depending on country circumstances. They can move sequentially or in parallel, and both the sequencing and the pace of reform can vary. However, at the end of the day, all four building blocks should end up in place to ensure that the agenda is sustainable and doesn't drift back to the *status quo ante*.

The following paragraphs summarize the broad scope of each building block. Subsequent chapters describe them in more detail.

5.1 OWNERSHIP

Major policy reforms in the road sector cannot usually succeed without the active support of road users and other persons with a vested interest in sound road management. After all, these are the people who use the road network and also pay for it (whether through taxes or user charges). Given that current allocations for road maintenance are erratic and well below the levels needed to keep the road network in stable long-term condition, the first building block involves winning public support for more road funding and taking steps to ensure that road agencies do not operate as public monopolies and do not spend more on roads than the country can afford. This is an essential precondition for getting road users to willingly pay for roads on a fee-for-service basis. Most road users are unwilling to pay unless they can influence fee levels and are satisfied that the proceeds will be spent on roads, the work will be done efficiently, and managers will be relatively free from political interference. The usual mechanism for winning the support of road users is to involve them in the management of roads.

5.2 FINANCING

The second building block concentrates on establishing an adequate and stable flow of funds, usually by introducing an explicit road tariff to manage demand and generate the revenues needed to support the operation and maintenance of roads. Without an adequate flow of funds, none of the reforms will be sustainable. All governments in Africa are seriously short of fiscal revenues. Budget allocations for road maintenance rarely exceed 30 percent of requirements, and it is simply not feasible for governments to increase these allocations under present fiscal conditions. Improved revenue mobilization is essential. However, if road user charges are increased, there is no guarantee that the additional revenues will be allocated to roads. Furthermore, traditional earmarking is not a viable solution. It has adverse impacts on the management of the government's overall budget and is rarely sustainable. An added concern is that the current financing mechanisms do little to strengthen market discipline, either by managing demand or by improving the efficiency of the road agency. Solving the financing problem calls for a radically new approach to road financing.

5.3 RESPONSIBILITY

The third building block concentrates on creating a consistent organizational structure for managing different parts of the road network. In other words, it focuses on establishing who is responsible for what. This requires a clear assignment of responsibility among different government departments and different levels of government and among individual road agencies. The arrangement needs to be based on an accurate road inventory, functional classification of roads, designation of appropriate road agencies, formal assignment of responsibility to each road agency, and clarification of the relationship between the road agency and the parent ministry. Responsibilities to be assigned include those for operation, maintenance, improvement, and development of the road network, for traffic management, for road accidents caused by the road agency's own negligence, and for the adverse environmental impacts associated with roads and road traffic.

5.4 MANAGEMENT

The fourth building block focuses on creating a more businesslike road agency. Once road users are involved in the management of roads, they generally press for the introduction of sound business practices to ensure that their constituents get value-for-money. Road users expect clear management objectives, competitive terms and conditions of employment, consolidated budgets, commercial costing systems, and effective management information systems. Introduction of sound business practices leads to consequential changes in managerial incentives. It brings pressure to dispose of in-house plant and equipment (or use it more efficiently), to do more work under contract, to control vehicle over-loading, and to improve road safety. These issues have become systemic sources of inefficiency in the road sector because current bureaucratic management procedures provide little incentive to do anything about them.

The following chapters elaborate on the four basic building blocks and propose a practical agenda for dealing with them in the African context.

6 OWNERSHIP

This chapter examines the issue of *ownership*, one of the most important building blocks in the agenda for reform. How can central and local governments encourage road users to take an active interest in the management of roads? This chapter tackles the topic in four stages. First, what is meant by ownership? Second, what grass roots organizations represent road users, and do they provide a sound basis for involving them in the management of roads? Third, how does one involve road users in the management of roads? Finally, how does one set about establishing a Roads Board?

6.1 CONCEPT OF OWNERSHIP

The idea of ownership is to empower road users and to encourage them to take an interest in the management of roads, since their enthusiastic support is a precondition for solving the problem of road financing (whether by raising taxes and reforming the budget process or by introducing an explicit road tariff). Ministries of finance are always reluctant to raise taxes and user charges. The public invariably complains, and the chances of persuading the ministry of finance to increase domestic revenue mobilization to finance more road maintenance is almost zero unless road users openly express willingness to provide the extra revenues. Since road users in Africa have every incentive to see more money spent on road maintenance (see Chapter 2), the issue comes down to finding ways of translating this interest into openly expressed support for a sustainable financing plan.

Road users also have their own vested interests. They may be willing to pay for roads, but only if the money is spent on roads and the work is done efficiently. This is another important concept and is part of the symbiotic relationship which underlies market discipline. Road users pay for roads but, in return, demand value-for-money. Road user involvement can thus create surrogate market discipline to encourage the road agency to use resources efficiently and prevent it from abusing its monopoly power. However, the benefits of ownership do not stop at financing and market discipline. Once road users are convinced that the government is trying to serve their needs, they will generally support a whole range of initiatives. Ownership can become the basis for a genuine partnership, with road users working with the government to improve road safety, control fuel smuggling (or at least find an alternative to the fuel levy for financing roads), and control overloading.

Zambia offers a good example of road users working with the government to address a wide range of road sector issues. The trucking industry takes an almost paternal interest in the road network: they are *their* roads. For example, the Federation of Zambian Road Hauliers (Fedhaul) provides financial support for the RMI secretariat in Zambia and has recently put forward a proposal which would improve administration of international transit fees (see Box 6.1). Furthermore, following an axle-load survey carried out by Fedhaul, which showed substantial overloading (particularly by foreign transit vehicles), the road transport industry as a whole requested that the transport ministry allow the private sector to enforce vehicle weights and dimensions regulations. This was done by appointing individuals nominated by the road transport industry as volunteer Road Traffic Commissioners and using them to help enforce road

transport regulations and supervise operation of weigh-bridges. This has already significantly reduced overloading (over 400 trucks were impounded during the first month of operation) and has also led to recommendations for strengthening existing road transport regulations and raising penalties (see Box 6.2). Road user involvement can thus play an important part in improving road management.

Box 6.1 Collecting International Transit Fees Under Contract

A recent report on harmonizing international transit fees, prepared by the PTA Secretariat and the SATCC Technical Unit, has recommended that these fees should, in the future, be paid by coupon. At present, they are paid in cash and many staff manning the border posts refuse to accept anything other than hard currency (i.e., travelers checks and PTA units of account are not accepted). Not only is this a security risk for drivers who must carry large sums of hard currency, there is ample evidence of widespread evasion and leakage. International vehicles stopped at weigh-bridges in Zambia are frequently found without receipts showing payment of transit fees (the driver uses part of the funds to pay off staff at the border post and then pockets the rest), and the actual collections remitted to the Ministry of Finance are well below their potential. In Zambia, collections fell sharply when responsibility for collecting international transit fees was transferred from British Petroleum (who collected them under contract) to the Customs Department. In Tanzania, the treasury only receives about $150,000 of the estimated $3.0 million that should be collected annually in transit fees.

To deal with this problem, the Federation of Regional Road Freight Associations, which includes representatives of the transport industries in Lesotho, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe, has resolved that a coupon system should be implemented in the region. To this end, the Federation of Zambian Road Hauliers (Fedhaul), has prepared a scheme to be piloted in Zambia, and a similar scheme is being introduced in Mozambique. The basic elements of the scheme are as follows:

- In the future, all transit fees will be paid by coupon. Coupons are printed in bank note quality — with watermarks and other security devices — and collecting agencies are issued equipment to detect counterfeits.

- Coupons will be issued through regional transporters associations who have indicated willingness to purchase quantities in bulk and distribute them to their members.

- Coupons consist of three parts which are used as follows: (i) stub retained by issuing authority (Fedhaul), (ii) part II retained by collecting agency at the border (border collection in Zambia will be carried out by one of the commercial banks which has branches at all border posts), and (iii) part III will be retained by the transporter as proof of payment and will be canceled on exit by the collecting agency as proof of payment (to ensure that vehicles which do not pay on entry do so on exit).

- The payment cycle involves four main steps: (i) transporter purchases the coupons for cash, (ii) driver hands the coupons to the collecting agency at the border post, (iii) collection agency returns the coupons to Fedhaul, and (iv) Fedhaul transfers the funds used to purchase the coupons into the road fund account.

- Fedhaul charges a 5 percent commission for its services, and it is expected that the commercial bank collecting coupons at the border will do the same. The costs of printing coupons is estimated at $200,000, and this will be financed through a commercial bank loan to be repaid from revenues over 3 years.

Annual revenues for Zambia alone are expected to exceed $1.8 million gross, or $1.6 million net of coupon printing and administration costs.

Box 6.2 Private Sector in Zambia Enforces Vehicle Weights and Dimensions Regulations

A recent 24 hour vehicle survey carried out in July 1993 by the Federation of Zambian Road Hauliers (Fedhaul) showed that there was widespread overloading (some vehicles carrying excess loads of 40 to 50 tons), minimal enforcement and that many of the overloaded vehicles passed the weigh bridges when they were closed. The current fine of 500 kwacha ($1.00 equivalent) was too low to act as a deterrent and the road traffic regulations were ambiguous and difficult to enforce. Following the survey, Fedhaul recommended that the legislation be amended to clarify the regulations and that a new penalty system be introduced.

The penalty system should cover incorrectly distributed loads and overloads. Their suggestion was that, when a vehicle exceeded the Gross Vehicle Mass, or axle weight, punitive fines should be imposed, starting at $60 for the first 1,000 kg overload and rising to a maximum fine of $10,000.

All Public Service Vehicles should carry written instructions from the operator detailing the amount of cargo to be loaded. If details on this document exceed legislated weight limits, the operator should be liable for the fine. If the shipper or forwarding agent has loaded cargo in excess of what is shown on the shipping document, the shipper or forwarding agent should be liable for the fine. If the vehicle is found to be carrying goods in excess of the manifested cargo and the operator's instructions, the driver of the vehicle should be liable for the fine.

Following the survey, the Ministry of Communications and Transport agreed to appoint *voluntary* road traffic commissioners, nominated by the organizations representing the road transport industry, to help enforce road transport regulations and, in particular, to supervise operation of weighbridges. The voluntary commissioners have powers to stop traffic, impound vehicles, and make arrests.

These arrangements are now in place, and over 400 trucks were impounded during the first month of operation in early 1994. However, since the new penalty structure is not yet in place, the Road Traffic Commissioners can only make vehicles off-load the excess, which must then be collected by another vehicle. This procedure has virtually eliminated the fourty to fifty tons of overload, but is not a sufficient deterrent. Fedhaul is therefore continuing to press for punitive fines.

The road transport organizations have willingly taken on the task of voluntary traffic commissioners because it protects the road pavement and reduces unfair competition, particularly from foreign vehicles operating on international transit routes.

6.2 GRASS ROOTS ORGANIZATIONS

Involving road users in management of roads cannot be done by simply involving them as individuals. Effective involvement requires individuals with a constituency, so that their participation creates a link between the road agency and a wider group of individuals with a vested interest in well managed roads. The individuals involved in management must act as spokespersons for larger grassroots organizations. Most countries posses a number of such organizations which operate at different levels as follows:

- *National, economy-wide organizations*: chambers of commerce, farmer organizations, consultant organizations, engineering societies, consumer groups, and women's organizations.

- *Local organizations:* village associations, parent-teachers associations, and other community groups.

- *Transport sector organizations:* transport institutions, transport training institutes, and transport consultative councils.

- *Road sector organizations:* roads associations (or federations), motoring organizations, trucking associations, taxi associations, and organizations representing bus owners and operators.

Those most relevant for establishing ownership in the road sector are chambers of commerce, farmer organizations, engineering institutions, roads associations (or federations), trucking associations, organizations representing bus owners, and other motoring organizations. Local community organizations and taxi associations are also relevant at the local level. All countries have chambers of commerce, most of which are usually well organized, take a keen interest in the state of the road network, and have a great deal of influence. Their involvement is essential. The roads boards in Tanzania and Zambia, the Board of Sierra Leone Roads Authority, and the Benin Road Fund Board all include representatives from their chambers of commerce. The South African Road Board also includes a representative of industry and commerce. Most countries also have farmer organizations. They tend to be well organized and influential, particularly when they represent large commercial farmers. The National Roads Board in Zambia includes a representative of farming interests.

Most countries have reasonably well organized engineering institutions (see Table 6.1). They usually act as leaders of opinion and are influential. Representatives from the engineering profession are members of road sector boards in Sierra Leone, South Africa, Tanzania, and Zambia. Africa also has a number of roads associations or federations. Since their members include consultants, contractors, and material suppliers, their numbers are likely to grow in line with increases in contract maintenance. They also tend to be well organized and effective. A representative from the roads association is a member of the Central Roads Board in Tanzania.

Coverage is more erratic when it comes to organizations representing vehicle owners and operators. There are a large number of general motoring organizations in Africa and representatives from these organizations are members of the roads boards in South Africa, Tanzania, and Zambia, and the president of the Driver's Association is a member of the Sierra Leone Roads Board. There are fewer organizations representing the road transport industry, although there is a representative of the road transport industry on the Roads Board in Zambia and on the Road Fund Board in Rwanda. Many countries either have no formal organization representing the road transport industry or have organizations which are moribund or ineffective. This is a serious weakness. It means that many countries have no formal mechanism for carrying on a dialogue with the most important road users, cannot effectively involve them in management of roads, and cannot work with them to strengthen axleweight enforcement or deal with other road sector issues. Establishing such organizations should be an important part of any agenda for strengthening the management and financing of roads.

Table 6.1 Organizations representing road users in selected SSA countries

Country	*Roads associations*[a]	*Trucking organizations*	*Bus owners and operators*	*Motoring associations*	*Engineering professions*
Benin	Yes	Yes	No	No	Yes
Cameroon	No	Yes	No	Yes	No
CAR	No	Yes	No	No	No
Kenya	No	Yes	Yes	Yes	Yes
Nigeria	Yes	Yes	Yes	Yes	Yes
Madagascar	Yes	Yes	n.a.	n.a.	n.a.
Rwanda	No	Yes	Yes	Yes	Yes
Sierra Leone	No	No	No	No	Yes
South Africa	Yes	Yes	Yes	Yes	Yes
Tanzania	Yes	No	No	Yes	Yes
Uganda	No	Yes	Yes	No	Yes
Zimbabwe	Yes	Yes	Yes	Yes	Yes
Zambia	No	Yes	Yes	Yes	Yes

n.a.: Not Applicable

a. Roads associations, or road federations mainly represent plant and materials suppliers and consultants.

6.3 WAYS OF INVOLVING ROAD USERS

There are several ways of involving road users in the management of roads. They can either be involved in overall management, management of parts of the road network (particularly at the local government level), or in specific aspects of management. Most countries invite outsiders to join steering committees, which guide consultants working on the road sector, or to sit on advisory boards, which review departmental research, training programs, design standards, and other technical matters. The outsiders often come from a university, although the steering committees, for important consultant studies, may include representatives from the road transport industry and other concerned organizations.

Another mechanism for involving road users, is the standard inter-ministerial steering committee (IMSC) which exists in many countries and is sometimes expanded to include road user representatives. A number of IMSCs were established under the RMI program and, although most simply coordinated preparations for a national road maintenance symposium, those in Tanzania, Uganda, and Zimbabwe evolved into something more substantive. The IMSC in Tanzania has evolved into an important policy review body serviced by a full-time RMI secretariat. At one stage there were plans to widen membership to include representatives of road users (and change the name to the National Steering Committee), but this was dropped after it had been decided to establish a Central Roads Board with road user representatives. In Uganda, the IMSC is chaired by the deputy prime minister and not only meets to review matters, but also makes decisions. The IMSC in Zimbabwe, which includes a representative from the Zimbabwe Roads Federation, has evolved into a steering committee overseeing an institutional study of the road sector. The IMSC in Zambia was also meant to evolve into a general policy review committee. It has fifteen members, just over half representing the private sector (including the University of Zambia and the Chartered Institute of Transport), but unfortunately never meets.

Several countries in Africa have national road safety councils (or the equivalent) which include representatives from the private sector (see Table 6.2). The councils attempt to coordinate the activities of different organizations in the road safety field and may also advise the Transport Ministry on a wide range of matters related to road safety. Although most councils lack statutory powers, are underfunded, and do not have an effective secretariat — and hence are ineffective — others function quite well and serve as a useful body for involving the private sector in discussions on road safety. The National Road Safety Councils in Tanzania and Zambia are currently being restructured to improve their effectiveness.

Table 6.2 Institutions Involving Road Users in Management of Rroads in Selected SSA Countries

Country	*Central roads board*	*Regional roads boards*	*National road safety council*	*Inter-ministerial steering committee*[d]
Benin	Yes[a]	No	No	No
Cameroon	No	No	No	Yes
CAR	Yes[a]	No	Yes	Yes
Kenya	No	No	Yes	Yes
Madagascar	No	No	No	Yes
Mozambique	Yes[a]	No	No	No
Rwanda	Yes[a]	No	No	Yes
Sierra Leone	Yes	No	No	No
South Africa	Yes	No	Yes	No
Tanzania	Yes	Yes	Yes	Yes
Uganda	No	No	Yes	Yes
Ghana[b]	No	No	Yes	No
Nigeria	No	No	Yes	No
Zambia[c]	Yes	No	Yes	Yes
Zimbabwe[c]	No	No	Yes	Yes

a. Oversees management of the road fund.
b. The Board was suspended by the military government and is expected to be reinstated shortly.
c. These inter-ministerial steering committees include private sector members.
d. Only those in Tanzania, Uganda, and Zimbabwe meet regularly.

At the local level (i.e., in urban and rural district councils), governments are not very good at involving road users in the management of roads. The usual mechanism for doing so is through working committees which operate at the local government level. All urban and rural district councils have committees which deal with finance, planning and development, housing, and the other functions delegated to their level of government. Some also have roads and road transport committees which deal with roads, street cleaning, street lights, drainage, public transport, and traffic management. These committees often include nonelected members (e.g., the police) but rarely include representatives of road users or of the local community, other than those who happen to be elected members. However, representatives of such organizations are sometimes invited to attend and participate in the business of the committee. It is clearly desirable to encourage the establishment of roads and road transport committees and the participation of road users in such committees, whether on a formal or informal basis.

At the national and regional level, road users are generally involved in the management of roads through road management boards. These are fairly common in Africa and there are at least eight functioning boards in Benin, CAR, Mozambique, Rwanda, Sierra Leone, South Africa, Tanzania, and Zambia. The Board of the Ghana Highway Authority, originally established in 1974 but suspended by the military government in 1981, is also about to be reinstated.[22] Tanzania also has Regional Roads Boards which operate at the regional level. The Boards in Benin, Rwanda, Sierra Leone, South Africa, Tanzania, and Zambia include private sector representatives (two, one, three, three, four, and seven respectively), while that in Mozambique is currently exploring ways of including private sector representatives. Ghana intends to have three private sector representatives when the Board is reinstated.

The South African Road Board is the oldest. It was originally established in 1935 and has had its membership (and functions) changed twice since then. It started off with six members, four representing the provinces and two appointed by the Minister of Interior. Although the Board was meant to function autonomously in the national interest, it quickly lapsed into gridlock because the provinces expected their representatives to promote provincial interests. In 1948 the Board was therefore replaced by one composed exclusively of civil servants. This worked better, although it led to a large freeway program (which critics claimed was excessive) and to the accumulation of a large surplus in the Road Fund (which contributed to its eventual closure). Finally, the present Board was established in 1988 with a much broader membership, which includes representatives of local government, the engineering profession, road users, and industry and commerce.

6.4 SETTING UP A ROADS BOARD

Several issues arise once it has been decided to establish a roads board. They concern the board's legal basis, its composition (including the choice of chairman), procedures for appointing board members, the role of the board, and board procedures. Each issue is examined below.

There are two ways of establishing a roads board. It can either be established under existing legislation (provided the legislation provides for appointment of a board) or under new legislation. The Central and Regional Roads Boards in Tanzania and the National Roads Board in Zambia were set up under existing legislation. The basic road legislation in most former British colonies permits establishment of roads boards to be established by notice from the minister. The basic legislation differs in each country and permits establishment of executive boards in Zambia, but only advisory boards in Tanzania.[23] Both Ghana and Sierra Leone could probably have established their boards under existing legislation, but wished to make a number of changes to the basic road act at the same time and chose to pass new legislation. The other boards listed to in Table 6.2 were set up under new legislation. New legislation offers the best long-term solution, but does have disadvantages in the short-term. First, it requires parliamentary approval, and ministers are often reluctant to spend parliamentary time getting new legislation approved. Second, it involves formalizing a number of operating procedures without the benefit

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22 They are not all called boards. Some are referred to as administrative councils or supervisory committees.

23 With appropriate membership, an advisory board can be influential and highly effective.

of hindsight. This has created major problems in Mozambique where the original wording of the decree makes it difficult to add private sector representatives, except as unpaid advisors. It is often better to get the board established under existing legislation, develop a set of operating procedures, and then formalize the procedures through legislation.

Box 6.3 summarizes the membership and characteristics of the boards in South Africa, Sierra Leone, Tanzania, and Zambia.[24] The composition of the board has a major impact on its effectiveness. There are three important elements: (i) choice of chairperson; (ii) membership of the board; and (iii) degree of flexibility in membership. It is not a good idea to have a chairman who is also head of the road agency (as in South Africa and Mozambique). When the director of roads is chairman, the board tends to be viewed as a lobby group arguing on behalf of the road agency, rather than as an impartial body acting on behalf of road users and the public as a whole. The chairman should ideally be a person of standing who can be expected to deal impartially with the business of the board. The boards in Sierra Leone, Tanzania, and Zambia all have strong, independent chairpersons and the Ghana Highway Authority intends to have a chairperson from the private sector when it reinstates its Board.

Membership is also important. A board composed wholly of civil servants tends to avoid difficult issues, concentrates on day-to-day administration of a given set of rules, and spends too little time on important policy matters. It is better to have a board representing a wide range of interests. The board generally needs to have a core of public sector representatives (from the ministries of finance, works or transport, and local government), but they should be complemented by other members representing road users, farming interests, industry and commerce, and the engineering profession. Sierra Leone probably has the neatest board structure. One-third of the board represents government, one-third road users (chamber of commerce, road transport industry, and the engineering profession), and the remainder are nominated by the minister (hence providing flexibility). The current chairperson is the retired headmistress of a major secondary school. Zambia has the most unusual arrangement. Seven of the eleven board members represent road users and other private sector interests, and the board chooses its own chairperson. It is worth noting that all boards have attempted to avoid having consultants and contractors as members, fearing that they might seek to use the board to pursue their own professional interests. This is an important point, since boards can easily become a lobby for their own special interests, rather than for those of road users.

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[24] The boards in Finland and New Zealand have a similar membership. In Finland, the director general of roads is chairman of the board, and members include representatives from the Ministry of Transport, the Ministry of Environment, municipalities, industry and commerce, road users (especially heavy vehicles) and two persons representing the road agency staff. The Transit New Zealand Authority has an independant chairman (a former local authority engineer), a deputy chairman (past president of the Institution of Professional Engineers), and six other members with experience in town planning, industry, local government, road transport (past president of the Automobile Association), farming, and accounting.

Box 6.3 Membership and Characteristics of Some Road Management Boards

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. The other, the Toll Road Committee, advises the Board on all matters pertaining to toll roads.

Board of Sierra Leone Roads Authority (SLRA):

- The Board consists of a chairperson, the director general and nine other members. The Board, together with the director general and deputy director general, are appointed by the president.
- Board members include the head of the Ministry of Works, the financial secretary, representatives of the Chamber of Commerce, local government, and road users, a professional engineer of standing; and three other persons appointed by the president on the advice of the minister.
- The drector general and his deputy are assisted by five directors who are appointed by the Board.
- The director of administration acts as secretary to the Board.

Tanzania Central Roads Board (CRB):

- 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 organizations 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.

Zambia National Roads Board (NRB):

- 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 organizations they represent
- The Board elects its own chairperson and vice chairperson,.
- The Board may have a core staff of up to five persons to deal with finance, planning, and inspection or auditing.

Finally, it is wise to allow for some flexibility in membership. This will enable the composition to evolve in line with changing road needs and, more importantly, provides a useful vehicle for resolving conflicts over membership. The inaugural meeting of the National Roads Board in Zambia was delayed for several months due to a disagreement over the organization

nominated to represent road users. This could have been avoided had it been possible to appoint one or more members "on the advice of the minister."

The way board members are appointed also influences their effectiveness. It is not simply a question of having someone on the Board who claims to speak on behalf of road users, like having a representative from the ministry of industry, or an acquaintance of the minister, who happens to run a trucking company. Such persons cannot, and do not, speak on behalf of the road transport industry. They have no constituency, no way of communicating with road users and cannot easily mobilize their support. The same applies to people representing concerned ministries. Unless they are senior persons with regular access to the permanent secretary, they will not really *represent* their ministry. Genuine ownership only occurs when the people selected to represent each constituency genuinely represent their members and have formal ways of communicating with them. Tanzania has attempted to address this concern by specifying that no ministry may be represented on the Central Roads Board by anyone below the level of director and requires the private sector agencies represented on the Board to nominate their own members. Zambia also invites the organizations represented on the Board to nominate their own members, while South Africa consults these organizations before appointing board members.

There is an important caveat to the above arrangements. Board members will only be effective if they spend sufficient time studying the business of the board and regularly consulting their constituents for guidance. In Zimbabwe, private sector members on several public boards have been ineffective because they did not spend enough time studying board matters. Board members should thus be paid an adequate allowance (to ensure they spend enough time preparing for board meetings) and should be required, as part of board membership, to consult their constituents before important board meetings. In Tanzania, board representatives from the Chamber of Commerce, Roads Association, Automobile Association, and Institution of Engineers, have been openly told that, as part of their function on the Board, they are expected to inform their members of the reasons for important Board decisions and of the Board's support for them.

The board also needs a clear role. This is usually spelled out in the legislation, or other parliamentary instrument establishing the board. The legal documents are usually supported by other instructions elaborating the general provisions of the legislation. These instructions need to cover the relationship between the board and the parent ministry, whether the board has executive powers or is merely advisory, its sources of finance (in the case of an executive Board), and its day-to-day responsibilities. Box 6.4 summarizes the duties laid down for the Board of the Sierra Leone Roads Authority and the Tanzania Central Roads Board. Box 6.5 summarizes the duties laid down for the roads boards in South Africa and Zambia. These legislated duties are normally supplemented through annual reporting arrangements that provide a formal vehicle through which the minister can amend or extend these duties.

Finally, there is the question of procedures. These are fairly standard but still need to be spelled out. They usually include the tenure of board members, payment of fees and expenses, secretarial arrangements, frequency of meetings, keeping of minutes (the board needs to meet at least once every three months; in Sierra Leone it meets more than once a month), accounting arrangements (where relevant), submission of reports and their content, and auditing arrangements (where relevant). Reporting arrangements are particularly important since they act

as a vehicle for keeping the parent ministry informed, enabling board members to report back to their constituents, and also help keep the public informed. The Sierra Leone Roads Board is required to submit an annual budget, annual statement of accounts (audited by independent auditors), and an annual report which includes information on Board policies and activities during the year. The Zambia National Roads Board has to prepare and publish the audited annual accounts of the Road Fund and also prepares quarterly and annual reports on the activities of the individual road agencies.

The key factors to be borne in mind when establishing a roads board are thus as follows:

- Decide whether the board is to have executive powers or act in an advisory capacity.
- If it is an executive board, it will usually require new legislation. Otherwise, it can often be established under existing legislation using simpler parliamentary procedures.
- Ensure that the board has an independent chairman of standing and has an adequate number of members representing road users and other persons with a vested interest in sound road management.
- Allow the organizations represented on the board to nominate their own members, pay adequate allowances, and require them to consult their constituents before important board meetings.
- Provide the board with clear terms of reference supported by a regular way of supplementing them through annual reporting procedures. Among other things, the terms of reference should spell out the relationship between the board and the parent ministry.
- Ensure that the board's rules and procedures are clearly spelled out, including the frequency of meetings and the content and timing of regular reports.

Box 6.4 Duties Laid Down for Road Boards in Sierra Leone and Tanzania

Board of Sierra Leone Roads Authority (SLRA)

The Authority was established on 19 March 1992 as a body corporate having perpetual succession and a common seal which may sue and be sued in its corporate name and hold and dispose of real or other property in any manner whatsoever for the purpose of carrying out the duties laid down in the act. The Board of the Authority has general control of the management, property, business, funds and of all other matters relating to the Authority. For the purposes of discharging its functions, the Board delegates to the Director General the following powers:

(i) To sign any contract for or on behalf of the Authority;
(ii) To collect any monies due to the Authority such as the monies from the Road Fund and Budgetary allocations and to discharge debts owed to the Authority;
(iii) To sign, accept, negotiate, endorse, and receive any negotiable instrument on behalf of the Authority;
(iv) To acquire or authorize the acquisition of any movable or immovable property and to transfer and or allocate any funds of the Authority for that purpose;
(v) To authorize the disposal of securities of any kind belonging to the Authority;
(vi) To open and operate current deposit or credit accounts on behalf of the Authority at any bank or financial institution; and
(vii) To negotiate and obtain loans on behalf of the Authority and to determine the nature and conditions of such loans.

Tanzania Central Roads Board (CRB)

The Board was established on 7 January 1994 as a body corporate which`: (a) has perpetual succession and a common seal; (b) in its corporate name, is capable for suing and being sued; (c) is capable of purchasing and otherwise acquiring or alienating any movable or immovable property; (d) has power from time to time to exercise and perform such other powers and functions as are conferred by the minister. 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:

(i) Advise the ministry on suitable management systems for roads;
(ii) Advise the ministry on issues of staff motivations;
(iii) Examine the operation of the Road Fund and advise the ministry on suitable arrangements for disbursement of adequate funds to end users;
(iv) 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:

(i) Any general policies of the government notified to it by the minister; or
(ii) 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 coordination, cooperation and consultation with other bodies, within or outside Tanzania, which have similar or related functions.

Box 6.5 Duties Laid Down for Roads Boards in South Africa and Zambia

South African Roads Board (SARB)

The original National Road Board was 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. 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 coordinate 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:

(i) To design, build, and maintain a national network of freeways and other roads, including toll roads;
(ii) To compile a priority list of roads to be built or improved;
(iii) To design and build various special roads that are in the national interest;
(iv) To set geometric standards for the construction of national and special roads;
(v) To preserve the environment;
(vi) To expend available funds in the most cost effective manner in the provision of a primary road network;
(vii) To do or initiate research, whether in South Africa or elsewhere, in connection with the design, planning, or construction of roads;
(viii) To grant bursaries or subsidies to enable persons to study or do research on any subject in connection with roads;
(ix) 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;
(x) 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.

Zambia National Roads Board (NRB)

The NRB was established through Statutory Instrument on 24 February 1994 under the Roads and Road Traffic Act. The order defines the functions of the Board as follows:

(i) To administer and manage the Road Fund;
(ii) To prepare and publish audited annual accounts of the Road Fund;
(iii) 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;
(iv) To recommend projects for donor funding to the minister;
(v) To allocate resources for road maintenance and rehabilitation for various classes of roads as may be determined by the ministers;
(vi) To recommend funding for the development of new roads;
(vii) To provide guidance and technical assistance to various road agencies;
(viii) To receive and consider reports from road agencies on their activities and prepare quarterly and consolidated annual reports;
(ix) To prepare and award contracts, certification of payments, and advise the ministers accordingly;
(x) To review design standards and classification of roads and traffic sign for approval by the ministers;
(xi) To prepare and review terms of reference and guidelines for the various road authorities and budget guidelines;
(xii) To recommend to the ministers the granting of highway authorityship to any person or institution;
(xiii) To plan, manage, and coordinate the road network in the country;
(xiv) 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.

7 AN ADEQUATE AND STABLE FLOW OF FUNDS

This chapter deals with pricing and cost recovery policies for roads. It develops a model which attempts to promote economic efficiency and also to generate sufficient revenues to operate and maintain the road network on a sustainable long-term basis.[25] To do that, the model needs to influence the *demand* for travel — whether and how to make the journey — as well as the *supply* of road services. The impact on supply is particularly important.[26] The road agency should be discouraged from simply passing on to road users the costs of its own inefficiencies in the form of higher user charges. Instead, the financing mechanisms should: (i) encourage the road agency to use resources efficiently, (ii) limit the scope of the road network to what is affordable, and (iii) only construct new roads when resources are available for maintenance. In other words, the pricing and cost recovery policies should bring roads into the marketplace by defining a clear *price* for roads and, by linking revenues and expenditures, subjecting the road agency to a hard budget constraint to promote some form of *market discipline*.

This chapter addresses three key questions: (i) which instruments are available for charging road users? (ii) which principles should guide pricing and cost recovery policies? and (iii) how should the resulting revenues be managed?

7.1 CHOOSING A CLEAR MARKET SIGNAL

To influence demand and provide a basis for linking revenues and expenditures to create a hard budget constraint, charging instruments should be:

- Related to road use;
- Easily recognizable;
- Easy to separate from indirect taxes and other service charges or fees;
- Simple to administer (i.e., not subject to widespread evasion, avoidance, and leakage).

In addition, the instruments should be able to distinguish among paying for: (i) the right to use the road network, (ii) traveling over the roads, (iii) occupying road space (either by parking or causing congestion), and (iv) the benefits of road access.

7.1.1 Selecting Appropriate Charging Instruments

The main instruments used to charge road users include vehicle license fees, heavy vehicle license fees, levies on transport fuels and tolls and parking charges. Most of the other taxes and charges paid by road users are either general revenue taxes (see Box 3.1 for an explanation of how to separate road user charges from general tax revenues), or service fees levied in connection with the provision of specific services (e.g., registration fees, driving license

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25 In Africa, where virtually all governments are critically short of fiscal revenues, improved cost recovery is more important than improved demand management.

26 This emphasis is to counteract the standard presumption made by economic theory that public sector production is efficient and that costs, including marginal costs, are minimized (see Kranton 1990).

fees, etc.).[27] The characteristics of the available charging instruments are compared in Table 7.1. The table suggests that the instruments best suited to Africa are vehicle license fees, heavy vehicle license fees, fuel levies, and international transit fees. Parking charges are less suitable as presently collected, because they are generally treated as yet another tax and this makes them difficult to administer (i.e., they suffer from high levels of avoidance and leakage).[28] However, if collected under contract, they could play an important role in helping to generate revenues and manage urban traffic. The other technically sound charging instruments, tolls, and weight-distance fees, are less suitable. Few roads in Africa carry sufficient traffic to make tolling economic, and weight-distance fees are difficult to administer (see Box 7.1 for a description of weight-distance fees). The advantage of weight-distance fees is that they encourage the use of vehicles with axle configurations which do less damage to the road pavement. They also make it easier to charge for roads when there is rampant fuel smuggling and, particularly if introduced on a regional basis, make it easier to charge international truck traffic. Weight-distance fees should therefore be considered as soon as a country has developed the capacity to administer them.

The actual charging instruments used in Africa are listed in Table 7.2. The table shows that most countries use vehicle license fees (usually based on gross vehicle weights or engine capacity), a few use license fees based on axle weights (Chad) or have a heavy vehicle license fee (CAR and Zimbabwe), a surprising number use fuel levies, and a number also use international transit fees. Several countries also charge ferry and bridge tolls. These charges offer the potential for being used as a two-part *road tariff*. The license fees can be used to charge for *access* to the road network, while the fuel levies can be used to charge for *use* of the road network. Fuel consumption is not exactly related to variable road maintenance costs, but is closely enough related for practical charging purposes (see Figure 7.1). In terms of revenues raised, fuel levies are by far the most important user charges currently used (see Figure 7.2).

7.1.2 Administrative Considerations

It is important to ensure that the above fees, fuel levies and, where applicable, bridge and road tolls are administered efficiently. This means minimizing evasion, avoidance, and leakage; avoiding inadvertent subsidies; ensuring that the fuel levy does not inadvertently tax non transport users of diesel; and minimizing fuel price distortions.

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[27] Service fees cover the costs of establishing title to property (to facilitate law enforecement), checking vehicles for mechanical soundness and monitoring payment of license fees. As such, they are not user charges and should be set to only cover servicing costs.

[28] Experience with parking charges is not encouraging. During 1991 Nairobi earned $17,500 from car parks and parking meters, but it cost $82,000 to operate and maintain these facilities.

Table 7.1 Administrative Characteristics of Different Road User Charging Instruments

					Administrative characteristics			
Charging instrument	*Potential role*	*Related to road use*	*Separable from general taxes*	*Easily recognizable*	*Collection cost (percent)*	*Avoidance or evasion*	*Ease of collecting by contract*	*Suitability for Africa* [d]
Tolls	user fee	yes	yes	excellent	10-20	moderate	simple	low
Vehicle license fee	vehicle access fee	no	yes	good	10-12	high	moderate	high
Heavy vehicle license fee	vehicle access fee	not directly	yes	good	unknown	unknown	simple	high
Fuel levy	user fee	partly	can be	good	negligible	low	simple	high
Weight-distance fee [a]	user fee	yes	yes	excellent	5	moderate	moderate	low
International transit fee	foreign user fee	should be	yes	good	10	high	simple	high
Parking charges [b]	control access	partly	yes	good	over 50	high	simple	low
Cordon charge [c]	congestion charge	partly	yes	moderate	10-15	unknown	simple	moderate
Area license	congestion charge	partly	yes	moderate	10-15	unknown	simple	moderate
Electronic road pricing	user or congestion charge	can be	yes	good	less than 10	unknown	simple	low

a. A simpler form of weight-distance fee is the vehicle-km fee. It employs the same basic principles, but relates fees more simply to vehicle type and distance.
b. These are difficult to administer in Africa and currently generate little revenue.
c. These are only suitable when the road network lends itself to cordon pricing.
d. This defines their suitability as *general* charging instruments.

Source: Heggie, 1992

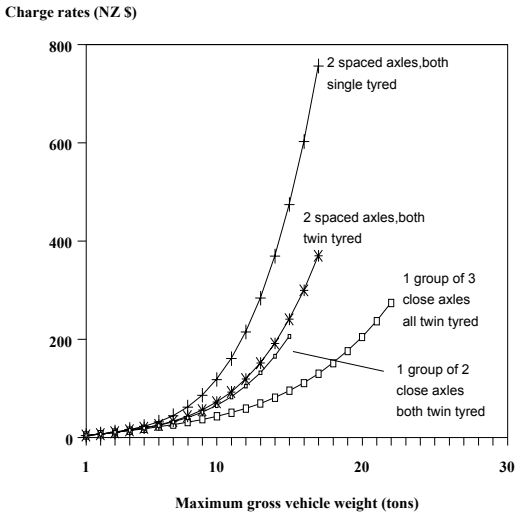
Box 7.1 Weight-Distance Fees for Diesel Vehicles

New Zealand, Iceland, Norway, and Sweden all use weight-distance fees to charge diesel vehicles for usage of roads, and Canada is planning to introduce them in the near future. The basic principle is that all diesel vehicles must buy a license (in New Zealand they are issued in multiples of 1,000 km) graduated according to axle configuration and gross vehicle weight. The charges are administered through sealed hub odometers or other certified distance meters. The charge is lower for vehicles with multiple axles and increases with gross vehicle weight (see figures below).

The charging system is best developed in Iceland and New Zealand. The weight-distance fee is administered separately from the general tax system and all revenues collected from the sale of weight-distance licenses are paid into a special account set aside to support spending on roads. The systems in Norway and Sweden are similar, except that revenues are not paid into a special account. In addition to the weight-distance fees, Iceland and New Zealand also levy a special fuel charge on gasoline to charge gasoline-powered vehicles. The revenues from this charge are also paid into the special account. Norway and Sweden do not levy specific charges for gasoline-powered vehicles and treat all revenues as general tax revenues.

Weight-distance fees can be difficult to administer. There is considerable scope for evasion — mainly by under-buying and avoiding detection — unless the sale of licenses can be checked for consistency and linked to an active enforcement program. In New Zealand it is estimated that collection and enforcement absorbs about 5 percent of gross revenues and that evasion varies from 10 to 20 percent. The system should work satisfactorily when it is effectively administered — with fees perhaps being collected under contract — and vigorously enforced. It should be possible to administer weight-distance fees in countries like Botswana, South Africa, and Zimbabwe.

Trailers



Rigid Vehicles

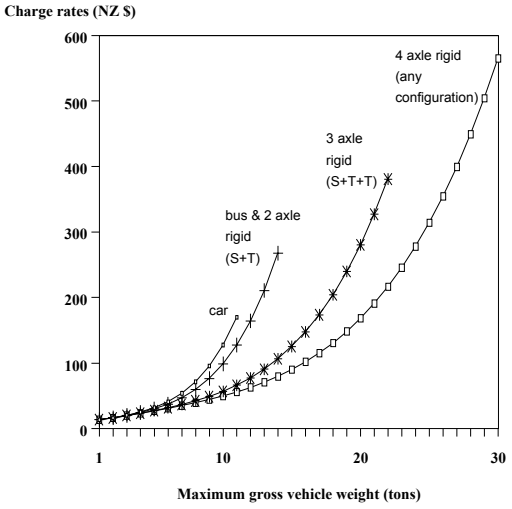


Table 7.1 shows that: (i) license fees suffer from wide-spread evasion, (ii) international transit fees suffer from serious leakage (this is aggravated by the fact that they are usually paid in foreign exchange), and (iii) road and bridge tolls suffer from high levels of evasion and leakage and are costly to administer. In some countries, half of the vehicles often go unlicensed and uninsured (e.g., Zambia), revenues from international transit fees are less than half their potential (e.g., Tanzania), and the costs of administering road and bridge tolls is higher than the revenues collected (e.g., Ghana). To minimize avoidance and evasion and improve the effectiveness of road user charging instruments, governments are attempting to improve revenue administration.

There are two main options. The first is to simplify the fee structure to reduce avoidance, and mobilize most license fee revenues through a heavy vehicle license fee. Since there are fewer heavy vehicles (perhaps 20 percent of the total), and they are mostly owned by registered businesses, a heavy vehicle license fee is easier to administer. Both Tanzania and Zambia are considering this option. The second is to collect more fees under contract with the private sector. Mozambique is in the proces of subcontracting the collection of international transit fees to a commercial bank and Zambia is proposing to use a similar contractual arrangement (see Chapter 6, Box 6.1).

Table 7.2 Charging Instruments Currently Used in Sub Saharan Africa

Country	*License fees*	*Heavy vehicle fee*	*Fuel levy*	*International transit fee*	*Other charges*
Tanzania	Yes	No [a]	Yes	Yes [b]	Various levies and duties from motor vehicles are supposed to be paid into the road fund
Benin	No	Yes [c]	Yes	Yes	Bridge tolls, import duties, value-added tax
Mozambique	Yes, at provincial levels	No	Yes	Yes [b]	Bridge tolls
Nigeria	Yes, at state levels	No	No	Yes	Bridge and road tolls
Sierra Leone	Yes [d]	No	Yes	No	-
Zambia	Yes	No [a]	Yes	Yes [b]	-
Ghana	No	No	Yes	No	Bridge and road tolls. The fuel levy applies to all fuels
CAR	No	Yes	Yes	No	Bridge and ferry tolls
Rwanda	No	No	Yes	No	Road tolls
Kenya	Yes	No	Yes [c]	Yes [b]	Road tolls
Uganda	Yes	No	Yes [c]	Yes [b]	Road tolls
Zimbabwe	Yes, by local authorities	Yes	No	Yes [b]	-
Chad	No	Axle-weight tax	Yes	Yes	Ferry and road tolls

Note: - Data were not available
a. Under consideration.
b. Fees are collected under the Preferential Trade Area (PTA) agreement.
c. Weigh-bridge fees.
d. Provisions exist for collecting license fees, but they are not allocated for spending on roads.

Source: World Bank project reports

Figure 7-1 Relationship between Variable Road Maintenance Costs and Costs of a Fuel Levy

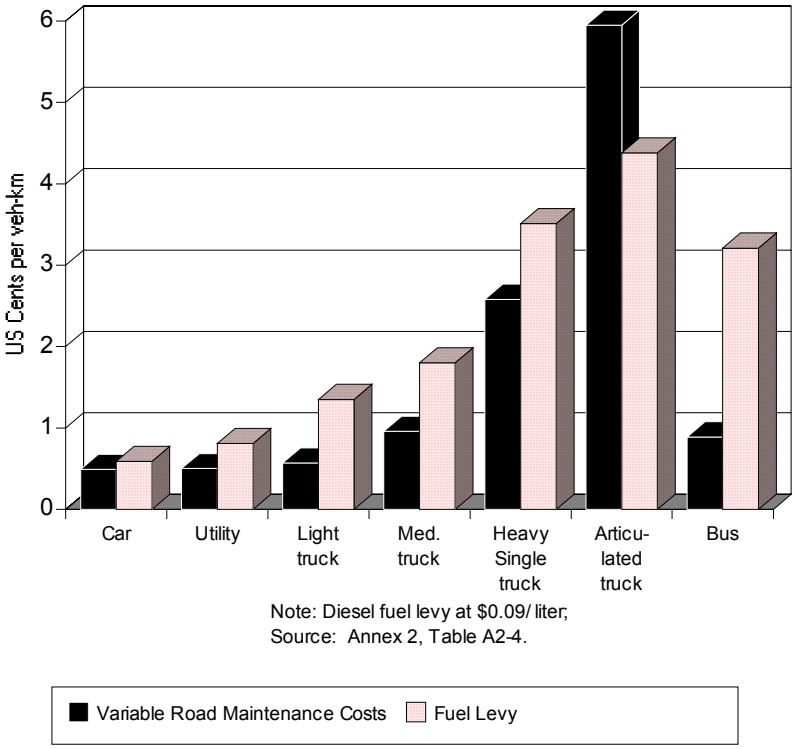
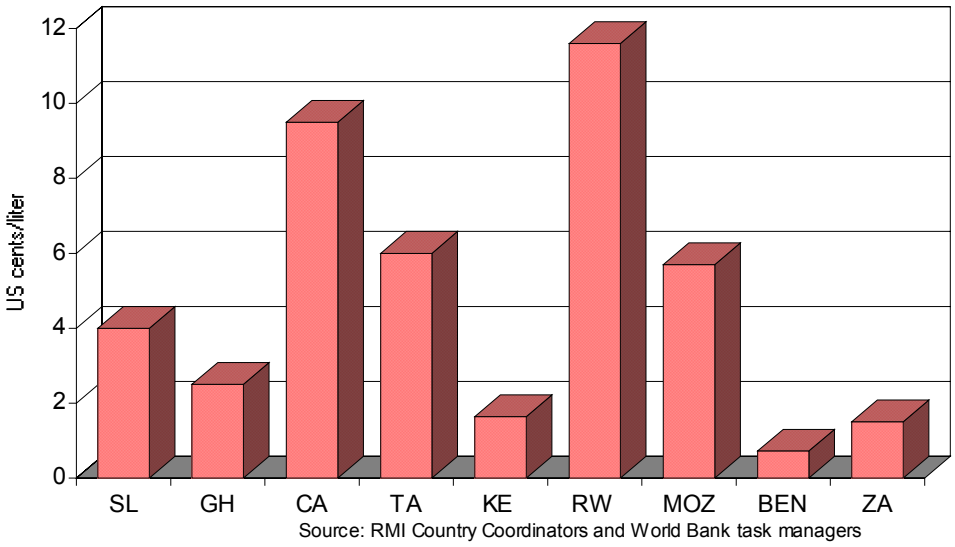


Figure 7-2 Fuel Levies Paid into Road Funds
(11 January, 1994 after the devaluation of the CFAF)



Administrative arrangements may also lead to inadvertent subsidies. Vehicles owned by the government rarely pay license fees and government and diplomatic vehicles often pay no fuel levies. These vehicles nevertheless impose measurable costs on the road network and someone, usually other road users, have to pay these costs. This creates distortions. To avoid this, all road

users should pay license fees and fuel levies, or the government should reimburse the road agency for loss of revenue caused by exemptions. A subsidy also occurs when the pump price of fuel (excluding the fuel levy) is lower than its *border price* (see Box 7.2 for a description of how to compute the relevant border price of fuel). When that occurs, the fuel levy does not generate additional net revenues. It simply reduces the implicit subsidy channeled to the road sector. To avoid this, the government should ensure that pump prices are higher than border prices and should ideally take full advantage of the low price elasticity of demand for fuel by imposing higher taxes on fuel than on general consumption goods (see Box 7.3). Of course the opposite can also happen. Pump prices may be too high because tax levels are higher than the optimum, as was thought to be the case in some West African countries before the CFAF devaluation, or because of inefficient petroleum procurement and distribution policies.[29]

One of the most difficult administrative issues is to ensure that non-transport users of diesel fuel do not pay the fuel levy. As much as a third of diesel fuel is used outside the transport sector for power generation and to operate heavy equipment in the construction, agriculture, and mining sectors. Few countries in Africa have managed to solve this problem. However, some countries (like Chad) already differentiate in their tax structures and apply different tax rates to automotive diesel, industrial diesel, and diesel for power generation (in Chad the rates are CFAF 127, 82, and 46 respectively). In principle, differentiation is therefore possible. Other countries operate rebate schemes or offer exemptions. CAR exempts river transport and power generation, Ghana exempts the fishing industry, and Mozambique has introduced an arrangement under which 20 percent of the diesel fuel levy is set aside to compensate agriculture for having to pay the fuel levy. There are therefore a number of ways to ensure that the diesel fuel levy is effectively only paid by road users. Most countries have nevertheless decided that the administrative complexities outweigh the advantage of these options.

The final administrative concern relates to relative fuel price distortions. Fuel levies raise fuel prices and this may encourage substitution between different transport fuels. The biggest problem arises with kerosene. Some governments keep kerosene prices low to minimize the impact on low-income households which use it for cooking and lighting. They also keep kerosene prices low to encourage substitution of kerosene for fuelwood to reduce deforestation. Kerosene can be mixed with either gasoline or diesel fuel and, when mixed with a little engine oil, can even be used as a complete substitute for diesel fuel. A high price differential between diesel and kerosene will thus encourage substitution, and the fuel levy will then not realize its full potential. The only ways to discourage substitution are by coloring kerosene and inspecting vehicles for mixing (as is done in Zambia) or by issuing coupons to poor households for the purchase of kerosene at concessionary rates. Neither solution is entirely satisfactory. The best option is to avoid wide price differentials between kerosene and diesel fuel.

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[29] A recent survey has estimated that Sub-Saharan Africa could save about $1.4 billion a year at 1989/90 prices by rationalizing the supply of petroleum products. About half the potential savings would come from improved procurement arrangements, which would cut costs and, more importantly, reduce gratification payments. Another 40 percent would come from improved refining practices, while the final 10 percent would come from improved distribution and storage arrangements. (See Schloss, 1993).

Box 7.2 The Border Price of Transport Fuels

Border prices measure the cheapest way to procure transport fuels. There are three main cases to be considered, countries which: (i) import refined fuel products, (ii) import crude petroleum and refine it in a domestic refinery (or pay a fee to have it refined in another country), or (iii) produce crude petroleum and refine it in a domestic refinery.

The method of calculating border prices is the same in all three cases. For case (i), the starting point is the f.o.b. price at the originating port, while for cases (ii) and (iii), it is the f.o.b. price at the most efficient, available, originating port (usually Bahrain, Curacao, Rotterdam, or Singapore). The reason for choosing the most efficient available originating port is to ensure that the costs of an inefficient local refinery, or inflated production costs, are not passed on to users as part of the border price, but are clearly recognized as an implicit subsidy to the refinery or local producer. Insurance and freight costs are then added to the f.o.b. price to produce the c.i.f. price. Alternatively the calculation can start directly with the c.i.f. price, which is readily available for most countries from the World Bank's quarterly report on Prices of Crude Petroleum and Petroleum Products. Finally, allowance is made for ocean losses, port charges, and transport costs (if any) from the port to the customs border. The sum of these costs represents the import parity, or border price of fuel.

The table shows how border prices were calculated for Botswana, a landlocked country, in January 1983. The final estimates for the border prices of premium gasoline, diesel fuel, and kerosene were $0.31, $0.29, and $0.34 per liter, respectively. Comparable figures for Nigeria, an oil producing country, were $0.32, $0.26, and $0.28 per liter in April 1983, excluding inland transport costs.

Border Prices of Transport Fuels: Botswana, January 1983
(US. cents per liter)

	Premium gasoline	*Diesel fuel*	*Kerosene*
f.o.b. Price	21.74	21.78	23.88
Freight Charges	1.60	1.81	1.70
Insurance Costs	0.02	0.02	0.03
c.i.f. Price	23.36	23.61	25.61
Ocean Losses	0.07	0.07	0.08
Landing and Wharfage	0.39	0.39	0.43
Coastal Storage	0.35	0.35	0.35
Rail to Gaberone	7.18	4.86	7.36
Import Parity Gaberone	31.36	29.28	33.82

Source: Botswana: Issues and options in the Energy Sector, Report No. 4998-BT, UNDP/World Bank Energy Assessment Program, World Bank, Washington, 1984.

7.1.3 Fuel Smuggling

Fuel levies break down when there is rampant fuel smuggling. This is a major problem in parts of East and West Africa where the low price of diesel in some countries has led to massive fuel smuggling. It is estimated that during 1992 one-quarter to one-half of the fuel consumed in Cameroon and Benin was smuggled from Nigeria. This makes it virtually impossible to finance roads through fuel levies. Indeed, it makes it virtually impossible for governments to mobilize any revenues by taxing imported fuels (in Africa, fuel taxes account for up to one-third of the government's total tax revenues).

Box 7.3 Strengthening Revenue Mobilization by Improving Taxation of Transport Fuels

Fuel prices in Sub-Saharan Africa are currently well below those in other parts of the world and are also lower than they were in francophone countries before the recent CFAF devaluation. Several countries have negligible tax rates (i.e., the pump price is at or close to the border price), while others simply apply standard consumption tax rates to fuel.

Little effort has been made, other than in francophone West Africa prior to the CFAF devaluation, to improve domestic revenue mobilization by having higher taxes on fuel than on other commodities. This contrasts starkly with practice in other parts of the world where fuel taxes are generally significantly higher than general consumption taxes. A recent survey of selected Organization for Economic Cooperation and Development (OECD) countries has shown that gross tax rates on leaded gasoline during 1990 and 1991 were between 60 and 70 percent (75 percent in France), leading to net tax rates of 150 to 230 percent (the gross tax rate = net tax rate/[1 + net tax rate], where tax rates are measured in percent). This was three to five times higher than the general consumption taxes in these countries. Furthermore, the available evidence on the price elasticity of demand for gasoline suggests that these differentials are justified from an economic efficiency point of view (i.e., the higher rates move the taxation system closer to the optimum).

Since gross consumption tax rates in Africa are about 15 percent, gross petroleum tax rates might be expected to be between 45 and 75 percent to be economically efficient. This would result in net tax rates of 120 to 300 percent. In other words, if the base price of gasoline was 25 cents per liter, the fuel tax would be between 30 and 75 cents per liter. This is far higher than existing gasoline taxes in most Sub-Saharan African countries. Most Sub-Saharan African countries could therefore *improve* domestic revenue mobilization *and* reduce the welfare costs of taxation by raising fuel taxes and lowering other general consumption taxes.

There is no easy way around this problem. Wide disparities in price lead to large potential profits and hence to widespread bribery and corruption. Attempts to prevent smuggling cannot therefore rely on enforcement alone. Three alternatives currently being tried include: (i) making the currency nonconvertible to make the sale of smuggled fuel more difficult, (ii) introducing network-wide road tolls in lieu of the fuel levy, and (iii) promoting harmonization of fuel prices under regional trading agreements. Convertibility has been suspended in Cameroon and Benin, and Cameroon has introduced road tolls over the entire main road network (the tolls were not primarily intended to discourage smuggling). However, introduction of network-wide road tolls is a strategy of despair. Unless the system is carefully designed and administered in collaboration with the road transport industry, it will not generate much revenue and will also face public hostility. It is estimated that Cameroon loses up to 75 percent of its potential toll revenue through evasion and leakage. However, with strong support from the road transport industry, which has a vested interest in generating funds for road maintenance, a road toll system might just work.

7.2 PRICING AND COST RECOVERY POLICIES

This section sets down the basic principles which guide pricing and cost recovery policies for roads. It focuses on ways of recovering the costs of maintaining, improving, and rehabilitating the road network and on ways of using congestion charges (where relevant) to ration scarce road space. It does not deal with the costs of other externalities, since the government should handle these directly through regulations and corrective taxes, which may take the form of an additional *environmental* levy added to the price of transport fuels. The pricing and cost-recovery policies discussed in this chapter have four objectives: (i) to provide the correct market signals to road users, (ii) to ensure road agencies use resources efficiently, (iii) to constrain the size and quality of the road network to what is affordable, and (iv) to generate sufficient revenues to operate and maintain the *core* road network on a sustainable long-term

basis. The policies must therefore balance several conflicting objectives. The following sections deal first with the basic principles and the practical problems encountered when trying to implement them, the way in which maintenance, new construction, and rehabilitation are financed, and how to use pricing policies to help manage urban road congestion.

7.2.1 Basic Principles

To maximize net economic benefits, road user charges should be set equal to the costs of the resources consumed when using the road network. These costs are generally referred to as short-run marginal costs (SRMCs). There are two costs to be considered: (i) the damage done to the road surface by the passage of vehicles (i.e., the variable costs of operating and maintaining the road network), and (ii) the additional costs which each road user imposes on other road users and on the rest of society (i.e., the costs of road congestion and other externalities). Congestion is the classic source of external disbenefit in the road sector and is the one normally taken into account when estimating the optimal user charge.[30] However, since less than half the costs of operating and maintaining the road network vary with traffic (see Table 7.3) — and roads in Africa do not experience widespread and persistent road congestion — prices set equal to SRMCs will result in large financial deficits. Furthermore, since most governments in Africa are acutely short of fiscal revenues, it is rarely possible for them to finance these deficits through general taxation. The funds are simply not available.

How should these deficits be financed? The obvious target are the road users themselves, and in the case of local access roads, also those who benefit from road access. They use the roads, or benefit from them, and might be expected to pay for them. Furthermore, there is a *prima facie* case for supposing that the welfare costs of raising most of the required revenues from road users are lower than the costs of mobilizing them through general tax revenues. There are also distributional arguments in favor of raising most of these revenues from road users. Road users are among the wealthiest members of society and, although the poor depend heavily on public transport for jobsearching and gaining access to public services, it is better to assist such persons by subsidizing selected transport *services* or by providing other forms of income support. Therefore, unless there are reasons to the contrary, there are strong arguments in favor of financing these deficits from road users and those who benefit from road access.

The idea of going for full cost recovery is also consistent with the desire to link revenues and expenditures to subject the road agency to a hard budget constraint. If some costs are financed by others, whether by way of subsidies or other transfer payments, it weakens market discipline. Pressure to keep costs under control — and only undertake expenditures for which users are willing to pay — requires a clear market signal which makes road users recognize the full costs of providing road services. The road tariff should therefore reflect the costs of operating and maintaining the road network and increased road spending should automatically raise the road tariff (although it will usually reduce VOCs). Imposition of a hard budget constraint thus requires full cost recovery from road users and, in the case of local access roads, both road users and the beneficiaries of road access.

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[30] External disbenefits also include the road damage externality. Each vehicle damages the road pavement and this increases the VOCs of all subsequent vehicles which use the road. However, if the road network has a fairly uniform age distribution, and if maintenance policies are condition-responsive, road damage externalities are zero when traffic growth is zero and all road damage is caused by vehicles, and is negligible in all other reasonable cases. (See Newbery, Hughes, Paterson, and Bennathan, 1988).

Table 7.3 Costs of Road Maintenance on Different Types of Road
(US cents per veh-km)

	Main roads		*Local access roads*		
			Paved roads	*Unpaved roads*	
	Minor arterial	*Collector or arterial*	*High volume*	*High volume*	*Low volume*
Traffic (AADT)	3,000	1,000	300	300	50
Pavement SNC[a]	5	3	2	2	-
Normal loading (8 ton limit), high motorization (20% trucks)					
Variable costs	0.28	0.53	0.65	-	-
Fixed costs	0.29	0.84	2.40	-	-
Total	0.57	1.37	3.05	-	-
Normal loading (8 ton limit), low motorization (70% trucks)					
Variable costs	0.50	1.01	1.92	1.92	3.01
Fixed costs	0.32	0.92	2.68	0.91	5.48
Total	0.82	1.93	4.60	2.83	8.49

Notes: - Not applicable
Based on data from a selection of developing countries that do not have any extremes of climate.
US cents per veh-km is the average cost for all vehicles.
a. Modified structural number of the road pavement.

Source: Paterson and Archando-Callao, 1991.

This leads to three basic pricing and cost recovery policies:

- Never set the road tariff lower than the variable costs of operating and maintaining the road network;
- Ensure that the road tariff and the taxes and charges used to support local access roads collectively cover all road costs;
- When there is significant road congestion, the road tariff should also include congestion costs, although this will only apply to a handful of seriously congested cities.

7.2.2 Practical Considerations

There are three main practical problems. First, the variable costs of maintaining different types of roads vary significantly. Table 7.3 shows that they vary from about 0.3 US cents to 0.7 cents per veh-km on the main network, to 0.5 cents to 0.7 cents per veh-km on the urban network and to 1.9 cents to 3.0 cents per veh-km on the rural road network. Total costs likewise vary from a low of 0.6 cents per veh-km on the main network to a high of 8.5 cents per veh-km on the rural road network. Charges based strictly on costs would thus involve wide differentials between different types of roads and different road agencies. This is simply not practicable, although it is possible to maintain some differential between urban and rural areas and among different regions. A practical set of user charges will thus involve a great deal of averaging.[31]

Second, the variable costs of maintaining the road network also vary significantly between different types of vehicle (see Figure 7.1). Cars impose relatively small costs on the road network, while articulated trucks impose costs twelve times larger. In principle, an articulated truck should therefore pay twelve times more than a car. However, if the main charging instrument is a fuel levy it will only pay six or seven times more (an articulated truck uses about seven times as much fuel as a diesel car). The available charging instruments therefore introduce further averaging that can only be avoided by switching to weight-distance fees, which can be accurately calibrated to reflect underlying road-use costs.

The final practical problem relates to the way license fees and the fuel levy are set to ensure that: (i) to the extent feasible, each class of vehicle covers the variable costs it imposes on the road network, and (ii) the road tariff and the taxes and charges used to support local access roads collectively cover all road costs. The fuel levy by itself would undercharge articulated trucks and overcharge other vehicles, particularly buses. The license fee must therefore be used to compensate for this. In other words, the license fee cannot be strictly used as an access fee set to cover fixed costs. The available pricing instruments are too blunt for that. Instead, the combined license fee and fuel levy have to be set to meet the above two objectives. This then results, not in a strict two-part tariff, but in a *quasi two part tariff*. Clearly, there is no scope with these charging instruments for using the inverse elasticity rule (i.e., Ramsey pricing), although it would be applicable when using weight-distance fees (see Annex 2 for a description of the inverse elasticity rule). Annexes 3 and 4 provide an example illustrating how to estimate the above two-part tariff.

7.2.3 Financing Maintenance

The above model suggests that: (i) the costs of operating and maintaining the interurban road network should be financed through the road tariff, (ii) in urban and rural areas, the *variable* costs of operating and maintaining the road network should also be financed through the road tariff, and (iii) the *balance* of the required expenditures in urban and rural areas should be financed from local revenues. These local revenues may come from parking charges (in large urban areas), local property taxes, head taxes, market taxes, or product taxes (in Kenya, service charges on tea and other products provide local revenues to support road maintenance). In Zambia, the basic road legislation permits the minister to impose taxes on adjoining property owners to finance the costs of branch and estate roads. In rural areas and urban squatter

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[31] This is true in many sectors. In the case of electricity, the costs of generating the base load are estimated by pooling the costs of individual power stations and calculating the average variable and fixed costs for the entire group. The variable costs of a hydro-power station (which are virtually zero) are thus pooled with those of coal, oil, and gas-fired stations and also with stations of different age.

settlements, the local community sometimes contributes materials and/or volunteer labor in lieu of such taxes.

One of the key features of the above financing arrangement is that it focuses attention on the *affordability* of a fully-funded road maintenance program and hence on the need to define a *core* road network which users are willing and able to fully finance. Most African countries are now having to face this issue. Road networks were expanded too rapidly during the 1960s and 1970s, and governments are no longer able to fully maintain the entire road network. Instead, they are being forced to define a core network which they can afford to maintain. Noncore roads either receive minimal maintenance or are handed over to lower levels of government. In Tanzania, this has resulted in a decision to fully maintain all main and regional roads in good and fair condition (about two-thirds of the total) and to carry out emergency and spot maintenance on only about 20 percent of the remaining third in poor condition. CAR has defined a core network, amounting to less than 20 percent of the total, which they intend to fully maintain, while Benin has effectively handed over maintenance of most rural roads to local communities.

7.2.4 Financing New Investment

New investments include road improvements (e.g., surfacing an earth track), extending the road network (e.g., constructing an agricultural penetration track), and expanding road capacity (e.g., widening a road). There are sound economic reasons for wanting to finance improvement and extension of the road network by applying the *benefit principle* of taxation: those who benefit should pay. There are also sound economic reasons for wanting to finance increased road capacity on congested roads through congestion charges. However, the bluntness of the available charging instruments makes it virtually impossible to confine charges to beneficiaries, or to administer congestion charges on the interurban and rural road networks (urban road congestion is dealt with in section 7.2.6). The choice of financing instruments thus comes down to charging all road users, or financing investments from general taxes channeled through the government's development budget.

People have strong views on how to finance investment. Many believe the road tariff should only finance operation and maintenance and that all new investment should be financed through the development budget. Otherwise there is a danger that new construction might take precedence over maintenance or that the road agency might undertake too much investment. Major new investments in the interurban road network, furthermore, have major impacts on landuse, location of industry, and property values. This raises both strategic and political issues which should properly be dealt with by the government. There is some evidence to support this view. During the 1980s, countries like Tanzania and Zambia continued to build new roads at the expense of maintenance. On the other hand, there are also arguments in favor of financing new investment through the road tariff. Only by forcing road users to pay the full costs of using the road network — including the costs of investment — will the size of the network be constrained to what is affordable and will essential investments be carried out regardless of the state of the government's budget.

There is no simple answer. Some countries finance new investments through the development budget (including Mozambique, Tanzania, and Ghana), while others finance some investment through user charges (including Benin, CAR and, until recently, South Africa). It is really a question of governance. In countries where new investments are frequently undertaken for political reasons and where the roads board (if any) is unable to stand up to these political pressures, new investments should be financed through the development budget. Where there are

strong, representative roads boards which are able to withstand political pressure, it may be better to finance new investments through the road tariff. This will ensure that they are subjected to the test of the marketplace. The board should also ensure that new investment does not displace maintenance.

Slightly different considerations apply in the case of urban and rural district roads. In the case of new investment, the overriding objective is to ensure that districts only undertake priority projects, rather than undertake new investments because the funds are provided as a grant channeled through the government's development budget. This argues in favor of a matching-grant system. The district has to demonstrate the priority of its investment program by paying part of the costs from its own local revenues. The local revenues can come from land-value increment taxes (i.e., betterment taxes and frontage levies) or other forms of property tax. The balance of the expenditures are then financed by the road tariff or through the government's development budget. The amount financed by the district should clearly be based on the ability to pay.

7.2.5 Financing Road Rehabilitation

Most countries have large backlogs of deferred maintenance. Governments are furthermore short of fiscal revenues and are generally unable to finance much road rehabilitation from their own resources. So where will funds come from? The first thing to recognize is that Africa cannot afford to rehabilitate *all* roads in poor condition. The best it can hope for is to rehabilitate a core network which the country can afford to maintain on a sustainable long-term basis (see section 7.2.3 above). The remaining roads in poor condition will either have to receive minimal maintenance or be handed over to lower levels of government and local communities. However, even rehabilitation of the core road network will still cost an estimated $1.5 billion per year over the next ten years. There are three possible ways of financing this: (i) by reallocating existing spending from new construction, (ii) through donor-financed loans and grants, and (iii) through the road tariff.

The first option offers little hope. Few African countries have large construction programs — other than those financed by donors — so there is limited scope for reallocating domestic resources from construction to rehabilitation. The second option, donor financing, is already being used, with donors currently financing about $800 million of rehabilitation per year. This money is, however, not free. True, some comes in the form of grants and some comes in the form of concessionary loans, but governments still have to service the loans. Somebody has to pay. In the short term, most governments are doing this from general revenues. In other words, other sectors are being taxed to finance road rehabilitation programs. This is not sustainable under present fiscal conditions, and, furthermore, donor financing will not be available indefinitely. In the longer term: (i) governments will not be able to continue servicing donor-financed road rehabilitation programs from general tax revenues, and (ii) donor-financing will eventually cease. This only leaves one realistic long-term option: road rehabilitation programs have to be financed through the road tariff. There are two qualifications. First, funds for rehabilitation should be clearly designated as a *temporary* surcharge and, second, the costs can be spread and made more affordable by continuing to use international and domestic borrowing. The decision to borrow should nevertheless be based on a careful assessment of alternative financing options and their costs.

7.2.6 Managing Urban Road Congestion

Pricing and cost recovery policies can be used to manage traffic and generate additional revenues for investment. One of the basic principles of efficiency pricing is that additional road capacity on congested roads should be financed through congestion charges. Capacity should be expanded when the annual costs of road congestion are equal to the annualized costs of expanding capacity. In practice, it is difficult to do this, other than in seriously congested cities and, even then, it is not easy. The only serious attempt made so far in Africa to develop special arrangements for financing urban roads, including possible use of urban congestion charges, is in South Africa (see Box 7.4).

Box 7.4 South Africa's Urban Transport Fund

Urban roads in the declared Metropolitan Transport Areas are financed through local government rates and grants made from an Urban Transport Fund (UTF) administered by a subcommittee of the South African Roads Board. The original intention was to partially support the UTF with revenues collected by applying road congestion charges in urban areas. However, these charges were never introduced. Instead, money was channeled to the UTF from the road fund (in 1986-87 $30 million was transferred), and it is currently financed entirely through a central government grant amounting to about $16 million per year. Money from the Fund is used to finance urban transport plans and infrastructure improvements, provided the latter are designed to assist public transport. The Fund finances 50 percent of the costs of studies (the remaining costs are shared between the provincial government (30 percent), and the local authority, (20 percent). It finances 60 percent of infrastructure costs, with the balance being equally shared between the province and the local authority.

The simplest approach is to start with parking charges, supplemented by improved traffic management to prevent parking charges from spilling over into illegal parking and other avoidance strategies. Parking charges offer a natural transition from the use of physical measures to improve road capacity to the use of congestion charges to ration scarce road space. Full-scale area-wide congestion charging is the next best option. Box 7.5 summarizes methods of charging for urban road congestion and suggests that, presently, the only feasible options for Africa are area licensing and cordon pricing. And area licensing is difficult to administer. The most attractive method is cordon pricing, but such schemes are only suitable when: (i) there are a limited number of major arterial roads entering the city, (ii) traffic using these roads is a major cause of urban road congestion, and (iii) it is possible to intercept traffic on these routes to collect the congestion toll. Only Lagos and Nairobi, together with some cities in South Africa, stand any chance of satisfying these criteria. Urban congestion charges therefore have limited applicability, but they may eventually provide a useful instrument for helping to manage urban traffic and generate additional road sector revenues in large, seriously congested cities.

7.2.7 Likely User Charge Structure

A sustainable road maintenance program generally requires vehicle license fees which vary from about $75 for a car through $500 for a bus or medium truck to about $2,500 for an articulated truck. Alternatively, license fees can be kept at nominal levels and combined with a heavy vehicle license fee, varying from about $200 for a light truck, through $1,000 for a heavy truck to $2,000 for an articulated truck. These license fees need to be combined with a fuel levy of from $0.10 to $0.15 per liter to ensure the costs of operating and maintaining the road network can be fully funded. License fees in most countries, particularly those applicable to heavy vehicles, are generally lower than this and generally need to be raised and/or supplemented by a heavy vehicle license fee. The same is not true of fuel levies (see Figure 7-2). A number of countries either have or are well on their way to having fuel levies of $0.10 per liter. The fuel

Box 7.5 Methods of Charging for Urban Road Congestion

There are four main ways of using pricing to reduce urban road congestion: (1) charging for parking, (2) imposing a higher license fee or fuel levy on urban road users, (3) charging a fee for entering the urban road network, or (4) charging for the use of individual streets or designated parts of the urban road network. This box describes methods (3) and (4).

Entry fee systems charge vehicles each time they cross a cordon. Fees can be collected manually or electronically. Manual charging schemes either use *toll booths* to charge vehicles entering the restricted zone, as in Bergen, Norway, or use a*rea licenses,* as in Singapore. With area licenses, vehicles simply display a supplementary prepaid license when entering and operating within the restricted zone. There is no need for toll booths. General road pricing, where vehicles are charged either on individual routes or when using parts of the road network, are only feasible with electronic charging schemes such as: *Automatic Vehicle Identification* (AVI), *Electronic Number Plate* (ENP), and *Smartcard.* The vehicles equipped with an AVI tag, an ENP, or a Smartcard are identified when they pass an electronic reader. The reader charges either the vehicle's account (precredited or not) or the prepaid Smartcard itself. Oslo and Trondheim in Norway use both manual and electronic tolling systems. Users can thus choose either to subscribe to AVI and be identified or use the manual toll lanes and remain anonymous. The ENP scheme has been tested in Hong Kong and the Smartcard system is currently being tested in Singapore. Electronic charging schemes do away with the need for toll plazas and reduce delays.

Electronic Charging Schemes are generally not suitable for Africa. The technology is still under development and it will be some years before it will be available off-the-shelf. The ALS requires disciplined road users and an effective enforcement system. For these reasons it may not suit Africa at the present time. Therefore, the best practical solutions for Africa are the manual and mixed manual or electronic cordon pricing schemes. But such schemes are only suitable when: (i) there are a limited number of major arterial roads entering the city, (ii) traffic using these roads is a major cause of urban road congestion, and (iii) it is possible to erect toll booths at points which intercept a significant amount of this traffic.

levies, furthermore, should not make fuel unduly expensive. Prior to the CFAF devaluation, francophone countries frequently priced diesel at $0.70 per liter and gasoline at over $1.00 per liter. Since the devaluation, few countries price diesel at more than $0.55 per liter and gasoline at more than $0.70 per liter (see Figure 7.3). Africa now has some of the lowest fuel prices in the world. A $0.10 to $0.15 fuel levy would still leave fuel prices in most African countries at acceptable levels. Only in a few countries, like Uganda and Malawi, might the introduction of a high fuel levy need to be accompanied by revision of the underlying fuel tax structure to ensure that the final price of fuel was not unreasonably high.

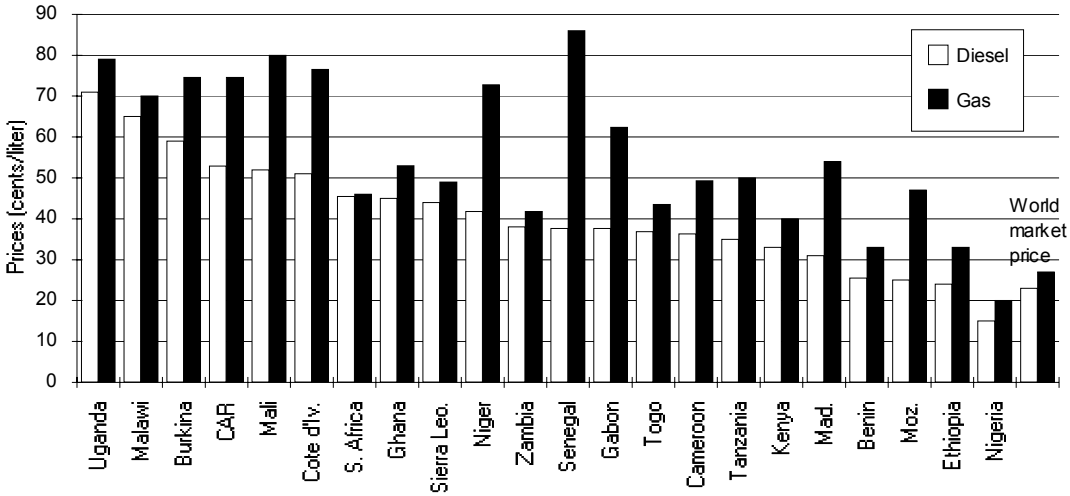
7.3 MANAGING THE REVENUES

The above pricing and cost recovery policies will only influence demand and strengthen market discipline if the revenues collected from road users are spent on roads and used to impose a hard budget constraint on the agencies supplying road services. Furthermore, road users are generally only willing to pay explicitly for roads "provided the money is spent on roads and the work is done efficiently."[32] To that end, it is important to recognize that vehicle license fees, heavy vehicle license fees, international transit fees, and the fuel levy are not regular *taxes*. They are the *road tariff* and should not be confused with the general taxes which road users pay. Instead, the proceeds from the road tariff should be collected and deposited into a *special account* to prevent them being diverted and spent on other public programs. These special

[32] During the National Road Maintenance seminar in Zambia, a representative from the road transport industry stated this for the record. The same sentiment was expressed by a representative from the private sector during an RMI workshop in Tanzania, and a representative of the road transport industry from Zimbabwe made a similar statement at a SATCC meeting in Arusha.

accounts are normally referred to as road funds. It is important to note that putting roads on a fee-for-service basis, introducing a road tariff and depositing the proceeds into a special account is not the same as conventional *earmarking* (see Box 7.6).

Figure 7-3 Fuel Price in Selected African Countries



Note: Prices for most countries are fourth Qtr 1993; Prices for CFAF countries are post devaluation.
Source: G. Metschies, GTZ, and World Bank.

7.3.1 Establishing a Road Fund

A road fund can be established in one of two ways. It can either be opened under existing legislation or by passing new legislation to establish the road fund as a separate legal entity. The first option is the easiest. The basic legislation in most countries gives the Ministry of Finance powers to open a special account, either through a parliamentary resolution or ministerial decree. The Minister of Finance simply tables a resolution in parliament or the minister or cabinet issues a decree stating: (i) that a special road fund account is being opened, (ii) why it is being opened, (iii) the source of revenues, and (iv) how the account will be managed. The parliamentary resolution establishing the special account for financing main and regional roads in Tanzania is shown in Box 7.7. In Zambia, the road fund was established by the permanent secretary of the Ministry of Finance after parliament had passed an amendment to the Finance (Control and Management) Act. The drawback of the above procedures is that they lack the full backing of the law and do not define the detailed arrangements for managing the road fund.

Box 7.6 Earmarking versus Commercialization

Earmarking is the practice of setting aside revenues raised from certain *taxes* to cover specified *public expenditures*. Some economists argue that earmarking imposes undesirable rigidity on government expenditure decisions and should be discouraged. For example, it is inefficient to set aside, say, 20 percent of overall fuel tax revenues to finance national roads, since not all fuel consumption is related to road use. The required expenditures will generally be larger or smaller than this amount, and it may be desirable to use fuel tax revenues for other purposes. However, others argue that earmarking taxes under certain circumstances can improve allocative efficiency by acting as surrogate prices when the taxes are levied on those who benefit from the expenditures. For example, in both the US and Japan, part of the gasoline tax and other motor vehicle tax proceeds are earmarked for the road fund and the income from the fund is used to meet the costs of operating, maintaining, improving, and extending designated parts of the road network. It is argued that such earmarking is a helpful device for approximating benefit taxation and will promote more efficient expenditure decisions.

What is being proposed in this paper is nevertheless not the above type of earmarking. Earmarking generally applies to revenues which: (i) form part of the governments overall tax system and (ii) flow into the government's general revenue account. What is proposed here is a system of user charges which: (i) do not form part of the overall tax system, (i.e., like the landing fees at an airport, they do not form part of the government's sales taxes, excise taxes, and import duties), and (ii) are kept in the accounts of the agency supplying road services. This institutional distinction has important implications for efficiency. The charges create a constituency for the agency supplying the service (i.e., they create a specific market), make the agency more accountable to its users and, by clearly linking revenues and expenditures, are used to impose a hard budget constraint on the road agency. Specifically, what is different about the proposed financing arrangements is that the road tariff:

(i) Is not set within the government's overall tax framework;
(ii) Is set to achieve specific objectives, like demand management and cost recovery for a particular service;
(iii) Is added to pre-existing standard sales and excise taxes or, when fuel is highly taxed, partly replaces and partly adds to pre-existing taxes;
(iv) Is used to impose a hard budget constraint on the agency supplying road services.

The road funds in Tanzania and Zambia should therefore not be classified as *conventional earmarking* since: (i) the road tariff is set by the roads board outside the government's tax framework, (ii) it is set to ensure that all vehicles cover the costs they impose on the road network and collectively cover the entire cost of operating and maintaining the road network, (iii) the fuel levies are added to preexisting standard sales and excise taxes, (iv) the charges are related to road usage, and (v) the proceeds from the road tariff are used to impose a hard budget constraint on the agencies entitled to draw from the road fund.

The second option is to establish the road fund under new legislation. This provides a much firmer basis for the arrangement, although it does have two disadvantages. First, the legislation must set down rules for managing the road fund before the parent ministry has gained experience on what these rules should be. Second, ministers are often reluctant to spend parliamentary time passing new legislation, and this may make it difficult to get the road fund established. It may therefore be easier to establish the road fund using a simple resolution or decree and then to translate the working rules into legislation after all the initial teething problems have been sorted out.

Box 7.7 Parliamentary Resolution used to open a Special Account to support maintenance of main and regional roads in Tanzania

DECLARATION ON THE OPENING OF SPECIAL ROAD FUND
"THE ROAD FUND"
AS ANNOUNCED BY THE MINISTER OF FINANCE

BECAUSE the government has an intention of strengthening the maintenance of core roads in the country after realizing the importance of roads in the restructuring of the country's economy;

AND BECAUSE in fulfilling this objective it is necessary that funds must be obtained for this purpose;

AND BECAUSE under the present procedure of road maintenance, the internal revenue and development fund is not enough for this purpose;

AND BECAUSE in accordance with Clause 17 (1) of the "Exchequer and Audit Ordinance" (Cap.439) whereby the government can open a special fund;

THEREFORE, FOR THOSE SPECIAL PURPOSES,
THIS PARLIAMENT IS SUGGESTING THAT

(a) There should be a special fund called "The Road Fund."

(b) The objectives of this fund should cover costs of rehabilitation and maintenance of major and core roads.

(c) Money for this fund should come from:

(i) Road tolls as charged from diesel and petrol at an amount to be decided by the Minister of Finance,
effective July 1991/92.

(ii) Various levies and duties from motor vehicles such as licenses, registration and transferring of vehicles, at an amount to be decided by the Minister of Finance effective July 1992/93.

The Ministry of Works will be responsible and will monitor this Special Fund and the Ministry of Works will need to get an authority from the Planning Commission and the Ministry of Finance before embarking upon any project.

Note: Translated from the original in Swahili.

7.3.2 Review of Existing Road Funds

There are a large number of road funds in Africa (see Tables 7.4 and 7.5). None are perfect and most have serious faults. A recent review has nevertheless identified what works and what does not work. This section focuses on some of the underlying weaknesses which cause road funds to fail, while the next section concentrates on how to avoid these pitfalls and design an effective road fund. The features which adversly affect operations include: (i) generic design problems which affect the overall operation of the road fund, and (ii) specific problems which only affect certain parts of the operation.

Generic design problems include:

(i) *Funding problems*. The ministry of finance stops paying money into the road fund, holds up the release of funds (as happens in Ghana), or takes money out of the road fund and uses it for other purposes. In CAR, the government borrowed money from the road fund to pay civil service salaries, while in Mozambique, Sierra Leone, and Tanzania there have been several occasions when the ministry has withheld funds. This is generally caused by poorly designed arrangements for collecting road fund revenues, paying them into the special account, and authorizing their release. It may also be caused by a weak or nonexistent road fund board, and ambiguous legislation.

(ii) *It looks too much like earmarking*. Anything that looks like traditional earmarking will be opposed by the ministry of finance and the International Monetary Fund (IMF). This generally happens when funds deposited into the road fund include service fees and general taxes (as in Benin and Ghana), or where the road tariff is specified as a portion of the government's regular fuel taxes (as in Mozambique and Chad). Depositing such funds into the road fund clearly looks like the earmarking of general tax revenues, and such funds will be under the constant threat of closure.

(iii) *Oil companies withhold payment*. This usually happens when the government is in arrears on its own payments for fuel (as in Chad, Rwanda, and Zaire). When that happens, the oil companies stop paying the fuel levy and also withhold payment of government sales and excise taxes. This is a country problem, but it is also related to the influence of the road fund board. A strong board should be able to persuade the oil companies to pay up.

(iv) *Insufficient road fund coverage*. This happens when the road fund is set up to finance only part of the qualifying expenditures, with the balance being financed through the governments recurrent or development budget. Once road agencies are getting some money from the road fund, it often becomes even more difficult to get funds allocated through the normal budgetary process (this happens in Ghana where the road fund was originally set up to finance only 60 percent of periodic maintenance). Road funds should be set up to eventually finance *all* qualifying expenditures.

(v) *Excessive road fund revenues*. This is rare, but happens when the initial road tariff is set too high. The high tariff generates a large surplus, encouraging other ministries to *raid* the fund or bring pressure to have it closed, as happened in Mali during the 1970s and has recently happened in South Africa.[33] Clearly, there should be arrangements for varying the level of the road tariff.

The specific problems which only affect certain operations are often related to the above generic problems but deserve special mention. They include:

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[33] About one-third of the pump price of fuel was earmarked for the South African Road Fund. In 1989, when the Fund was abolished, more than $0.15 per liter was earmarked. This high levy caused the Road Fund to build up a large surplus. This led to concern that the South African Roads Board might go on a spending spree, and this eventually led to the dedicated Fund being abolished.

(i) *Legal problems*. The road fund lacks a firm legal basis. This usually happens when the legislation is prepared too quickly or without adequate preparation and ends up being too inflexible. This affects a number of road funds. It can be avoided by establishing the road fund under existing legislation and only passing legislation after the initial teething problems have been sorted out (as in Tanzania and Zambia), or spending more time preparing the operating procedures before passing the legislation.

(ii) *Ineffective and inconsistent management*. This may happen when there is no road fund board (as in Ghana), when there is a board but with the wrong membership (the initial board in South Africa, which primarily consisted of provincial representatives, found it difficult to get the provincial members to act in the national interest), or when it meets too infrequently (as in Rwanda).

(iii) *Inconsistent road tariff*. The tariff is inconsistent and not able to deliver a clear market signal to road users. This happens in Ghana (where vehicle inspection fees and taxes on kerosene are paid into the road fund) and in Tanzania (where the parliamentary resolution provides for car benefit, and vehicle transfer taxes to be paid to the road fund).[34] The road tariff should consist only of vehicle license fees (including heavy vehicle license fees and axle-weight fees), the fuel levy, international transit fees, and bridge and ferry tolls.

(iv) *Inability to adjust the road tariff*. There is no mechanism for adjusting the road tariff other than through the normal tax-setting process combined with approval by several ministries that have nothing to do with roads (as in the case of Mozambique). This makes it difficult to adjust the tariff for inflation or to generate additional revenues.

(v) *Problems collecting the road tariff*. This happens when the revenues are collected by the customs and excise department and channeled through the Ministry of Finance, before being paid into the road fund. The ministry of finance almost invariably withholds some of these revenues (as in Mozambique and Tanzania). The best solution is to have the road tariff collected under contract and deposited directly into the road fund. Among other things, this emphasizes its role as a user charge.

(vi) *No mechanism for objectively allocating funds*. When the road fund finances roads managed by different road agencies, it needs transparent and equitable procedures for dividing the revenues between these road agencies. Sometimes, as in Ghana, it is merely a question of dividing the revenues between the agencies responsible for the main, urban, and rural roads. In others, as in Tanzania, it may involve dividing funds between more than 100 district councils. One of the persistent weaknesses of most road funds is that they have no objective procedures for allocating funds. As a result, allocations tend to be erratic, as in Ghana, or subject to political whim. For example, in Tanzania, weak allocation procedures resulted in 75 percent of the funds allocated for urban and rural roads going only to urban areas.

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[34] At present, the fuel levy is the only user charge being paid to the Tanzania Road Fund.

Table 7.4 Review of Road Funds in Selected Countries in Sub Saharan Africa: Legal and Administrative Arrangements

Country	*Legal basis*	*Status*	*Management structure*	*Board composition*	*Type of work financed*
Benin	Decrees; 1984, 85 and 1992	Public utility	Board Director and staff	6 Civil servants 2 Private sector	Routine and periodic maintenance
CAR	Ordinance, 1981 and decree, 1991	Public utility	Board Director and staff	11 Civil servants	Routine and periodic maintenance
Mozambique	Decrees, 1989 and 1990, amended in 1993	Bank account	Board Director of roads	7 Civil servants Examining possibility of participation from the private sector	Routine and periodic maintenance Rehabilitation
Rwanda	Act, 1989 and decree, 1990	Bank account	Board Director of roads	7 Civil servants 1 Road haulier	Maintenance
Sierra Leone	Opened, 1989, incorporated in SLRA Act, 1992	Bank account	Board Director of SLRA	Chairperson 3 Civil servants 3 Private sector 3 chosen by Minister of Works	Routine, periodic, and emergency maintenance
South Africa	National Road Act, 1935, amended in 1971	Bank account	Board Director and deputy Director-general, Tpt Director of roads	3 Civil servants 1 Local government 1 City representative 3 Private sector	Routine, periodic, and emergency maintenance Investment Studies, research and bursaries
Tanzania	Parliamentary resolutions, 1991, 1992	Bank account	Board Ministry of works Prime minister's office	Roads board oversees MOW fund Chairperson 8 Civil servants 4 Private sector	Routine and periodic maintenance Rehabilitation
Ghana	Executive decree, 1985	Bank account	Director of roads and highways	Board suspended by the military govt in 1984	Periodic maintenance
Chad	Law, 1993 and decree, 1994	Bank account	Director of roads	No board	Routine and periodic maintenance

Source: de Richecour, 1994.

Table 7.5 Review of Selected Road Funds in Sub Saharan Africa: Financial Arrangements

Country	*Source of funds*	*Size of fuel levy (dollars/liter)*	*Who sets the fuel levy*	*How is levy deposited*	*Annual revenues (million $)*	*Arrangements for accountability*
Benin	Fuel levy Weigh-bridge fees Bridge tolls Transit fees VAT and import duties Govt. allocation	Premium gasoline, 0.008 Diesel 0.007	Ministry of Finance	Through Ministry of Finance	1.8	Separate accounts Internal audit Independent audit
CAR	Fuel levy Ferry tolls Weigh-bridge fees	Gasoline and diesel, 0.095	Ministry of Finance	Direct deposit	3.0	Separate accounts Internal audit Independent audit
Mozambique	Fuel levy Transit fees Bridge tolls	Premium gasoline, 0.18 Regular, 0.12 Diesel, 0.04	Min. of Industry and Price Commission	Through Customs	6.3	Financial and technical control Independent audit (newly introduced)
Rwanda	Fuel levy Road toll fees	Gasoline, 0.133 Diesel, 0.112	Ministry of Finance	Direct deposit	8.0	Separate accounts Independent audit
Sierra Leone	Fuel levy	Gasoline and diesel, 0.04	Ministry of Finance	Through Customs	3.2	Separate accounts Internal control Independent audit
South Africa	Govt. allocation Miscellaneous	n.a.	n.a.	n.a.	152.0	Audit by auditor general
Tanzania	Fuel levy	Gasoline and diesel, 0.06	Min of Finance on advice of Central Roads Board	Through Customs	21.5	Audit by Tanzania Audit Corporation
Ghana	Fuel levy Bridge, ferry, and road tolls Veh inspection fees	Gasoline, 0.025 Diesel, 0.02	Ministry of Finance	Direct deposit	24.0	Audit by auditor general and Independent audit
Chad	Fuel levy Transit fees Road and ferry tolls Axle-weight tax	16 percent of all fuel taxes	Ministry of Finance	Through tax authority	3.1	Separate accounts Independent audit Internal control

Source: de Richecour, 1994.

(vii) *Unsatisfactory audit procedures*. Financial transactions are at least audited by the auditor general, thus helping to ensure that funds paid into the road fund are accounted for and that there is some check on whether they were disbursed to finance approved expenditures. It does not provide a check on whether the work was actually done and done according to specification. Such checks are particularly important when the work is done by force account.

The above observations can now be used to define the key features which need to be considered when designing a new road fund.

7.3.3 Designing a Road Fund

To avoid setting up a conventional, earmarked road fund, a special account should only be introduced in conjunction with an explicit road tariff. The road tariff should consist of license fees, a fuel levy, bridge and ferry tolls, and international transit fees. The proceeds from the road tariff should then be deposited into the road fund. To ensure that the road fund functions effectively, it should be designed in the following way:

(i) *Collecting the revenues*. The proceeds from the road tariff should be collected and deposited directly into the road fund without having to pass through the accounts of the customs department or the Ministry of finance. The oil companies should deposit the fuel levy directly into the road fund, and both license fees and international transit fees should ideally be collected under contract. Fuel levies in Ghana, CAR, Chad, Rwanda, and Zambia are collected by the oil companies and deposited directly into the road fund. Chad is proposing to collect license fees under contract, and Mozambique and Zambia are proposing to collect international transit fees under contract.

(ii) *Road Fund management*. The road fund should be managed by a strong board with clear terms of reference. When one road agency is responsible for managing the entire road network (as in Sierra Leone), the road fund can be managed by the same board as the road network. Otherwise, there should be a separate road fund board. The board should have a broad-based membership and meet regularly. The boards in Sierra Leone, South Africa, Tanzania, and Zambia all have potentially strong, representative boards capable of managing the funds effectively.

(iii) *Setting the road tariff*. There should be a formal mechanism for varying the road tariff and charges should be indexed to ensure that they keep pace with inflation. The board should either have the power to set the tariff (in the same way the railways set their tariffs) or at least to recommend tariff levels to the Ministry of finance for inclusion in the annual budget statement. Both Tanzania and Zambia propose to use the latter method, and the Ministry of finance in Tanzania has indicated that it would have great difficulty approving tariff increases without the support of the board.

(iv) *Allocation of funds*. There should be a simple and consistent procedure for allocating funds between the different agencies entitled to draw from the road fund. This is discussed in section 7.3.4.

(v) *Auditing arrangements*. Once road maintenance is fully-funded, the road fund will be handling $25 to $50 million per year, and it then becomes important to ensure that these large sums of money are properly accounted for. The audit should make sure that

revenues are collected efficiently (i.e., avoidance, evasion, and leakage are kept to a minimum), funds are only disbursed to finance approved expenditure programs, funds are actually spent on these programs, and the work is carried out according to specification. This generally requires an independent financial audit, a technical audit of all contract work, and a selective audit of work done through force account. The best arrangements are those involving an independent financial audit (as in Benin, CAR, Chad, and Sierra Leone) and a technical audit of work done under contract (as in Benin and CAR) and through force account (as in Benin).

7.3.4 Allocating Funds

It is important to have allocation methods which are simple, transparent, and encourage consistency in standards between roads managed by different road agencies. There are three basic methods. They range from simple to complex and establish priorities in an increasingly complicated way. They include methods which use: (i) a simple allocation formula, (ii) an indirect assessment of needs, and (iii) a direct assessment of needs.

Several countries, including Japan (see Chapter 3, Box 3.2), use a simple formula to allocate funds between different road agencies. Ghana has one of the simplest formula-based methods. When it started, it simply allocated 80 percent of the road fund resources to trunk roads and the remaining 20 percent to rural roads. When funds were first allocated for urban roads, the formula changed to: trunk roads, 52 percent, rural roads, 28 percent, and urban roads, 20 percent. The proportions have changed every year since then and, in principle, have attempted to equalize priorities at the margin. Mozambique developed an even more elaborate formula for allocating funds between urban, provincial, and rural roads (it is spelled out in a 1990 decree which has been temporarily superceded by a new allocation process established as part of a donor-financed National Roads Program). The method is similar to that used in Japan. The formula allocates the fuel levy as follows: (i) 80 percent of the revenues from super gasoline go to cities, (ii) the remaining 20 percent go to cities with low revenues (as decided by the Ministry of Finance), (iii) 60 percent of the revenues from regular gasoline go to provinces, (iv) 20 percent of these revenues go to rural roads, and (v) the remaining 20 percent go to the general budget to support programs "on energy and minerals" (basically to compensate other sectors for having to pay the fuel levy).

The indirect needs-assessment method bases allocations on an indirect measure of priority. It is done indirectly because there are either no reliable data to do so directly, or there are insufficient technically qualified staff to analyze the data. There are several methods available and all try to use information on population, land area, road length, agricultural output and per capita income to assess: (i) road sector needs, (ii) ability to finance these needs from local resources, and (iii) the need for matching grants. Tanzania is currently developing an indirect needs-based assessment method to help allocate the 20 percent of the road fund allocated for district roads to the 101 district councils entitled to draw on these funds (see Box 7.8).

The direct needs-assessment method bases allocations on a direct assessment of priorities and can be more or less complicated, depending on the technical capacity of the individual road agencies. Tanzania uses this method to allocate routine maintenance funds between the twenty regions under the jurisdiction of the roads department. It uses standard unit rates for each routine maintenance activity by type of road surface. These rates are then multiplied by the length of maintainable road in each region (the *core* network) to arrive at the total routine maintenance budget required by each region. South Africa also uses this method, but also applies it to periodic

maintenance (see Box 7.9). It is planning to improve on the method by linking it to an inspection system which will enable standard unit rates to be replaced by figures based on actual road conditions.

Box 7.8 Procedures for Allocating Funds to District Councils: Tanzania

In Tanzania, 20 percent of the road fund receipts are allocated to support maintenance and rehabilitation of district roads. There are eighty-four rural and seventeen 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: (i) three-quarters of the funds went to urban district councils (they simply prepared better road programs), (ii) about one-quarter of the rural districts received no funds at all, and (iii) 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: (i) based on needs, (ii) simple, (iii) transparent, and (iv) 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 = least developed to seven = 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).

7.3.5 Disbursing Funds

The final task is to work out procedures for disbursing funds to individual road agencies. These procedures are important, since they can be used to strengthen financial discipline. There

are three ways of structuring these procedures. The road fund can either: (i) disburse funds directly to the road agencies, (ii) settle bills periodically after certification that approved work has been completed satisfactorily, or (iii) disburse funds on a conditional basis and undertake technical and financial audits *ex post*.

The first method is the simplest, but it does little to strengthen financial discipline. Funds are simply disbursed directly to each road agency and the agencies then have to account for the way that they spend the funds within the usual government audit framework. The financial audit of the road fund simply checks to ensure funds-in match funds-out. The road agencies are not accountable to the road fund, but to their parent ministry, which is expected to ensure that the money has been spent on roads and the work has been done according to specification. In Ghana, road fund revenues are split at the source and paid directly into the accounts of the Ghana Highway Authority, the Department of Feeder Roads, and the Department of Urban Roads. Each agency then has to prove to the Ministry of Roads and Highways that it has used the resources efficiently (Box 7.10 summarizes the way funds are disbursed for rural roads). The road fund thus plays no part in checking to ensure that road fund revenues produce value for money.

The second method involves more oversight by the road fund. The road fund disburses funds on a regular basis, but it only does so after certification that the work has been completed according to specification. This requires an approved work program, together with a system of technical and financial audits. It works best when the work is done under contract, but it can also be applied to force account work. This procedure is used in Benin, CAR, and Mozambique. Mozambique has well-developed procedures for controlling work at the provincial level. A provincial inspector is appointed for each contract and he is responsible for supervising the contractor, administering the contract, and certifying payments (the contractor is a parastatal construction enterprise). The contractor submits monthly statements of work completed and, within fifteen days of presentation, the inspector has to certify the work for payment. In Benin, similar arrangements are used for force account work. However, such rigorous procedures are only effective when there are enough qualified inspectors to certify the work and they are mobile, experienced and hence sufficient authority to stand up to contractors.

Box 7.9 Procedures for Allocating Funds Between Different Road Authorities: South Africa

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: (i) routine maintenance (patching and sealing cracks, maintaining gravel shoulders, maintaining drainage, attending to the road reserve, and maintaining road signs and markings); and (ii) 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 below). For this purpose, roads are classified as freeways, conventional four-lane roads, surfaced two-lane roads (roads with ADT greater than 12,000 vpd, primary roads with ADT greater than 4,000 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: (i) environmental conditions, and (ii) 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.

Maintenance Unit Rates Per Carriageway km, 1992
(dollars)

	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 maintenance:*		
Patching and crack sealing	300	260	525	420	350	Blading	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 maintenance:*		
Bridges	122	88	105	88	70	Bridges	26	18
Resealing	6,030	2,495	2,495	2,495	2,495	Regraveling	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, 1992.

Box 7.10 Procedures for Disbursing Funds for Rural Roads in Ghana

In Ghana, the Department of Feeder Roads (DFR), which forms part of the Ministry of Roads and Highways, has been designated as highway authority for a feeder road network of about 22,000 km. The network is administered through a fairly decentralized structure comprising ten regions, with ten districts per region. The planning cycle starts when district secretaries are requested to submit a road program to the regional planning officer. These programs are discussed at local meetings where DFR staff provide technical advice and help to prepare the schemes. Funds are allocated centrally and come from the road fund (25 percent is allocated to the DFR) and the central government budget. District requests are balanced centrally and matched with the available funds. Routine maintenance funds are transferred to the regional engineers who manage the funds and report back to headquarters on progress in the field. District assemblies are advised of approved work programs and play an active role in ensuring that work is carried out effectively. Completed work is checked by headquarters on a selective basis. In the case of rehabilitation, periodic maintenance, and minor works, completed work is certified by the regional engineer and regional planning officer before funds are released. Most civil works are done by small-scale contractors. The DFR has about 700 staff of its own, comprising forty engineers, 560 technicians, accountants, secretaries and other administrative staff, and 100 casuals. About 10 percent are stationed at headquarters.

The third method is designed to handle a decentralized system of road administration. Under this arrangement, the road fund allocates funds directly to each road agency — sometimes on a monthly basis — and then audits the use of the funds at the end of the fiscal year. The results of the audit report may then be used to help determine subsequent road fund allocations. Tanzania uses this system to channel funds to urban and rural district councils. Funds are routed to districts through the regional development director who is expected to audit the work to ensure that the funds are actually spent on roads and that the work is done efficiently. Zambia is currently implementing a similar system covering the entire road network. The intention is to subject completed works to a full financial and technical audit and to use the results to help decide on matching grants for the next budget period.

The above arrangements can help to strengthen financial discipline. The second method imposes *ex ante* discipline on each road agency by only disbursing funds against evidence that works have been carried out satisfactorily. The only drawback is that it involves a great deal of field inspection. It is therefore only suitable for major road projects, and this usually means work on the main and regional road networks. The third method operates *ex post* and can be applied to any number of roads because the audit (particularly the technical audit) can be done on a sample basis. When the results of the audit are used to help decide on subsequent matching grants, the method can also be used to combine the devolution of responsibility with an assurance of quality.

8 ASSIGNING RESPONSIBILITY

This chapter deals with the issue of assigning responsibility for managing different parts of the road network and managing road traffic. Managing road traffic includes responsibility for controlling vehicle weights and dimensions, providing road signs and signals, controlling vehicle safety, regulating motor vehicle emissions, managing on-street parking, and managing urban road congestion. This chapter discusses the basic principles which guide the way responsibilities are assigned, how they affect overall management of the road network, and how they affect responsibility for managing road traffic.

8.1 BASIC PRINCIPLES

The first task is to prepare a functional classification of the road network. That means measuring its length and condition and establishing the legal status of individual roads (i.e., whether they have been gazetted and assigned to a legally constituted road agency). This calls for an accurate road inventory, a condition survey (also recording pavement strength), and identification of the responsible road agency. Since some roads may not have been gazetted, the second task is to assign these roads to a legally constituted road agency or, in the case of community roads, to the responsible community group (e.g., village council). There may also be a need to reclassify selected roads. Traffic may have grown on some roads and their status will need to be upgraded (e.g., from regional to trunk roads), while traffic may have fallen on others which might need to be downgraded.

Once the network has been classified, responsibility for managing different parts of the road network has to be assigned. The organizational structure attempts to reconcile three conflicting objectives. First, it attempts to assign responsibility to agencies with sufficient financial and technical capacity to manage the roads placed under their jurisdiction. Second, most countries are attempting to decentralize managerial responsibility to reduce the fiscal burden on the central government and strengthen accountability. Managerial responsibilities are thus being increasingly assigned to provincial and district-level governments, even though local governments rarely have the financial and technical capacity to effectively discharge these responsibilities. Finally, there are always areas where responsibilities overlap. Most countries attempt to deal with this by establishing a formal coordination mechanism.

It is easiest to define responsibilities by starting at the bottom and working upwards. This means starting with community roads, working up through *special purpose* roads (e.g., game department roads) and local government roads, and ending up with the national trunk road network (see Box 8.1). The agencies responsible for managing roads include village-level governments, special-purpose central government departments or parastatal boards, rural district councils, urban district councils, and central government agencies. The local government agencies generally operate under the overall jurisdiction of a central government agency, usually the ministry of local government. There are also other options. For example, the agency with prime responsibility for managing roads may delegate this responsibility to other public or private sector agencies. In both Ghana and Sierra Leone, the road agency can delegate management of selected roads to "a local authority or other competent body." Alternatively, government may establish a special-purpose agency to manage selected high-density roads (e.g., through an autonomous toll road agency) or invite the private sector to build and operate such

roads under a management contract (as in South Africa), or under a concession agreement (as is increasingly being done in Asia and Latin America).

Box 8.1 Criteria for assigning responsibility to different government organizations

The following criteria can be used to decide which functions ought to be: (i) assigned to any level of government acting as agents on behalf of beneficiaries, (ii) assigned to local governments acting as agents on behalf of the central government, (iii) retained by the central government, or (iv) delegated to parastatals or special purpose agencies.

Criteria for assigning responsibility to local communities. Consideration could be given to assigning responsibilities to local communities for providing services which: (i) require community-level location-specific decision making because the area served has relatively unique characteristics in terms of service requirements; (ii) do not have significant consequences for priority objectives of the country as a whole; (iii) require local participation; and (iv) are not capital intensive, have few economies of scale, and do not require support from other agencies because of their ability to use simple technology.

Criteria for assigning responsibility to local governments. Responsibilities can be assigned to local governments as principal agents acting on behalf of central governments for services which: (i) have significant consequences for priority objectives of the country as a whole; (ii) require some location-specific adaptation to unique features of the environment within which operation and management need to take place; (iii) have some economies of scale, compared with operation and management at either the local or national level; (iv) are relatively small-scale and labor intensive, but require significant levels of technical, logistical, and/or managerial support; (v) are more easily contracted-out to the private sector at local levels than would be the case at the national or regional level; or (vi) involve activities which local governments do not now have the capacity to implement, but for which it is desired that they develop such capacity so as to serve as discretionary authorities in future.

Criteria for Retaining Authority at the Center. Criteria for retaining authority at the central government level is the easiest to identify because it includes anything which is not assigned to local communities, local government, or delegated to parastatals or special purpose agencies. Responsibilities of central governments should nevertheless include those activities which define the overall enabling environment, such as: (i) responsibility for overall monetary policy, (ii) elimination or minimization of internal tariffs, (iii) coordination of external tariffs, and (iv) maintaining coordinated legal and judicial systems protecting property and contracts. In addition, it is not prudent to assign discretionary authority to local governments for activities which have high priority for a country as a whole, because it is unlikely that central governments will sustain local discretion over the longer-term.

Criteria for delegating responsibility to parastatals or special purpose agencies. Criteria vary depending on the type of organization to which responsibility will be delegated. Criteria for delegation include: (i) requirements are technical and capital, rather than labor intensive, and (ii) requirements do not need significant supporting actions by other government agencies. Criteria particular to one or another type of organization can also be specified. For *parastatals* (e.g., autonomous highway authorities), the range of activities should focus on the delivery of a single, discrete service (or limited range of discrete services), and the activities should be of a commercial or quasi-commercial nature (but are considered public goods by virtue of tending toward natural monopolies). For *special purpose agencies* (e.g., game parks, cocoa marketing board), the range of activities should focus on delivery of a single, discrete, service (or limited range of discrete services), and they should also be of a commercial or quasi-commercial nature (as in the case of parastatals). However, the efficient and effective delivery of services should require location-specific decisionmaking because the area served has relatively unique characteristics which do not coincide with the regular administrative boundaries of the government.

Source: J. Silverman.

Similar principles apply when defining responsibility for managing road traffic. Those issues which are primarily local in nature (e.g., managing urban road congestion), are normally assigned to urban district councils, while those dealing with use of the network as a whole are normally handled by the central government (e.g., regulating vehicle weights and dimensions). Again, the agency with prime responsibility may delegate some of these responsibilities to other

government agencies or to the private sector (e.g., axle-weight enforcement and vehicle inspection).

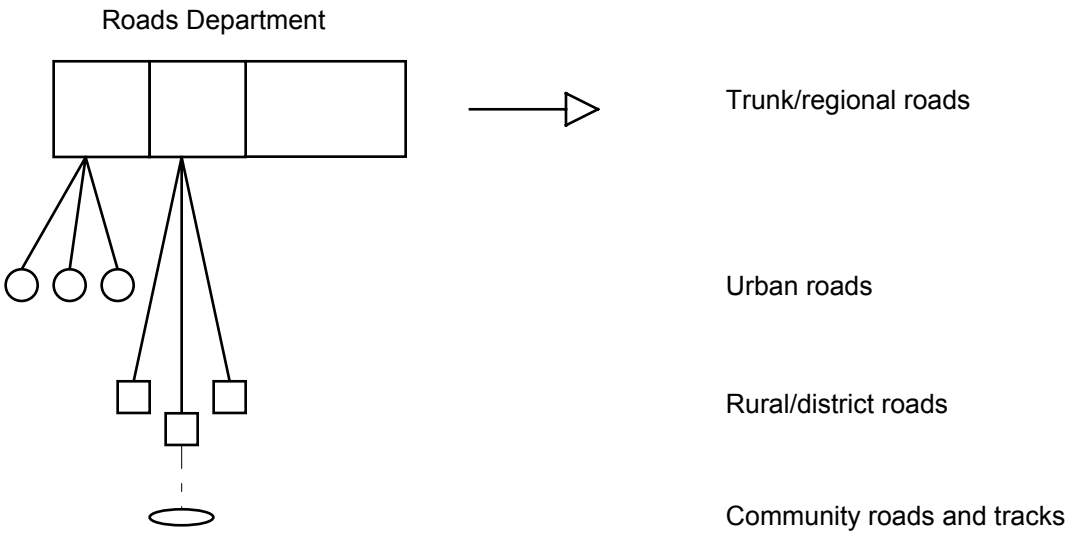
8.2 MANAGING THE ROAD NETWORK

For purposes of defining managerial responsibility, the road network is usually divided into six functional classes. Working from the bottom up, they are: (i) community roads, (ii) special purpose roads, (iii) rural roads, (iv) urban roads, (v) regional roads, and (vi) major trunk routes. There are several ways of assigning responsibility for managing these roads. The preferred choice usually depends on the size of the country, the extent of motorization, and the structure of the central and local governments. The three management models which are most common include the single-tier, double-tier, and three-tier systems. Each is outlined below.

8.2.1 Single-Tier Systems

The simplest model is the single-tier road agency where one or more central government agency is responsible for managing the entire road network (see Figure 8.1). Community roads, which essentially consist of the unclassified road network, may either be left in the hands of village councils or placed under the jurisdiction of the central government. This model suits small, compact countries with a centralized system of government. Both Sierra Leone and Ghana have chosen this model.

Figure 8.1 Diagram Illustrating Single-Tier Organizational Structure



In Sierra Leone, which has a classified network of 11,669 km (including 360 km of urban roads), management of the entire road network has been put under the jurisdiction of the Sierra Leone Roads Authority (SLRA), established in 1992. To ensure that the management of feeder roads keeps in touch with local communities, the Authority has a special Feeder Roads Department which deals exclusively with the 4,254 km feeder-roads network. The Authority also has powers, as yet untested, to delegate responsibility for managing selected parts of the road network to local government agencies or other competent bodies. It is expected that, as the road

network expands, management of some urban roads and parts of the rural road network will be delegated to local government agencies.

Ghana also operates a single-tier system. However, being a much larger country (it is over three times the size of Sierra Leone), it has established three separate central government agencies, under the Ministry of Roads and Highways, to manage different parts of the road network. The entire 21,830 km feeder-roads network, that includes all roads that were formerly private or managed by the Cocoa Board, is managed by the Department of Feeder Roads (DFR). The 2,801 km urban road networks in Accra (partly), Tema, Sekondi/Takoradi, and Kumasi are managed by the separate Department of Urban Roads (DUR). Finally, the 14,100 km trunk road network, including urban roads outside the four main cities, is managed by the Ghana Highway Authority (GHA).

It is worth noting that Ghana had a single highway authority in 1974 which was responsible for managing all roads in the country. However, in 1981 the government found it necessary to create the DFR to improve the management of rural roads. Experience with the DFR suggests that a strong, highly decentralized, feeder-roads agency working alongside the main road agency (they both belong to the same ministry) can be a highly effective way of managing rural roads. The DUR was likewise created in 1988 to strengthen the management of urban roads. The intention with the DUR is to eventually transfer responsibility for managing urban roads to municipal governments as soon as they have developed the capacity to manage them. Responsibility for maintenance has already been transferred to the Accra Metropolitan Assembly, and the same will eventually happen in the other three major cities. The GHA also operates a short section of toll road between Accra and Tema and is considering expanding the toll road network under concession agreements with the private sector.

8.2.2 Two-Tier Systems

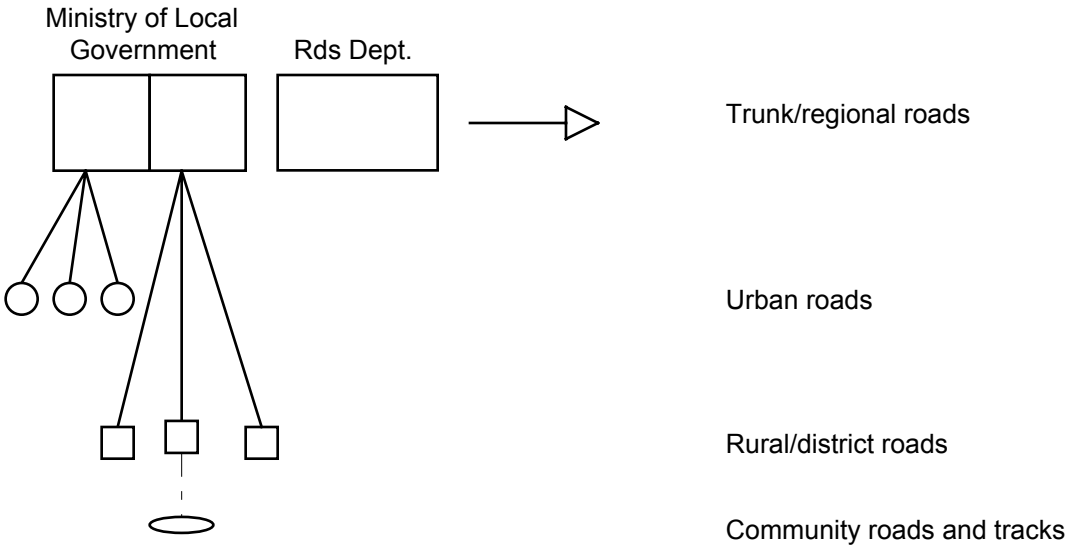
Two-tier systems make a clear distinction between the central and local governments (see Figure 8.2). They also tend to leave more roads in the hands of local communities (e.g., village councils). The model suits larger countries where it is not feasible to effectively manage an extensive road network through a system of centralized road agencies. Both Tanzania and Zambia have chosen this model. Tanzania is about four times larger than Ghana, while Zambia is three times larger. On this scale, single-tier systems tend to break down since a single road agency — generally lodged in the ministry of works — becomes too remote from the actual users of the road network.

Tanzania has an extensive network of unclassified roads. There are at least 28,000 km of such roads which serve game parks, large commercial farming interests (tea, cotton and pyrethrum), or local communities. Central and local governments take no formal responsibility for these roads, although some efforts are currently being made to find better ways of dealing with them.[35] However, whatever responsibility the government assumes for community roads tends to be dealt with as an extension of local government responsibilities. The 36,000 km network of classified district roads are managed by eighteen urban district councils (4,007 km) and eighty-four rural district councils (31,989 km). These are clearly very small networks with an

[35] Tanzania has several donor-financed pilot programs which are helping local communities to establish priorities and, in the case of roads and tracks, to get finance for improvement and new construction. The finance only covers costs of bought-out materials, leaving the local communities to carry out the works on a self-help basis, or pay for the labor themselves.

average length of only about 353 km. For purposes of administration, district councils report to the Prime Minister's Office, which is responsible for all matters pertaining to local governments. Finally, the 28,011 km main road network, comprising 10,300 km of trunk roads and 17,711 km of regional roads, is managed by the Department of Roads (and Aerodromes) which forms part of the Ministry of Works, Communications and Transport. There are several important international transit routes in Tanzania which are managed as part of the overall trunk road network.

Figure 8.2 Diagram Illustrating Two-Tier Organizational Structure



The organizational structure in Zambia is similar, although the road network is much smaller. The official unclassified network is a mere 5,714 km, although it is thought that the actual unclassified network may be between 20,000 km and 30,000 km. These roads are managed by the Game Department and by local village councils. The 19,600 km district road network is managed by eight urban districts (3,625 km) and fourty-eight rural district councils (15,980 km), which operate under the overall jurisdiction of the Ministry of Local Government (MLG). Again, these are very small road networks with an average length of only about 350 km. Finally, the 20,783 km main road network, which includes 3,119 km of international trunk roads, is managed by the Roads Department under the Ministry of Works. The trunk road network serving interregional transport needs is managed through nine Provincial Roads Department offices. International trunk roads, which are considered a particularly important part of the Zambian road network, are managed directly from Roads Department headquarters.

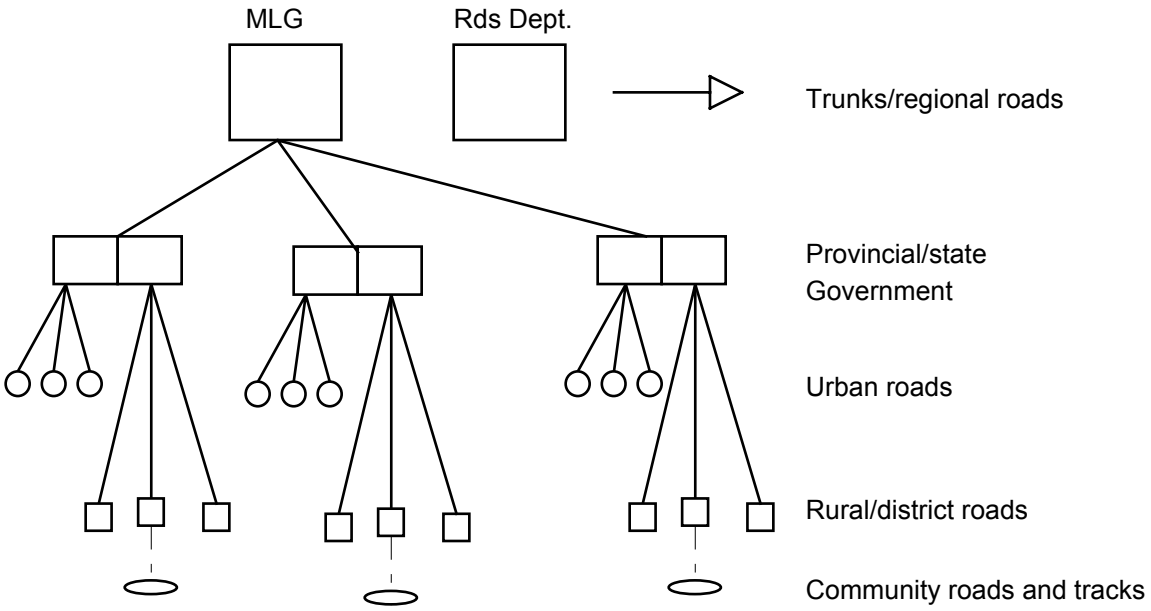
There are two points worth noting about the above management arrangements. First, district council road networks are very small, and it is almost impossible for them to establish a free-standing road agency with the technical capacity to manage these small road networks. As a result, most district road networks, particularly in rural areas, are badly managed and poorly maintained. The governments in both Tanzania and Zambia are therefore in the process of improving arrangements for channeling funds to district councils and strengthening the management of district roads. In the case of rural district roads in Zambia, the government is also providing technical assistance to district councils through a newly established Feeder Roads Section in the MLG. The technical assistance helps the rural districts prepare their road programs and provides training and advice to support the implementation of approved programs. Second, the separation of responsibility for main roads from that for rural roads–the former being under

Ministry of Works and the latter under the MLG–has not proved particularly effective. As a result, Tanzania is proposing to transfer overall responsibility for rural roads to the Ministry of Works, and Zambia is considering what to do with the MLG's Feeder Roads Section in the longer term.

8.2.3 Three-Tier Systems

Three-tier systems add a third layer to the management structure, usually by adding provincial or state governments to the model (see Figure 8.3). The hierarchy thus follows from the central, to the provincial (state), to the local governments. These countries also tend to have large unclassified road networks which they leave in the hands of local communities. The model suits larger countries like Nigeria and Madagascar. Both countries are roughly the same size as Tanzania and Zambia.

Figure 8.3 Diagram Illustrating Three-Tier Organizational Structure



Nigeria has a clear three-tier structure. Responsibility for the rural road network, of 108,700 km, and the urban network, of 21,875 km, is assigned to over 600 local government authorities (effectively rural and urban government agencies). Because of the recent proliferation of local government authorities in Nigeria (in 1976 there were only 301), the average length of their road networks — about 218 km — is even smaller than the district councils in Tanzania and Zambia. The second tier consists of state road networks. It comprises about 30,500 km of roads which are managed by 20 state governments. The average length, 1,525 km, is quite small, but is large enough to support a viable road maintenance organization. Finally, there are 28,600 km of main roads, including 1,150 km of tolled roads, that are managed by the Federal Highway Department, which forms part of the Federal Ministry of Works and Housing. However, although tolls are collected over part of the federal highway network, these roads are not managed as toll roads. The toll revenue is simply treated as general tax revenue.

Madagascar also has a fairly clear three-tier structure, although it also has a network of about 15,000 km of unclassified roads and tracks which are left in the hands of local

communities. The classified network starts at the first level, with about 13,000 km of rural access roads which are managed by 110 local government departments. These networks, with an average length of less than 120 km, are even smaller than those in Nigeria. The second tier comprises the provincial road networks. It consists of about 11,000 km of roads which are managed by six provincial governments.[36] The average length, 1,800 km, is larger than that in Nigeria and large enough to support a viable maintenance organization. Finally, there are 10,150 km of main roads (including 1,507 km of urban roads) which are managed by the Ministry of Public Works.

The surprising thing about these examples is the small size of the first tier road networks. At this small scale, it is difficult to carry out maintenance efficiently. The same problems arise in three-tier systems when central government responsibilities are divided between the ministry of works and another ministry dealing with local government. Where feasible, central government responsibility for roads should fall under one ministry. Finally, it is also surprising that Nigeria does not operate its tolled roads on an autonomous basis to strengthen performance and improve managerial accountability.

8.3 MANAGING ROAD TRAFFIC

The concern here is with responsibility for those characteristics which interact with the road network and affect the management and financing of roads. The assignment of some responsibilities is fairly obvious, since they are widely recognized as an intimate part of the overall road management function. Road signs and signals fall into this category (they are, in any case, usually specified under international agreements), as do road design standards. These are clearly a central government responsibility and will usually be delegated to the agency responsible for managing the main road network (in Zambia, they have been delegated to the National Roads Board). The agency with prime responsibility may nevertheless delegate some of these responsibilities to lower level road agencies (e.g., for road signing in urban areas).

At the other extreme, it is clear that control of parking, particularly on-street parking, and management of urban road congestion should be assigned to the agencies responsible for managing the urban road networks. The two issues are closely linked, tied to the issue of urban road safety (particularly pedestrian-vehicle conflict), and are essentially local in nature. They are therefore generally dealt with most effectively at the local government level in conjunction with local level policing. Traffic regulations, particularly those dealing with the routing of heavy vehicles in cities, are also largely a local matter. They either form part of local level traffic management or, in the case of heavy vehicles, are intimately related to control of vehicle impacts and construction of local relief roads and urban by-pass schemes. Although the broad framework for these regulations should be set at the central government level, their detailed application needs to be delegated to the agencies responsible for managing the urban road networks.

More problematic are the questions of vehicle weights and dimensions, vehicle safety, vehicle emissions, and the environmental impacts associated with new road schemes. Overweight vehicles damage the road pavement and increase road maintenance costs, while permissible vehicle dimensions affect road design standards and hence construction and maintenance costs.

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[36] New legislation is under consideration which provides for the creation of twenty-two to thirty-two new regional organizations to replace the six provincial authorities.

All road agencies therefore have a vested interest in seeing that these regulations are well designed and consistently enforced. Axle-weight regulations are the most important, but the most difficult to enforce. The regulations are promulgated by the central government, following consultation with concerned road agencies, while enforcement is generally left to the police. Reviews of past enforcement efforts have pointed to three areas of weakness: lack of clearly assigned responsibilities, weak enforcement agencies, and resistance by the road transport industry. Part of the solution thus lies in assigning responsibility more clearly to the agency managing the main road network. The key nevertheless lies in winning the support of the road transport industry. Without their support, most initiatives will fail. That is why the recent initiative in Zambia involving the appointment of voluntary road traffic commissioners to supervise weigh-bridges warrants serious consideration (Chapter 6, Box 6.2). Tanzania is also considering using the private sector to help enforce axle-weight regulations.

Regulations governing vehicle safety and vehicle emissions are usually administered in conjunction with the issuing of vehicle licenses. In some countries this is done by central government (e.g., Tanzania), while in others it is handled by local governments (e.g., Zambia and Mozambique). Administration is generally done by the transport ministry (licensing branch) or by the local tax office. Since about half of the vehicles in Africa are unlicensed and uninsured, vehicle safety and emissions regulations, where they exist, are not effective. Road agencies have a clear interest in vehicle safety since it affects the usage of the road network and has an important impact on road safety, for which most road agencies also have some responsibility. It may therefore be worthwhile to assign responsibility for regulating vehicle safety to the agencies responsible for managing the road network and, since this involves vehicle inspection, to also assign them responsibility for administering vehicle emissions regulations. However, it is only worth doing this if the agencies have the skills and resources to carry out the inspections properly.

Finally, there is the important question of assigning responsibility for dealing with the environmental impacts associated with new road schemes.[37] Such schemes can have major environmental impacts. They may inadvertently result in damage to ecologically sensitive areas, destroy property, displace people, or disrupt established settlement patterns, particularly in urban areas. The road agency should, at least in principle, be assigned the responsibility of ensuring that adverse environmental impacts are minimized and that remaining impacts are considered acceptable. The usual way of doing this is by ensuring that major road schemes are subjected to some form of environmental assessment process involving public consultation.[38] The responsibilities assigned to a road agency should thus include the need to undertake environmental impact studies for major road schemes and to use them as the basis for undertaking public consultations.

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[37] Responsibility for the environmental impacts associated with new road schemes is not the same as responsibility for dealing with the environmental impacts associated with road traffic. Road agencies have little control over the latter impacts, which are mainly affected by the tax structure (which influences the size of vehicles, their age, the type of fuel used, etc.), vehicle emission regulations and inspection procedures, and the quality of imported and locally refined fuel. These responsibilities are normally assigned to the ministries of environment, energy, and finance.

[38] A study of the circumstances which might make it desirable to discuss the impacts of major road schemes in the context of a public inquiry is currently being carried out in Tanzania.

8.4 THE BASIC ORGANIZATIONAL MODEL

The above discussion leads to the following suggestions for strengthening organizational arrangements:

(i) It is best to leave community roads under the jurisdiction of village councils and other local government bodies.

(ii) Since local communities usually lack the financial and technical capacity to manage their road networks, a higher level road agency (perhaps at the regional or provincial level) should be contracted to provide them with technical advice and act as a channel for transferring financial resources. Local communities should be encouraged to undertake most work on a self-help basis, and outside financial support should be confined to meeting the costs of bought-out materials.

(iii) Rural roads have special characteristics and require special attention. A single-tier systems requires a separate Feeder Roads Department. In two and three-tier systems management should be handed over to local government agencies at the provincial or district levels, while keeping management coordinated at the central government level by having a single ministry responsible for roads. Central government also needs to provide funds and technical assistance.

(iv) Since most rural district councils are small and have limited technical and financial capacity, they should be encouraged to manage their road networks under contract or by combining with other rural district councils to form a larger operating unit with sufficient scale economies to make sound management feasible (perhaps combining them on a provincial basis). A formal arrangement should also be put in place to ensure that rural district councils have access to technical support services.

(v) Roads in villages can be managed by the main road agency, while those in larger urban areas should eventually be managed by the municipality or town council. Some support may be required in the interim to help them develop the required managerial capacity. This could come from the main road agency or a special urban roads department at the central government level.

(vi) International transit routes are important in some countries and often deserve special treatment. They may either be managed by a dedicated section of the main road agency or, where traffic volumes are high enough, could even be operated as toll roads.

(vii) There is little point in having toll roads unless the revenues are spent on roads and the arrangement is used to improve performance and strengthen accountability. Such roads should ideally be operated on an autonomous basis, either by the main road agency, under a management contract, or under a private sector concession agreement.

(viii) The main road agency should be assigned all regulatory responsibilities affecting the entire road network (e.g., design standards and signs and signals), even though it may delegate some of these to other road agencies or other competent bodies.

(ix) Urban road agencies should be assigned those responsibilities which have significant urban impacts (e.g., control of parking and congestion and routing of heavy vehicles).

(x) The main road agency should be assigned responsibility for enforcing axle-weight regulations. This should ideally be done in conjunction (and with the cooperation of) the road transport industry. The main road agency could also carry out vehicle safety and vehicle emission inspections, provided they have the skills and resources to do them properly.

(xi) All road agencies should be made responsible for examining the potential environmental impacts of new road schemes and should be required to satisfy the public that adverse impacts have been minimized and that remaining impacts are acceptable.

9 INTRODUCING SOUND BUSINESS PRACTICES

Public sector agencies tend to function most efficiently when they are faced with some form of competition or a competition surrogate. Competition creates market discipline, which is the primary factor that motivates managers to cut waste, improve performance, and allocate resources efficiently. Previous chapters have suggested ways of creating such discipline by introducing an explicit road tariff (to encourage users to demand value for money), linking revenues and expenditures (to create a hard budget constraint), and involving users in management of roads. Another option is to unbundle services and contract them out. These strategies strengthen market discipline and provide managers with the incentive to operate efficiently. The corollary is that managers need to work within an organization which can respond to market discipline. They need a clear and unambiguous corporate mission, competent staff, a sound management structure, appropriate management systems, and sufficient autonomy to enable them to run the agency efficiently. These topics are examined below.

9.1 DEFINING THE MISSION

The first task is to state clearly the role of the road agency: what is it supposed to be doing? It is surprising how few road agencies have any vision or mission statement to guide their operations. The Ghana Highway Authority has one of the clearest: "The vision of the Ghana Highway Authority is to ensure that Ghana has a smooth, economic, efficient, safe, and reliable trunk road network linking national, regional, and district capitals and other major towns in Ghana to themselves and to major towns in neighboring countries. The network also forms the main routes for internal distribution, defense, export, and import in harmony with other modes of transportation." From this vision statement they have derived a simple mission statement: "To provide a safe and reliable trunk road network that should facilitate socioeconomic development in the country." Malawi has a similar mission statement: "The main objective of the Ministry of Works is to have a viable network of roads to enable the transfer of goods both within and outside the country."

However, most governments currently supplement these vision statements with a statement of national policy regarding civil service reform — and the associated policy of reducing the size of the civil service — development of the local construction industry, use of local consultants, and involvement of private sector financing under concession agreements. An increasing number of governments also have policies to encourage the use of labor-based work methods, particularly in rural areas. These policies, though not necessarily included in the road agency's mission statement, still have to be taken into account because they affect the size of the road agency, number of regular staff required, and type of skills they need. Although it varies significantly between countries, road agencies are being increasingly urged, as part of overall government policy, to:

- Do less construction and maintenance work in-house and more under contract with the private sector,
- Hand over government plant and equipment to autonomous plant pools or private sector agencies and hire it back only when required,

- Encourage private sector interests to construct and operate toll roads under concession agreements or to take over, rehabilitate, and operate existing roads on a similar basis,

- Do more work using labor-based work methods, and

- Reduce staff numbers as part of civil service reform.

There are some caveats. First, you cannot hand over work to the private sector unless private contractors already exist. Most countries therefore combine contracting out with initiatives to develop the local construction and consulting industry (see Box 9.1). Second, you cannot prepare bid documents, award contracts, and supervise implementation of civil works with staff accustomed only to force account work. Nor can you easily manage all contractual work through local consultants. It may be feasible at the local level (i.e., for urban and rural district roads), where a consortium of consultants and contractors could manage the road network on an agency basis, but not at the national level. Some staff in the main road agency must know something about contracting arrangements, contract law, and arbitration procedures, even if only to be able to advise local authorities about them.

Third, labor-based work methods will only work when road agency staff are familiar with them, government procurement and payment methods have been adapted to favor small-scale, labor-based contractors, and small-scale contractors have access to training in labor-based work methods. Finally, there are limits to how far one can go with contracting out, particularly at the national level. The main road agency is often the only source of training in labor-based work methods and, since staff rarely join the road agency from senior positions in the construction industry, may provide the only source of training for road agency staff in road construction methods. In Botswana, Ghana, and Zimbabwe, in-house construction units are seen as important training grounds for small-scale contractors and in-house staff. These caveats have to be taken into account when translating the mission statement into country-specific actions on the ground.

In keeping with the above mission statements and overall government policies, most road agencies are evolving into white-collar agencies which concentrate on planning, training, contract supervision, and the monitoring and control of works. This generally means they end up with a mission where they:

- Do most design work using consultants,
- Do all periodic maintenance under contract,
- Do most routine maintenance under contract,
- Do all new construction and road improvements under contract.

The larger road agencies may also operate one or two mobile maintenance units (one for emergency works and the other for training), an in-house construction unit for training purposes, and a labor-based training program for small-scale contractors linked to on-site programs of road construction, rehabilitation, and maintenance.

Box 9.1 Developing Domestic Contractors for Road Maintenance

A number of initiatives have recently been taken to develop the capacity of local contractors. They have concentrated on: (i) providing preparatory training, (ii) providing hands-on training, (iii) providing access to plant and equipment, (iv) assisting road agencies to acquire the skills to supervise contracts, and (v) simplifying government procurement procedures.

Preparatory training. Seminars have been organized, or are under preparation, in Burundi, Ghana, Tanzania, and Zaire to teach contractors how to manage small civil works contracts. The most comprehensive seminar program for contractors is in Tanzania. It offers training for administrative managers, engineers, site superintendents, and technicians. The owners and managers of the firms have also asked to participate in the training so that they can understand what is being taught to their staff.

Hands-On training. Potential contractors have been permitted to work on small projects to gain practical contract experience. In Ghana, sections involving 5 km of road rehabilitation have been used as training works for implementing labor-based work methods (contract value around $50,000). Similarly, in Guinea Bissau, the International Labor Organization (ILO) has organized 3 km training sections for labor-based rehabilitation of feeder roads. In Uganda, contractors have been trained on 10 to 15 km road sections under contracts amounting to about $100,000. In Kenya, contractors have been progressively trained to bid for road rehabilitation works. The first time unit prices were fixed by the road agency. The second time contractors were allowed to bid on the same rates but with a plus or minus factor. Now they have to compute their unit prices themselves. Current contracts amount to about $500,000 each. In Tanzania, training works for equipment-based road rehabilitation are 30 to 70 km in length and are estimated at $1 to $2 million per contract.

Availability of plant and equipment. These initiatives have focused on helping contractors get better access to plant and equipment. A plant pool has been in operation in Ghana for years and has helped to develop domestic road contractors. In Uganda, rented equipment belonging to the Ministry of Works was made available to contractors, but it was not sufficient. Contractors therefore decided to buy additional machinery and share it from a pool. Renting equipment to contractors is being considered by the ministries of works in Burundi, Guinea, Tanzania, and Zaire. The Integrated Roads Project in Tanzania is providing contractors with access to foreign currency to enable them to buy equipment and spares.

Contract supervision. Most road agencies have a limited capacity to supervise contracts and several initiatives are under way to strengthen this capacity. Burundi, Guinea, Guinea-Bissau, Tanzania, and Zaire are all building or strengthening control units in the road agency in order to adequately supervise contracted road works. In each case, foreign expertise is involved in preparing sample documents for preparation, procurement, and supervision, staffing the unit during the initial years, and training civil servants in this new activity.

Simplifying procurement procedures. Simplification of procurement procedures is an essential component of efforts to do more work under contract and develop the local construction industry. In Ghana, a comprehensive review of conditions of contracts for ICB and LCB has been carried out under the Road Rehabilitation and Maintenance Project. Proposals for changes have been prepared and accepted. New conditions of contracts are being implemented. If implemented earlier, some specific clauses, such as provision for compensation for delayed payments, might have prevented some contractors from going bankrupt, although there is no substitute for prompt payment. In Chad, Guinea Bissau, and Tanzania, governments have decided to reshape and simplify the regulations for procurement and contract administration to make them easier for contractors.

Source: J-M Lantran.

Finally, the mission statement has to be operationalized by translating it into a specific set of objectives (e.g., *pot-holes on arterial roads will normally be repaired within one week of being reported*) and service standards, which define the thresholds that trigger action on these objectives (e.g., *a pothole is defined as localized, severe raveling extending to greater than the full depth of the surfacing*).

9.2 HUMAN RESOURCE REQUIREMENTS

Once the road agency has defined its mission, it can turn its attention to the number and type of staff needed to discharge this mission. The above mission could clearly be handled by fewer staff, but they need different qualifications. The regular staff could be quite small and could be supported by lengthman subcontractors for most routine maintenance work, small-scale, labor-based contractors for the rehabilitation and periodic maintenance of gravel roads, and regular contractors for the patching, periodic maintenance, and rehabilitation of paved roads (see Table 9.1).

For a road network of about 20,000 km (5,000 km paved), it would require about 800 to 1,000 regular staff (fourty to fifty engineers, about 100 technicians, administrators and foremen, 500 to 600 supervisors, and about 100 laborers). It would also require about 5,000 to 6,000 lengthman subcontractors and, with road maintenance fully-funded, more than 2,000 additional staff would be involved in contract rehabilitation and maintenance work. It is significant that the Department of Feeder Roads in Ghana, which used to manage a 22,000 km road network with 2,000 staff, now does so with 700, including about fourty engineers. By these standards, virtually every road agency included in Table 3.2 is over-staffed.

Table 9.1 Estimated Number of Staff Required to Operate a Medium-Sized Road Agency

Function[a]	*Managerial/ professional*	*Technical/ administrative/ foreman*	*Charge-hand/ supervisor*	*Laborer/ lengthman*
Management	5	10	-	-
Other HQ staff	15	25	-	-
Regional offices	20	50	500	-
Road management system	3	10	10	-
Mobile maintenance unit[b]	2	6	12	120
Labor-based training unit[c]	2	5	25	-
Total	47	106	547	120

a. 20,000 km road network managed through ten regional offices.
b. Mainly for emergency maintenance and training in-house staff.
c. Provides training in labor-based construction, rehabilitation, and maintenance.

The above reduction in size needs to be accompanied by a significant improvement in the terms and conditions of employment, particularly for older staff with experience and for the chief executive officer (CEO) and directors. In general, as Chapter three points out, current salaries for engineers and technicians now need to be increased by about two and a half times to make them competitive with the private sector. In some countries — notably Rwanda, Uganda, Tanzania and Zambia — they need to be increased by more, as do the salaries of the CEO and directors. Allowances also need to be revised. There was a time when road agency staff enjoyed all sorts of perks which made up for lower salaries. Inflation has eroded these fringe benefits and private sector employers now offer better bonuses, housing allowances and car allowances. Salaries for laborers tend to be less out of line with the private sector, but also require adjustment.

At first glance, the above downsizing will create a large number of redundancies. However, restructuring and downsizing can normally be handled in the following way: (i) a large number of existing laborers can be converted into lengthman subcontractors, (ii) with road maintenance fully-funded, road contractors would start recruiting new staff and this would create new jobs for road agency staff, (iii) daylighting by technical staff is now so widespread that many would join their other employers on a full-time basis, and (iv) the remaining displaced staff would have to be offered a redundancy package. The Ghana and Sierra Leone Highway Authorities managed to reduce their staff from 8,400 to 4,700 and from 10,000 to 1,400, respectively through voluntary retirement and by converting staff into petty contractors. The road agency in Senegal has dramatically reduced its staff by offering redundancy packages (up to two years salary). Other countries, notably the UK, managed to reduce the number of engineers and technicians by negotiating their transfer to private sector consultants in conjunction with the transfer of agreed design and supervision work. Downsizing is not only necessary, its feasible.

A smaller road agency must also address its skill-mix requirements. The agency will be smaller, more commercial, and more of a planner, facilitator, and paymaster. It will thus need more managers, more staff with financial backgrounds, and more engineers with experience in contract management, contract law, and arbitration procedures. With an increased focus on labor-based work methods, it will also need staff who know when such techniques are suitable and must be in a position to provide training to small-scale contractors doing labor-based work. These changes require new personnel policies and revised training programs. They also call for a new look at technical assistance programs. With a clear mission and competent, well-paid staff, there should be no need for long-term expatriates in line management positions. Technical assistance can instead be refocused to meet clearly identified skill needs.

9.3 MANAGEMENT STRUCTURE

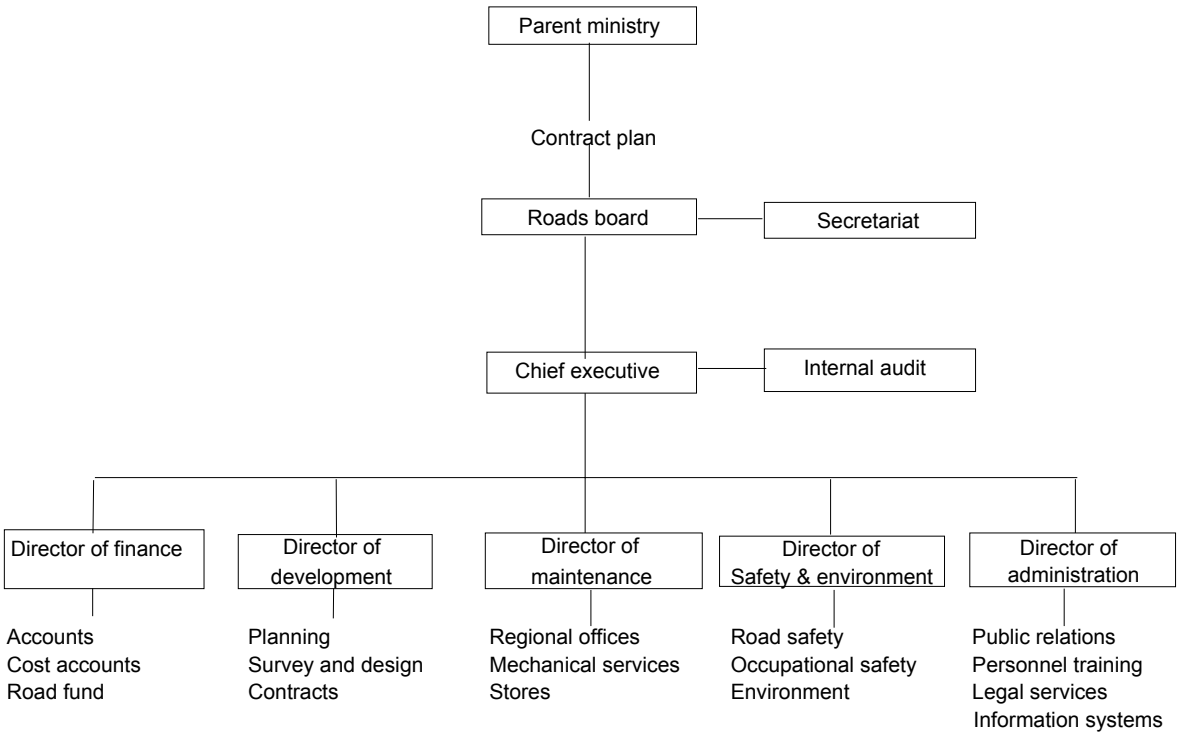
Chapter 3 pointed out that most road agencies have management structures which date back to the time when the Ministry of Public Works spent about as much time on roads as it did on maintenance of public buildings and procurement of government vehicles. That is no longer the case. Roads departments now typically account for over 70 percent of the ministry's total expenditures and are responsible for managing more assets than either the railways or national airline. The head of the roads department is nevertheless appointed at a level which corresponds to that of chief civil engineer in the railways and chief mechanical engineer in the airline. Furthermore, the organization chart of a typical central government road agency exhibits four structural weaknesses: (i) it is missing a layer of management, (ii) several important functions do not report to the director of roads and are shared with other departments (e.g., personnel, finance, and training), (iii) the director of roads rarely reports directly to the permanent secretary (in contrast to the railways and airline which report directly to the PS of works or transport), and (iv) the structure is usually overly centralized.

Some road agencies have already been restructured to create a more commercially oriented management structure along the lines illustrated in Figure 9.1. The highway authorities in both Ghana and Sierra Leone have established the post of CEO and created a new layer of line managers appointed at roughly the same level as the former director of roads. The GHA has three line managers (deputy CEOs) responsible for administration, development, and maintenance, while SLRA has a deputy CEO and five directors responsible for equipment and supplies,

development, administration, maintenance, and feeder roads. The CEO and his deputy in Sierra Leone are appointed by the president on the advice of the minister of works, while line managers are appointed by the board. Tanzania is proposing a similar form of restructuring involving the creation of a separate department of Public Roads (instead of the current Department of Roads and Aerodromes), headed by a commissioner and four directors responsible for development, road maintenance, feeder roads, and administration. The growing importance of financing arrangements, combined with a move toward commercial accounting systems, suggests one line manager should be responsible for accounting and finance.

The above restructuring has also addressed the issues of shared services and confused reporting arrangements. Nonroad activities have been removed (e.g., responsibility for aerodromes in Tanzania), and the road agencies have been given their own support services (e.g., administration and accounting). Reporting arrangements have also been simplified and made more direct. Regional engineers report directly to the CEO (in Tanzania they reported to the PS, and Madagascar has a similar arrangement), and the CEO reports through the board to the PS. Similar reforms have also taken place with regard to urban and rural roads. In Ghana, the departments responsible for urban roads and feeder roads report directly to the Ministry of Roads and Highways in the same way as the GHA. Likewise in Zambia, where rural roads are dealt with through a feeder roads section in the Ministry of Local Government, the departmental head now reports directly to the PS.

Figure 9.1 Proposed Management Structure for a Large Road Agency



The GHA has taken the process of restructuring one stage further. It noticed that there were a large number of job grades and that grades were not related to the size of the division or needs of the task. There was also too much layering. They therefore prepared new job

descriptions based on current functional needs, designed a new organizational structure for each division based on the new job descriptions, reduced layering by grouping staff into three broad categories (senior management, middle management, and operating staff), introduced a new reward and career system, and reviewed and revised the disciplinary code. Other road agencies are beginning to do the same.

The regional structure of the road agency is also important, particularly in large countries where centralized agencies remain too remote from their constituents. Several countries are attempting to address this issue by decentralizing operations to regional offices. Under such arrangements, most planning and execution is done at the regional level, while the headquarters staff coordinate regional programs, operate the management information system and provide other central support services. In the case of main roads, the headquarters staff may also deal with trunk roads (Tanzania), or international transit corridors (Zambia). Up to 80 percent of the staff may thus be placed in regional offices. In Ghana, 90 percent of the feeder roads staff work in the regions. Tanzania has also appointed regional roads boards to decentralize the management of roads to the local level and improve coordination between trunk, regional, and district road programs.

9.4 MANAGEMENT INFORMATION SYSTEMS

Management cannot plan, deploy, and control resources without effective management information. The road agency's parent ministry and constituents likewise need transparent information to judge whether the road agency is using resources efficiently. The management information system consists of a set of established and documented procedures which can be used to generate and evaluate alternative ways of operating, maintaining, improving, and extending the road network. It will generally show the condition of the road network, its utilization (traffic volumes and loading), and the impact of potential future management interventions. This information can then be used to generate information on the physical and financial performance of the road network (see Box 9.2).

The management information system provides a framework for making decisions on a number of issues, usually handled by different divisions within the road agency. They include decisions on:

- Routine and periodic maintenance of gravel roads, paved roads, and bridges,
- Rehabilitation of pavements and bridges,
- Upgrading gravel roads to paved standard,
- Improving the geometric characteristics, or capacity, of roads,
- Setting charges for the use of roads and bridges.

Each of the above activities are interdependent with regard to the road agency's budget constraint. Resources have to be allocated between competing programs to optimize expenditures, and user charges must be set to generate the resources required to finance them. The management information system should thus provide the basis for allocating resources in a manner which achieves best overall road conditions.

The management information system will usually comprise data collection, storage and analysis, estimated traffic, predicted future road conditions, and the impact of alternative management strategies. The system need not–and should not–be too complicated. Africa is littered with the relics of failed management information systems which were poorly designed and overly complicated (see Box 9.3). The key guiding principle is that the system should be affordable, suit the decisionmaking needs of the road agency, be compatible with the scarce manpower resources needed to operate it, and be capable of being incrementally upgraded when resources permit. Most road agencies in Africa will start with a centralized, manual system with four modules: (i) traffic information (classified counts with some axle-weight data), (ii) a survey database (periodic, visual road condition survey data), (iii) road planning (upgrading and new roads), and (iv) maintenance management (using engineering judgment and standard unit costs). This roughly corresponds to the current system used by the Ministry of Works in Tanzania. It is about as simple as you can get, although some road agencies, as presently staffed, will not even be able to manage this level of sophistication. For a 20,000 km road network (5,000 km paved), the system would require about two to three traffic count teams, two road inspection teams, and at least one engineer and one technician to operate the system. Traffic counting and inspection could be done by consultants. The engineer and technician should ideally be in-house staff.

The next level of sophistication is probably to computerize the system and make it accessible to regional engineers. The system in Zimbabwe has currently reached this stage. The survey database might then be extended (to include surface roughness and pavement strength), and the pavement management system might be strengthened by basing it on an analytical model, like HDM III. However, this takes more resources, requires continuity among the staff operating the system, and should only be attempted when there are sufficient trained staff and other resources to operate the upgraded system. Further sophistication can then follow, perhaps along the lines being pursued in Botswana, although that level of sophistication lies well in the future for most African countries (see Box 9.4).

Box 9.2 Key Indices for Measuring Road Agency Performance

(1) Finance:

- Ratio of actual to required maintenance expenditures
- Ratio of new investment to total road expenditures
- Routine and periodic maintenance expenditures per km

(2) Condition of network:

- **Condition of pavement**
  percentage length in good, fair, poor condition by road type and class in terms of specific physical measures, such as roughness or condition ratings, or in terms of visual assessment,
  km backlog of rehabilitation and resurfacing,
- **Condition of bridges**
  number of bridges in terms of structurally and functionally sound, structurally deficient, or functionally deficient

(3) Utilization and management of network:

- **Traffic flow**
  km of road by range of average annual daily traffic according to functional class and road width
- **Vehicle size and weight**
  single and tandem axle load limits
  average gross vehicle weight per heavy vehicle
  average equivalent standard axle per heavy vehicle
- **Safety**
  total accidents, fatalities
  accidents or fatalities per road km, per vehicle, per vehicle-km

(4) Administration and productivity:

- **Staffing**
  by function (e.g., administration, planning, design, maintenance, or construction), age profile, number of expatriates, and vacancies
- **Annual salary range**
  highest versus lowest paid
- **Labor intensity**
  staffing ratios: ratio of administrative to technical staff, ratio of skilled to unskilled workers, ratio of permanent to temporary staff
  total staff and engineers per lane-km (for all activities and separately for maintenance)
- **Equipment**
  availability and utilization of equipment (by major categories and types of equipment and hours or mileage worked)
  age (by major types of equipment)
- **Average construction cost**
  per km (two-lane road) by terrain (flat, hilly, mountainous).
- **Percent maintenance by contract**
  routine
  periodic

Source: W.D.O, Paterson.

Box 9.3 Problems Implementing Road Management Systems

A recent study has reviewed projects dealing with the development of road management systems (RMSs) to identify why they encountered problems during implementation and what might be done to overcome these problems. The following factors were identified as important contributory factors:

Design problems
- Inappropriate and unrealistic terms of reference.
- Consultants lacking sufficient qualified staff.

Client attitudes
- Lack of commitment, often because the RMS had been imposed by donors as a loan condition.
- Expectation of high-tech solutions when simple common sense solutions were more appropriate.
- Greater than expected resistance to change.

Cultural problems
- Problems of introducing Western management practices, including incentives, into cultures that were gerontocracies, where interethnic problems existed, or where nepotism and favoritism were prevalent.
- Traditional behavior where excuses had to be found to avoid blaming individuals.

Economic and financial problems
- Weak local economies and *foreign exchange* shortages preventing the purchase of inputs needed to support the system.
- Local funds sufficient to pay for little more than staff salaries, with the result that little road maintenance could actually be carried out.

Staff problems
- Shortage of experienced local staff.
- Operational requirements prevented local staff from being released for training.
- Over-ambitious training programs with poorly prepared instructors.
- Insufficient follow-up training and updating.

Hardware and software problems
- Focus on procurement of new equipment, rather than systems needed for maintenance and repair.
- Deficient computer facilities and unsuitable hardware.
- Inadequate data.
- Systems too complicated to be sustainable with local staff and other resources.

In all the cases reviewed, the RMS was judged unsuccessful. All systems ceased to function effectively within a short time of the consultants departing. Failure was not due to any inherent faults in the RMS, but because institutional and managerial shortcomings in the road agency were not recognized and corrected before implementation. The study concluded that, for successful operation, systems need: (i) agreement on objectives and methods of implementation, (ii) qualified staff who are well motivated and properly supervised, and (iii) an integral training and upgrading program. More specifically, the provision of an RMS needs to be considered within the general context of the road agency's institutional structure. It was thus recommended that the following factors be borne in mind when specifying and selecting an RMS:

- Obtain genuine government commitment before proceding.
- Identify system users and the outputs they require to support informed management decisions.
- Identify the policy framework and the road agency's technical and institutional capacity to operate the RMS; if the appraisal indicates that the institutional capacity does not exist, proceed no further.
- If the appraisal indicates that an RMS is needed and can be supported, agree on objectives for the system, design it (based on an analysis of costs and benefits of each component), and prepare a procurement plan.
- Identify data and models required to produce these outputs.
- Identify appropriate software.
- Identify hardware and operating systems needed to support the RMS.

It typically takes five to ten years to institutionalize management systems in industrialized countries. It takes at least as long in a developing country.

Source: R. Robinson.

Box 9.4 The Road Management System (RMS) in Botswana

The RMS currently under development in Botswana consists of a central database linked to subsystems covering data collection, planning, and management. The role of each subsystem is summarized below.

(1) Central database (CDB) contains validated summary data generated by the other subsystems. To allow rapid export and import of data to and from the other subsystems, it uses a Fourth Generation Language database management system. The other subsystems use the same database system.

(2) Pavement management subsystem (PMS) determines the type, and optimum timing and level of maintenance required, given prevailing road conditions. It provides information on: (i) optimum maintenance requirements, (ii) the short and long-term consequences of restricted maintenance funding, (iii) pavements with the highest priority when maintenance funds are limited, (iv) the best maintenance strategy for each road link, and (v) the impact of past maintenance strategies on overall road conditions.

- At the network level, the PMS identifies and ranks pavements for improvement, prepares network level budgets, produces long-range budget forecasts, assesses network level pavement conditions, and forecasts future pavement conditions.
- At the project level, the PMS assesses causes of road deterioration, specifies alternative pavement interventions, assesses the benefits of alternative pavement interventions using life cycle costing, and selects and displays preferred solutions.

The support system for the PMS includes data collection, data analysis (using HDM III), optimization (using appropriate criteria), and preparation of an implementation program.

(3) Maintenance management subsystem (MMS) is not yet operational. Its aim will be to specify, for the selected maintenance strategy: (i) *performance standards* describing the procedures to be followed, resources required (in terms of people, equipment, and materials), and rate of production to be achieved, (ii) *budget requirements* (in terms of people, equipment, and materials) to accomplish the planned maintenance program, (iii) *schedule* of activities within the program to ensure resources are used efficiently, and (iv) a *management information reporting* system to provide the basis for regular management reports. The MMS will eventually include a road inventory, inspection reports, assessment of maintenance needs, costs of proposed works, priorities, implementation plans, and arrangements for monitoring results. It will help to improve the planning and scheduling of work, establish standards (optimum standards being set by the PMS), guide management decisions (optimum timing also being determined by the PMS), and support preparation of accurate budgets.

(4) Bridge management subsystem (BMS) is not yet operational. Its aim will be to provide a rational basis for managing bridge structures. It will eventually cover: (i) the allocation of funds for construction, replacement, rehabilitation, and maintenance, (ii) the identification of bridges requiring remedial action, (iii) the selection and prioritization of selected bridge works, (iv) the identification and prioritization of urgent remedial works, (v) the identification of the best bridge maintenance strategies, and (vi) the monitoring and evaluation of bridge conditions on an ongoing basis.

(5) Traffic subsystem (TSS) provides a variety of statistics on the road network, including traffic volume and loading by vehicle type by road link, total distance traveled, and growth rate by vehicle type by road link.

(6) Cost accounting subsystem (CASE) is not yet operational. It aims to provide accurate cost accounting data for purposes of: (i) establishing budgets and standard costs for road maintenance operations, (ii) tracking and accounting for *actual* costs of operations by activity and cost center, and (iii) monitoring performance and assessing productivity by cost center.

(7) Geographic information subsystem (GIS) allows visual presentation and production of maps of the road network. The subsystem can be configured to display and plot data for any link in the road network, such as road classification, average road condition, and traffic flows.

Resource requirements are: (i) two to three full-time traffic census teams, (ii) two road inspection teams (a technician and surveyor), and (iii) two engineers, a systems analyst, and a technician to operate the RMS.

Source: M.I. Pinard.

9.5 FINANCIAL ACCOUNTING SYSTEMS

The financial accounting system should be designed to complement and support the management information system. It should present a clear picture of the road agency's overall financial health and be capable of producing the financial data needed to plan expenditures, compare alternative strategies, monitor implementation, and account for the way funds are used. Standard government accounts, which focus almost exclusively on cash expenditures, cannot do this. A number of road agencies, notably in New Zealand and parts of Australia, are therefore restructuring their accounting systems to provide a better basis for informed management decisions. They are generally moving toward regular commercial accounting systems, including a standard *income statement*, *balance sheet* and *sources and application of funds statement.*

Many of the benefits of commercial accounting can be achieved with simpler reforms. The most important involve: (i) preparing an income statement which matches revenues and expenditures, (ii) accounting for all the assets owned directly by the road agency (i.e., excluding the capital invested in roads), (iii) recording, in a simple and transparent fashion, the financial condition of the road network, and (iv) producing better information on costs to support the above road management systems.

The SLRA produces some of the best road agency accounts in the world. To start with, they simply produced an *income statement* and a *statement of affairs*. The income statement recorded their income (income from the Road Fund, proceeds from sale of contract documents, and government grants), together with the expenditures associated with the operation and maintenance of the road network. The expenditures included *all* expenditures on roads and excluded expenditures associated with other responsibilities handled by the Ministry of Works. The statement of affairs was a modest document which simply listed the fixed assets owned by the SLRA (vehicles, plant and equipment, and office equipment), money owed to the Authority (debtors), cash in hand, and money owed by the Authority (creditors). These reforms require little more than better book keeping arrangements. The next step involved turning the statement of affairs into a regular *balance sheet* and adding a *cash flow statement* to the financial accounts. The cash flow statement is a simplified sources and application of funds statement. Their accounts for the year ending 30 June 1993 are illustrated in Table 9.2.

These financial reforms can have a major impact on managerial behavior. They provide managers with a better record of what is happening to the business; motivate them to make an effort to locate all their assets[39], value them, and record their value; encourage an *asset-management* culture; and take a first step toward fully costing the overhead and administrative costs of operating and maintaining the road network. Financial reform is thus intimately related to managerial accountability. Without proper accounts, managers cannot be fully accountable.

The next reform focuses on creating a financial statement which accounts for the capital invested in roads, the impact on this of new investment, and shortfalls in regular road maintenance. It has two parts. The first provides an estimate of the total book value of the road network at the end of the fiscal year. It can either be estimated in great detail, as was done in

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[39] When the Ministry of Works in New Zealand was commercialized and required to prepare regular commercial accounts, it was astonished to learn how much land and other assets it owned and how much these assets were worth.

Table 9.2 Financial Satements for the Sierrra Leone Roads Authority, Year Ending 30 June, 1993
(millions of leones)

I. Income and Expenditure Statement

Income for road repairs (fuel levy and government grants)		1,757.3
Expenditure on roads		(761.5)
Surplus on road repairs		995.8
Administrative expenses		(122.0)
Other income (sale of contract documents)		1.6
Grant income (Government of Japan grant)		283.3
Surplus of income over expenditure (after charging depreciation and audit fees)		1,158.7
Taxation		-
Accumulated surplus		1,158.7

II. Balance Sheet

Fixed assets		
Tangible assets (land, buildings, plant, vehicles, and furniture and equipment)		233.5
Intangible assets		209.4
Current assets		
Stocks	476.7	
Debtors	6.2	
Cash and bank balances	811.7	
Sub-Total	1,294.6	
Creditors: Amounts falling due within one year	(21.3)	
Net current asset		1,273.3
Total asset less current liabilities		1,716.2
Creditors: Amounts falling due after one year		(526.1)
Total assets		1,190.1
Reserves		
Capital reserve		31.5
Accumulated surplus		1,158.7
Total Reserves		1,190.1

III. Cash flow statement

Net cash inflow from operating activities (including depreciation)		707.5
Investing acitivities		
Payment to acquire fixed assets	(242.0)	
Value of assets taken over on vesting day	(2.0)	
Payment on behalf of Freetown Infrastructure Rehabilitation project	(209.4)	
Net cash outflow for investment activities		(453.4)
Net cash inflow before financing		254.1
Financing		
IDA advances	526.1	
Assets introduced by Department of Works	31.5	
Net cash inflow from financing		557.6
Increase in cash		811.7

Hungary,[40] or on an approximate basis. The latter method is acceptable when the results are to be used for illustrative purposes only. It is done by multiplying the length of each type of road by its estimated replacement cost, adding any required inflation adjustment to bring book values to their current replacement cost, and adding to this to any new investment completed during the year. This gives the total book value at the end of the year, valued at current replacement costs. The second part of the statement measures the erosion of capital. It is made up of four items: (i) the rehabilitation backlog at the beginning of the fiscal year (the length of road classified as being in *poor* condition, multiplied by the average costs of rehabilitating such roads), (ii) the amount of rehabilitation completed during the year, (iii) the shortfall in regular recurrent maintenance during the year (routine and periodic maintenance), and (iv) the additional costs of future road rehabilitation caused by shortfalls in recurrent maintenance (chapter two section 2.2, suggests that cuts in road maintenance increase the future cash costs of rehabilitation by a factor of two to three). Every four to five years, the estimated rehabilitation backlog should be replaced by a new estimate, based on a new road condition survey. The sum of these items provides an estimate of the current rehabilitation backlog. Finally, the above figures can be used to estimate the current value of the road network and the erosion of capital as a percent of current book values. A prototype road asset statement is shown in Table 9.3.

Table 9.3 Prototype Road Asset Statement for a Road Agency
(millions of dollars)

	December 31 1990	December 31 1991
Fixed assets		
Total book value at beginning of year[a]	2,030.00	2,035.70
Adjustment for Inflation	0	0
New works completed during the year[b]	5.70	3.90
Total book value at end of year	2,035.70	2,039.60
Erosion of capital:		
Rehabilitation backlog at beginning of year[c]	(670.00)	(714.31)
Rehabilitation completed during the year	14.95	6.94
Shortfall in recurrent maintenance[d]	(29.63)	(26.59)
Additional rehabilitation costs[e]	(29.63)	(26.59)
Rehabilitation backlog at end of year	(714.31)	(760.55)
Current value of the road network	**1,321.39**	**1,279.05**
Overall erosion of capital (percent)	**35**	**37**

a. Book values are calculated using the following replacement costs per km: paved, $250,000, gravel, $50,000, and earth, $20,000.
b. Investment in new roads and upgrading existing roads.
c. Calculated for all roads in poor condition using the following costs per km for rehabilitation: paved roads, $230,000, gravel, $36,000.
d. Required maintenance expenditures based on the following values per km: paved, $4,000, gravel, $1,000, and earth, $400. Shortfall is the difference between actual maintenance expenditures (from income and expenditure statement) and required maintenance expenditures.
e. A rough estimate based on figures given in chapter two, section 2.2. The rehabilitation backlog should be updated every four to five years, based on road condition surveys.

40 Highway Department, 1988.

Box 9.5 Establishing a Commercial Cost Accounting System for Roads: Botswana

The Roads Department (RD) in Botswana is in the process of installing a maintenance management system (MMS) as part of its overall management information system. To be effective, the MMS needs to utilize accurate cost accounting data, which can be used to estimate costs, plan future work programs, monitor implementation, and provide accurate information on overall financial performance. Although most periodic maintenance and 60 percent of routine maintenance are contracted out to the private sector, the design of all maintenance programs and the remaining 40 percent of routine maintenance continue to be done in-house, and the RD wishes to quantify the effectiveness of its in-house work and develop guidelines to increase efficiency.

The cost accounting system is being designed to achieve the following goals and objectives: (i) establish comprehensive routine maintenance budgets and job standard costs which can be compared to actual costs; (ii) establish performance standards by work activity and cost center to determine productivity and efficiency with which available resources are utilized; (iii) track and account for actual direct and indirect unit costs of operations by activity, cost center (location), and road link; and (iv) monitor performance and record progress on implementation by activity and cost center.

A database is being established, with an associated computerized coding system, to account for all anticipated inputs as follows:

Cost centers and responsibility centers. Each cost item will be coded according to its location.
Work activities. Work activities will be coded, based on an updated version of the current list of thirty-four work activities, to specify type of maintenance (routine, periodic, spot, emergency) and type of road (paved, gravel, earth).
Personnel. All personnel (industrial Class personnel, casual labor, and professional staff) will be coded by compensation level, including allowances.
Plant and equipment. This is currently supplied free by the central transport organization, but will be coded by type and fee structure (fee levels being based on recommendations included in a recent road maintenance study) to avoid biasing costs in favor of equipment-based work.
Materials and supplies. All materials and supplies used during the execution of work will be separately coded.
Overheads. These include headquarters and other indirect costs.

Sources for the above data include the *work activity weekly reports,* for quantities of labor, plant and equipment, and materials, and the s*tandard cost report,* for standard costs of each item and for overheads. The major outputs from the system will consist of weekly, monthly, quarterly, and annual cost summaries on the following topics:

- Comparison of budgeted unit costs with actual unit costs by cost and responsibility center;
- Comparison of budgeted unit costs with actual unit costs for each specific work item (labor, plant and equipment, materials and supplies, and overheads);
- Budgeted unit costs by work activity and type of road surface;
- Annual plans and budgets based on actual resource requirements and standard input costs.

It is estimated that the above cost-accounting system could be operated alongside the existing management information system without any increase in staff, but would require one additional computer plus suitable software. A consultant would also be needed for three to four months to set up the system and train staff. Although the design of the system in Botswana is unique, many of the elements can be used as the basis for setting up similar cost accounting systems in other countries. In most cases, the road agency will need to recruit a cost-accounting clerk and procure computer hardware and software to support the system, since many countries do not have access to the level of resources currently available in Botswana.

Source: C. McKudu.

The third reform focuses on the development of a better costing system. This is usually done by setting up some form of cost accounting system, as is currently under consideration in Botswana (see Box 9.5). Cost accounts show how resources are used, for what purpose, and how well they serve that purpose. In particular, they show how financial performance varies over time, between different parts of the road agency, and between work done in-house and under contract. Cost accounts provide the basic raw materials needed to operate a maintenance management system effectively. The maintenance management system defines the amount of

work required, while the cost accounting system estimates what it will cost and whether it will be cheaper to do work in-house or under contract. The system must nevertheless be kept simple and compatible with existing financial reporting systems and capable of being operated within existing staffing and other resource constraints.

9.6 STRENGTHENING MANAGERIAL ACCOUNTABILITY

Accountability requires clear management objectives, monitorable targets, a regular reporting system, systematic auditing, and effective oversight arrangements. It also requires autonomy. Managers cannot be held accountable unless they have sufficient freedom to sign and award contracts, offer reasonable terms and conditions of employment, and operate without outside interference. The first step required to strengthen managerial accountability is thus to specify clear objectives and, based on these, to set monitorable targets. It is desirable to do this in the form of a written document to avoid later disagreements and to share it with others. It is usually done by preparing a *corporate plan* and using it as the basis for negotiating a *performance contract* with the parent ministry (see Box 9.6). The GHA prepares a three-year rolling corporate plan and uses the first year of the plan to draw up a draft performance contract. The contract spells out the government's goals for the GHA, strategies for achieving them, and procedures for implementation, monitoring, and control. Monitoring is usually done in terms of the indicators outlined in Box 9.2.

Box 9.6 Basic Principles Governing the Preparation of Contract Plans

The contract plan should be developed jointly by the road agency and government, and formally ratified by both. It is primarily an implementing document, not a planning document, and will usually be based on the road agency's corporate plan, or similar statement of corporate intentions. It should be in the form of a clear, written document ratifying and committing both the road agency and the government to the road agency's objectives and policy choices defined in its corporate plan. It should clarify the authority to make decisions, clearly specify those areas where government review or approval is necessary, and set down the road agency's performance goals (in terms of road conditions, staff productivity, and financial targets). The performance goals should be simple, mutually consistent, and restricted to those items which define the direction of development and measure the performance of senior management. The contract plan should also include a statement of related government commitment, which may include budgetary support, regulatory changes, and potential changes in labor laws and procedures.

Source: L. Thompson.

Reporting systems are also an important tool for strengthening managerial accountability and should be produced on a regular basis using the sort of indicators included in the above performance contract. It is surprising how few road agencies produce such reports. Most simply produce *ad hoc* reports when preparing donor-financed road projects. The SLRA produces some of the best reports. It prepares a detailed annual budget (so do other road agencies), an annual statement of accounts audited by an independent auditor, and an annual report. The annual report includes information on the proceedings and policies of the SLRA, the audited accounts, report of the auditor, and any other information requested by the parent ministry. All road agencies should be required to regularly produce such reports.

Effective auditing is also an important tool for strengthening managerial accountability. Most auditing is done by the government audit office, which checks to ensure that budget allocations have not been exceeded and that funds have been handled according to government guidelines. This does not go far enough. Staff in the auditor general's office lack institutional

independence and the audit usually falls short of the rigorous auditing needed to account for the large sums of money associated with a fully-funded road maintenance program. Some road agencies have therefore opted for an independent audit by a member of the Institute of Chartered Accountants (as is done in Sierra Leone). Other countries have gone even further and are introducing independent technical *and* financial audits. Kenya is doing so on the rural access roads and minor roads program (using an international auditing firm working in association with a local engineering consultant), Burkina Faso has started doing so on their road maintenance program (using a local engineer, supervised by an expatriate engineer, to carry out the technical audit), and Senegal is carrying out an independent technical and financial audit of their entire road maintenance program (using expatriate engineers to carry out the technical audit).

Oversight arrangements can also strengthen accountability. The roads boards in Sierra Leone, South Africa, Tanzania, and Zambia (together with the board of the GHA, which is due to be reinstated) and the various roads committees which operate at the local government level make an important contribution to strengthening accountability, as do the boards and committees which oversee the road funds in Benin, CAR, Mozambique, and Rwanda. Such oversight arrangements should be encouraged and strengthened.

Finally, there is the question of autonomy. For over twenty years the World Bank has been urging governments to grant more autonomy to the managers of parastatals. The objective was to reduce political interference in management decisions, develop a more commercial managerial outlook, reduce overstaffing, and strengthen accountability. The same rationale applies to road agencies. Road managers will not behave commercially until the road agency is more autonomous and managers are held accountable for their performance. This has been done in Sierra Leone and Zaire with good results and is about to be reintroduced in Ghana. Greater autonomy is normally one of the cornerstones of a more commercial approach to management.

PART III

Finale

10 CONCLUSIONS

The replacement costs of the road network in SSA is about $150 billion, and it requires annual expenditures on routine and periodic maintenance of $1.5 to $2.0 billion to keep these roads in stable, long-term condition. During the past twenty years, African countries have spent nothing like this amount, and about $43 billion, amounting to nearly a third of the capital invested in Africa's roads, has been eroded because of lack of maintenance. Restoring only those roads which are economically justified and preventing further deterioration will require annual expenditures of about $1.5 billion over the next ten years. Cutting back on maintenance is self defeating. A dollar reduction in road maintenance expenditures *increases* vehicle operating costs by about $2.0 to $3.0. In Tanzania, the annual economic costs of poor road maintenance have been estimated to be between $100 and $150 million. In Kenya it is estimated that the annual $40 million shortfall in road maintenance expenditures adds about $150 million per year to vehicle operating costs. That is a high price to pay for poor road maintenance policies.

The main problems affecting road maintenance are institutional and financial. They relate to the institutional framework within which roads are managed, an inadequate and erratic flow of funds, poor terms and conditions of employment, lack of clearly defined responsibilities, ineffective management structures, weak management systems, and lack of managerial accountability. Roads are managed like a bureaucracy, not like a business. These are the root causes of poor road maintenance policies. Road managers are faced with a biased incentive system and that, in turn, leads to undue emphasis on force account work, ineffective use of plant and equipment, and lack of interest in labor-based work methods. Managers simply do not have the funds or the incentives to use resources efficiently, and nor are they penalized for poor performance.

10.1 GENERAL CONCLUSIONS

Solving these problems requires fundamental changes in the way governments manage and finance their road networks. The key concept which has emerged from the RMI program is *commercialization*: bring roads into the market place, put them on a *fee-for-service* basis, and manage them like any other business enterprise. However, since roads are a public monopoly and their ownership is likely to remain in government hands for some time, commercialization requires complementary reforms in four other important areas. These are referred to as the four basic building blocks: (i) involve road users in management of roads to win public support for more road funding, to control potential monopoly power, and to constrain road spending to what is affordable, (ii) secure an adequate and stable source of funds and introduce secure arrangements for channeling these funds to the respective road agencies, (iii) establish a clear organizational structure defining who is responsible for what, both for roads and road traffic, and (iv) strengthen the management of roads by providing effective systems and procedures and strengthening managerial accountability.

These building blocks represent the core of the required reforms. They are interdependent and should ideally be implemented together. Without all four, the reforms may only achieve part of their objective. You cannot solve the financing problem without the strong support of road users. And you cannot win the support of road users without taking steps to

ensure that resources are used efficiently. And you cannot improve resource use unless you control monopoly power, constrain road spending to what is affordable, and increase managerial accountability. And you cannot hold managers accountable unless they have clearly defined responsibilities.

The first reform focuses on winning the support of road users. They are the people who use the road network and also pay for it, whether through taxes or user charges. Major policy reforms in the road sector are unlikely to succeed without their active support. Given that current allocations for road maintenance are erratic and well below the levels needed to keep the road network in stable, long-term condition, the first building block involves winning public support for more road funding, taking steps to ensure that road agencies do not operate as public monopolies, and do not spend more on roads than the country can afford. This is an essential precondition for getting road users to willingly pay for roads on a fee-for-service basis. It is fundamental at the central government level, where most road maintenance funds are managed, and is also desirable at the regional, provincial, district and community levels.

The preferred method of involving road users at the central, regional and provincial levels is by involving them in road management boards. At least eight countries in Africa now have roads boards which operate at the national level and, in one case, also at the regional level. The oldest are the South African Roads Board (originally established in 1935) and the Board of the Ghana Highway Authority (established in 1974, but suspended by the military government in 1981). Other boards are of more recent origin and were established during the late 1980s and early 1990s. Most of these boards have members representing organizations like the chamber of commerce, farmer's organizations, the road transport industry, and the engineering profession. The most effective have independent chairmen and allow the organizations represented on the board to nominate their own representatives. Some boards manage the road fund, while others have wider responsibilities and oversee management and financing as a whole. Both Ghana (until it was suspended) and Sierra Leone have semi-autonomous executive boards which have powers to hire and fire staff, sign contracts, and otherwise operate according to sound commercial principles.

The second building block concentrates on establishing an adequate and stable flow of funds, usually by introducing an explicit road tariff to manage demand and generate the revenues needed to support the operation and maintenance of roads. Without an adequate flow of funds, none of the reforms will be sustainable. All governments in Africa are seriously short of fiscal revenues. Budget allocations for road maintenance rarely exceed 30 percent of requirements, and it is simply not feasible for governments to increase these allocations under present fiscal conditions. Improved revenue mobilization is essential. However, if road user charges are increased, there is no guarantee that the additional revenues will be allocated to roads. Traditional earmarking is not a viable solution. It has adverse impacts on the management of the government's overall budget and is rarely sustainable. An added concern is that current financing mechanisms do little to strengthen market discipline, either by managing demand or by improving the efficiency of the road agency.

Several African countries are addressing this issue by introducing an explicit road tariff consisting of vehicle license fees (or a heavy vehicle license fee), a fuel levy, and (where relevant) international transit fees. The fuel levy is ideally specified as a discrete amount, (e.g., 30 shillings per liter) to avoid the appearance of being part of the government's general tax

revenues, and is either levied in addition to all preexisting taxes or is partly additional and partly replaces existing fuel taxes. Ideally, the tariff should be set by the Ministry of Finance on the recommendation of the roads board and should be collected independently from government sales and excise taxes.

In the best examples (CAR, Ghana, and Zambia), the fuel levy is collected by the oil companies and deposited directly into the road fund. This prevents the proceeds from being siphoned off and spent on other public programs. The intention is to: (i) create a clear market signal to encourage road users to demand value for money from road spending, and (ii) link revenues and expenditures to impose a hard budget constraint on the road agency, so that more road spending means a higher tariff, while a lower tariff means less road spending. The tariff is generally set to eventually cover all costs of maintaining main roads and part of the costs of maintaining urban and rural roads. The remaining costs of maintaining urban and rural roads are financed through local taxes. The local taxes may consist of land-value increment taxes (e.g., betterment taxes or frontage fees), local property taxes, or other local taxes. Most of the countries with road funds have agreed procedures for allocating funds between different road agencies. Some use simple formulas (Ghana and Mozambique), others use formulas which are modified in relation to needs (Tanzania and Zambia), while others base them on a complex assessment of needs (South Africa).

A recent review of road funds in Africa suggest that there are several factors which contribute to successful operation. They include:

- *Collecting the revenues*. The road tariff should be collected and deposited directly into the road fund without having to pass through the Ministry of Finance account.

- *Road fund management*. The fund should be managed by a board which includes road user representatives.

- *Setting the tariff level*. There should be a formal mechanism for varying the level of the road tariff.

- *Allocation of funds*. There should be a simple and consistent procedure for allocating funds between the different agencies entitled to draw from the fund.

- *Audit arrangements*. The Fund should be audited by independent auditors, and the works financed through the road fund should be subjected to a full financial and selective technical audit.

The third reform focuses on establishing a consistent organizational structure for managing different parts of the road network and dealing with road traffic. In other words, it focuses on establishing who is responsible for what. This requires two things. First, clear assignment of responsibility among different government departments and different levels of government, and second, clear assignment of responsibility to the individual road agencies. The arrangement needs to be based on an accurate road inventory, functional classification of roads, designation of appropriate road agencies, formal assignment of responsibility to each road agency, and clarification of the relationship between each road agency and the parent ministry. Responsibilities to be assigned include those for the operation, maintenance, improvement, and

development of the road network as well as those for traffic management, road accidents caused by the road agency's own negligence, and the adverse environmental impacts associated with roads and road traffic.

At the community level, where roads are generally managed by village councils, higher level road agencies may provide technical advice but usually leave most of the work to be done by the local communities on a self-help basis. Financial support from the center is generally limited to meeting the costs of bought-out materials. Rural roads under the jurisdiction of the central government are generally managed by central government feeder roads departments. Those under the jurisdiction of local governments are generally managed by district councils. Since district councils have limited technical and financial capacity, they are usually encouraged to have their roads managed under contract or to merge with other district councils to create sufficient scale economies to enable the combined network to be managed by a larger road agency. Urban roads are usually managed by urban district councils, while the main trunk road network is generally managed by a central government road agency. International transit routes are critical for Africa and sometimes deserve special treatment. They may either be managed by a dedicated section in the main road agency, as is effectively done in Zambia, or as separate toll roads, as is done in South Africa.

Responsibility for the regulation of road traffic is generally assigned to the main road agency, although it may choose to delegate some of these functions to other agencies or to the private sector. Urban road agencies are normally assigned responsibility for activities which have significant impacts in urban areas (e.g., controlling parking and routing of heavy vehicles in urban areas), while the main road agency is normally responsible for enforcing axle-weight regulations. Axle-weight enforcement should ideally be done in conjunction with the private sector, as is done in Zambia. It is often desirable to make the main road agency responsible for carrying out vehicle safety inspections and vehicle emissions tests, provided they have the capacity to do it effectively (again, these functions may be delegated to the private sector). Finally, all road agencies should be responsible for examining the potential environmental impacts of new road schemes and should be required to satisfy the public that adverse impacts have been minimized and remaining impacts are acceptable.

The final building block focuses on creating a more businesslike road agency. Once road users are involved in the management of roads, they generally press for the introduction of sound business practices to ensure that their constituents get value for money. They expect clear management objectives, competitive terms and conditions of employment, consolidated budgets, commercial costing systems, and effective management information systems. The most important issue requiring attention is the wide gap between the terms and conditions of employment in the public and private sectors, and the impact that this has on staffing and staff morale. An engineer in the private sector in Cameroon normally receives a total remuneration package more than twice as large as his public sector counterpart (the ratio is five in Tanzania and nearly nine in Zambia). As a result, several road agencies have lost most of their technical staff or are being managed by expatriates who are paid international salaries by multilateral and bilateral donors. You cannot manage a road agency on a sustainable basis with expatriates or with demoralized local staff who spend most of their time daylighting to supplement their incomes. Any serious reform program must address these issues. Tanzania is now trying to define a competitive remuneration package for road agency staff which can be provided within existing civil service regulations.

Once staff are adequately paid, other reforms should concentrate on giving each road agency a clear mission and effective management structures, including appropriate management information systems; good accounting systems; and more managerial autonomy, enabling managers to act commercially. The Ghana Highway Authority has made great progress in this direction by streamlining staffing and disciplinary procedures and introducing a road management system. It has also developed a corporate plan which forms the basis of an annual contract plan between the Authority and the government. These reforms improve market discipline, provide managers with the freedom to operate commercially, and strengthen managerial accountability. They also encourage a more objective approach to setting priorities, comparing in-house to contract work, and evaluating labor-based work methods. Finally, auditing procedures also need to be improved to ensure that the public gets value for money from road spending. The aim is to ensure that funds allocated for roads are spent on road works and that the work is carried out according to specification. Where possible, both financial and technical audits should be carried out by independent auditors. Technical and financial audits are now being used on the rural access roads program in Kenya and on the road maintenance programs in Burkina Faso and Senegal. The technical audit usually covers all contract work as well as work done though force account on a sample basis.

10.2 ROLE OF THE DONOR COMMUNITY

The donor community has a particularly important role to play in facilitating these reforms. Their assistance strategies can either support the reform process by providing well targeted aid or can undermine it by providing contradictory aid which primarily serves their own narrow national interests. Therefore, one of the most important things that the donor community can do is to refuse to provide any assistance to the road sector without a clear government commitment to introduce sustainable road maintenance policies. There is no point rehabilitating roads which will be never maintained. Doing so merely reinforces the cycle of rehabilitation, lack of maintenance, and further requests for rehabilitation. To break the cycle, the donor community has to insist on a clear government commitment to reform, a time-table for implementing it, and some up-front actions demonstrating a serious intention to reform.

To be effective, the donor community needs to act in a coordinated way. This requires consultation and basic agreement on the underlying rules of the game. In that regard, the SSATP as a whole and the RMI in particular have been highly effective instruments for building consensus among donors. However, these programs are transitory in nature and will eventually have to be replaced by a more permanent, formal arrangement. The rules of the game also need to be formalized. The Donors Code of Conduct, prepared by the EEC, provides, a sound basis for doing so as long as all key donors agree to sign it. Although the Code lacks specificity, it shows the determination and commitment of the donor community, and the general agreements set out in the Code will be bolstered by the more specific reforms set out in this report.

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ANNEX 1. IMPACT OF ROAD MAINTENANCE ON VEHICLE OPERATING COSTS

by W.D.O. Paterson

The following example analyzes the impact of road maintenance on vehicle operating costs (VOCs), using data for Nigeria and the World Bank's Highway Design and Maintenance model, HDM III. The analysis was carried out for roads in both fair and poor condition, for traffic volumes of 500 and 1,000 veh/day annual average daily traffic (AADT) growing at 3 percent per year. Seventy percent of the traffic consists of trucks. The cases examined included a base case and 16 possible maintenance interventions, including: (i) patching of potholes; (ii) surface treated reconstruction with and without patching of potholes (i.e., flexible pavement with a crushed stone base and double surface treatment); and (iii) asphalt concrete overlays with and without patching of potholes. Five interventions were finally selected for detailed analysis. These interventions were either on or close to the "economic efficiency frontier", which represents the highest net present value (NPV) of benefits determined for each corresponding level of road agency expenditures. They consisted of:

P100 Patching of potholes only.
RY07 Surface treated reconstruction initiated when surface roughness reaches 7 IRI (m/km), with patching of potholes.
RN07 Surface treated reconstruction initiated when surface roughness reaches 7 IRI (m/km), without patching of potholes.
OY50 Asphalt-concrete overlay, initiated when surface roughness reaches 5 IRI, with patching of potholes.
ON50 Asphalt-concrete overlay, initiated when surface roughness reaches 5 IRI, without patching of potholes.

These five interventions were compared against a base intervention case in which no maintenance at all was done to the pavement. For this example, the deteriorated asset was still considered to be a paved road so its value was assessed relative to the cost of restoring it to full paved road quality and functionality after the analysis period. A null case, which effectively abandons the road to disintegrate to a gravel or earth road without full reconstruction was also analyzed, but is not presented in detail here.

Modified Analysis. For this analysis, some modifications were made to the traditional HDM-III analysis to introduce refinements which are important when evaluating cost recovery and comparing the costs and effectiveness of dissimilar strategies. These modifications are summarized below and are to be incorporated in future versions of the model.

Relative Residual Value. When comparing dissimilar alternative maintenance strategies over a finite evaluation period (in this case 20 years), it is important to take account of the condition of the road pavement at the end of the analysis period because this may vary depending on whether a treatment would be made just within or beyond the analyzed period. The analysis thus included a method for estimating the residual or salvage value of the pavement at the end of the analysis period. The Relative Residual Value (RRV) was defined as the net added structural cost of upgrading the pavement from its initial as-new structural capacity to the final effective structural capacity, which is the final pavement capacity

reduced by an amount related to the final damage state. The three elements used to derive the residual value included: (i) the condition or *integrity* of the pavement, defined by the damage or sum of cracking and potholing areas; (ii) the effective structural capacity defined by the resultant thickness of the pavement, reduced in proportion to the final amount of damage; and (iii) the pavement value in its final state relative to its initial new state. The definition of a relative value is a general approach, which avoids the difficulty of assessing the initial construction value and utilizes costs that are consistent with the same unit costs used for the rehabilitation and reconstruction analyses.

Reconstruction Cost. The cost of pavement reconstruction typically varies with the existing condition of the pavement and the target design life adopted for the new pavement. The reconstruction cost should thus be higher when the road is in very poor condition (11 m/km IRI), than when it is in fair/poor condition (7 m/km IRI). Typically, the costs would also include sideworks (repairing drainage etc.) which would vary with the level of routine maintenance applied and would be higher for deferred (worse condition) interventions. Reconstruction costs therefore vary widely and typically range from $90,000 to $250,000 per km for a 2-lane road. As a conservative approach, a flat unit cost of reconstruction of $93,470 per km was adopted as an adjustment to the Nigerian data. In a more rigorous adjustment, the increases would be higher for higher damage levels (more potholing, less patching) and for higher roughness levels (more shape correction and leveling needed), but these refinements would not have affected the particular strategies analyzed here and so were not added in this exercise.

Adjusting Maintenance Strategy Costs. These two sets of adjustments were applied to the HDM-III generated results for the above maintenance strategies. No changes were made to either the physical estimates (pavement condition, maintenance quantities or traffic quantities) or the vehicle operating costs. Adjusted estimates were made for the agency financial costs (undiscounted and discounted at 12 percent), and the net present value (NPV at 12 percent discount rate). In the case of the base and P100 strategies, the cost of reinstating the pavement at the end of the 20-year analysis period to its original capacity is added.

Interpretation of Adjusted NPVs. The adjusted NPVs consist of the original NPV, less the discounted additional cost of reconstruction, plus the PV of the Relative Residual Value. Since the RRV of the Base or Null Strategy (routine maintenance only without patching) is negative (there being a net loss in the final badly deteriorated condition relative to the initial as-new condition), there was a need to consider the most relevant definition of a base strategy. This could be either:

(a) Assume full loss of the functionality of the pavement asset, with reversion to indeterminate gravel/earth state (which would therefore exclude reconstruction at any time); or

(b) Assume that the initial functionality of the asset would have to be restored, so that full reconstruction to original paved standard is required after the analysis period.

It was decided to define the Base case as (b), relating values to the intended functionality of the asset which in this case is that of a paved road. Additionally, in order to demonstrate the loss of value associated with complete neglect, the Null case was defined as (a) above, so the Null case was typically of lower maintenance cost but also negative NPV when compared with the base case.

Comparison of Maintenance Strategies based on Annualized Costs. In a normal economic life-cycle analysis, the predicted agency costs are presented as either the PV of the cost stream or as an annualized cost, utilizing the applicable discount rate. The results from the above analysis are summarized in Table A.1 using annualized maintenance costs. This shows first that patching is more beneficial and cost-effective than not patching. The effect is strongest comparing the pothole patching (P100) with the base strategy, showing that the annualized maintenance cost including the patching is actually *lower* than the cost excluding the patching, *and* gains user benefits, because the pavement has to be restored eventually to regain functionality. The effects are also evident with the reconstruction (RY07 v. RN07), and overlay (OY50 V. ON50) strategies. For fair condition roads undertaking reconstruction at 7 IRI roughness provides significant benefits over patching only, with an incremental B/C ratio of 4 to 7.7. However, intervening with an overlay at 5 IRI is the most beneficial giving an additional 4.7 to 17.6 incremental B/C ratio. On poor condition roads, overlay strategies are very much more beneficial than reconstruction strategies because the reconstruction is required immediately and costs more than staging the restoration with overlays.

Comparison of Maintenance Strategies based on Average Costs. When considering cost recovery of road expenditures as a basis for road user charges, the applicable maintenance cost to be determined is an undiscounted average of the overall maintenance strategy cost because the distribution of pavement ages in a road network can be assumed uniform. For example, in each year some part of the network will be requiring treatment intervention, and typically a similar length will be handled each year. The results using average maintenance costs are shown in Table A.2. These show an even stronger preference for overlay strategies over deferred reconstruction strategies for both fair and poor condition roads, both in substantially lower average costs and in higher benefit/cost ratios. These results apply when road ages are uniformly distributed throughout the network, so that roughly the same amount of maintenance is each year applied to successive segments of the network, i.e. the road network is in a state of stable equilibrium.

Table A1.1 Impact of Alternative Maintenance Strategies Using Annualized Benefits and Costs ($s)

Strategy	*Base*	*P100*	*RY07*	*RN07*	*OY50*	*ON50*
Road in Fair condition; traffic volume 500 veh/day AADT:						
Increased maintenance	633	546	1,799	2,370	2,868	2,866
VOC savings	0	3,310	8,259	9,348	13,259	13,228
Benefit/cost ratio	-	6.1	4.6	3.9	4.6	4.6
NPV, mill @ 12 percent	-6.2	27.0	62.8	67.8	99.8	99.4
Incremental B/C ratio	-	6.1	4.0	3.3	4.7	4.7
Rank, by inc. B/C ratio		1	2	-	3	-
Road in Fair condition, traffic volume 1,000 veh/day AADT:						
Increased maintenance	633	606	3,011	4,677	3,399	3,520
VOC savings	0	13,371	31,976	36,141	40,418	40,947
Benefit/cost ratio	-	22.1	10.6	7.7	11.9	11.6
NPV, mill @ 12 percent	-6.2	125.2	283.7	307.9	361.0	364.8
Incremental B/C ratio	-	22.1	7.7	5.6	21.8	17.6
Rank, by inc. B/C ratio		1	2	-	3	-
Road in Poor condition, traffic volume 500 veh/day AADT:						
Increased maintenance	633	568	9,278	9,276	5,978	5,977
VOC savings	0	2,291	31,507	31,477	27,872	27,872
Benefit/cost ratio	-	4.0	3.4	3.4	4.7	4.7
NPV, mill @ 12 percent	-6.2	16.8	216.3	216.0	211.1	211.1
Incremental B/C ratio	-	4.0	1.1	1.1	4.7	4.7
Rank, by inc. B/C ratio		1	3	-	-	2
Road in Poor condition, traffic volume, 1,000 veh/day AADT:						
Increased maintenance	633	628	9,295	9,268	6,254	6,252
VOC savings	0	6,039	66,680	66,171	60,886	60,866
Benefit/cost ratio	-	9.6	7.2	7.1	9.7	9.7
NPV, mill @ 12 percent	-6.2	53.1	561.6	556.9	532.6	532.4
Incremental B/C ratio	-	9.6	1.9	1.8	9.7	9.7
Rank, by inc. B/C ratio		1	3	-	2	-

Table A1.2 Impact of Alternative Maintenance Strategies Using Average Annual Benefits and Costs ($s)

Strategy	*Base*	*P100*	*RY07*	*RN07*	*OY50*	*ON50*
Road in Fair condition; traffic volume 500 veh/dayAADT:						
Increased maintenance	3,000	2,473	2,202	2,214	1,034	1,029
VOC savings	0	3,310	8,259	9,348	13,259	13,228
Benefit/cost ratio	-	1.3	3.8	4.2	12.8	12.9
NPV, mill @ 12 percent	-6.2	27	62.8	67.8	99.8	99.4
Road in Fair condition, traffic volume 1,000 veh/day AADT:						
Increased maintenance	3,000	2,559	3,414	5,298	1,183	1,340
VOC savings	0	13,371	31,976	36,141	40,418	40,947
Benefit/cost ratio	-	5.2	9.4	6.8	34.2	30.6
NPV, mill @ 12 percent	-6.2	125.2	283.7	307.9	361.0	364.8
Road in Poor condition, traffic volume 500 veh/day AADT:						
Increased maintenance	3,000	2,486	6,117	6,110	4,290	4,288
VOC savings	0	2,291	31,507	31,477	27,872	27,872
Benefit/cost ratio	-	0.9	5.2	5.2	6.5	6.5
NPV, mill @ 12 percent	-6.2	16.8	216.3	216.0	211.1	211.1
Road in Poor condition, traffic volume 1,000 veh/day AADT:						
Increased maintenance	3,000	2,572	6,186	6,074	4,548	4,544
VOC savings	0	6,039	66,680	66,171	60,886	60,866
Benefit/cost ratio	-	2.3	10.8	10.9	13.4	13.4
NPV, mill @ 12 percent	-6.2	53.1	561.6	556.9	532.6	532.4

ANNEX 2. THE INVERSE ELASTICITY RULE

This Annex presents a simple exposition of the inverse elasticity rule as it might be used to determine an optimal set of road user charges. The question is how to mobilize a given amount of revenue from each group of road users (car, bus, truck) in a way which minimizes overall loss of welfare by all user groups. Heuristically, this involves minimizing the overall loss of welfare suffered by all road users by equalizing the dead-weight loss per dollar of revenue raised from each user group.

The rule will be illustrated in terms of a simple example which assumes that short-run marginal costs of road use (SRMCs) are constant (i.e., there is no congestion), cross-price elasticities are small enough to be ignored (i.e., the travel demand for each user group is independent of the other user groups), and that relevant elasticities are compensated demand elasticities. The example is illustrated in Figure A2.1. When the price of road use is raised from P (where it is equal to vehicle operating costs plus the SRMCs of road use) to P′, the dead-weight loss per dollar of revenue raised, S, is equal to the triangular dead-weight loss area ABC divided by the additional net revenue raised, DCAE. In other words:

$$S = -\tfrac{1}{2}(\Delta P \cdot \Delta N)/(\Delta P \cdot N') = -\tfrac{1}{2}\Delta N/N' ,$$
$$\text{where } \Delta P = (P' - P),\ \Delta N = (N - N').$$

Since the compensated own-price point elasticity of demand e^A evaluated at point A is defined to be:

$$(\Delta N/N')/(\Delta P/P')$$

S can be rewritten as:

$$S = -\tfrac{1}{2}e^A(\Delta P/P')$$

The overall loss of welfare is minimized by equalizing S across all user groups:

$$S = e_1^A T_1 = e_2^A T_2 = \ldots = e_n^A T_n \qquad (1)$$

where S represents the welfare gain associated with relaxation of the revenue constraint,
1, 2 ... n represent the different user groups, and
$T_1, T_2 \ldots T_n$ represent the relative mark-up of price over the final gross price, $(\Delta P_i/P_i')$.

This is the familiar inverse elasticity rule. The ratio of the relative mark-up of user group 1 over user group 2, T_1/T_2, is inversely proportional to the ratio of their respective own-price elasticities of demand, e_2^A/e_1^A. The solution is illustrated in Figure A2.2. Note that with a constant demand elasticity, the lines representing group 1, group 2, and group n are straight; otherwise they are curved.

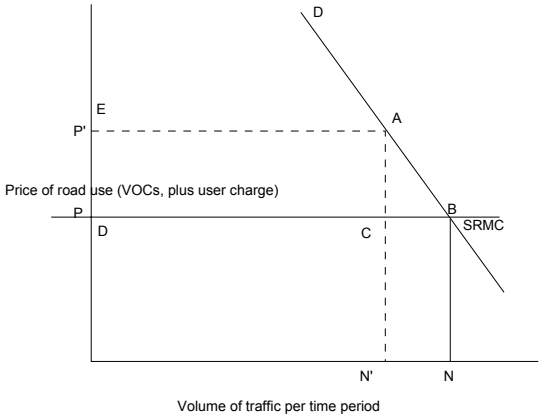

Figure A2.1 Loss of consumer surplus when price is raised

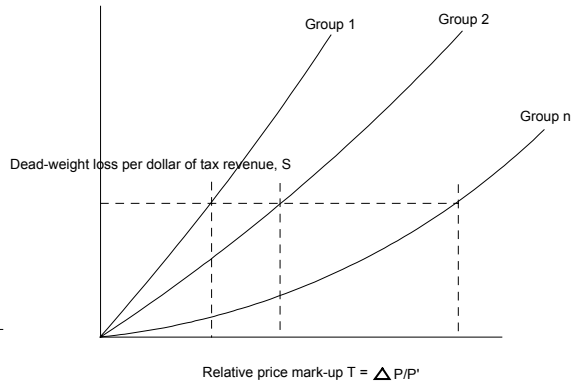

Figure A2.2 Equalizing the dead-weight loss per dollar of revenue raised

The revenue generated by the above mark-ups is:

$$R = T_1P_1'N_1' + T_2P_2'N_2' + \ldots T_nP_n'N_n'$$

$$= \Delta P_1N_1' + \Delta P_2N_2' + \ldots + \Delta P_nN_n' \qquad (2)$$

where $N'_1 \ldots N'_n$ represents the volume of each type of traffic at the final traffic levels; and $\Delta P_i = P_i \cdot [T_i/(1 - T_i)]$, i = 1,...,n.

Since the values of P, e^A, and R are known, the only unknowns are the values of N′ and T. These are estimated from equations (1) and (2) using trial and error[41] or a simple numerical algorithm.

Empirical estimates of the price elasticity of demand for transport generally ignore income effects. When the income effect is thought to be important, the compensated demand elasticity should be used. It is equal to the ordinary demand elasticity plus the proportion of the household budget spent on transport multiplied by the income elasticity of demand for transport. When the cross-price elasticities of demand between the different user groups are significant, the relevant cross-price elasticities should be subtracted: $e^A = (e_{11}^A - e_{21}^A)$.

In practice, empirical estimates of the price elasticity of demand by different road users are subject to wide margins of error (see Oum, et al, 1990). Recent estimates vary from: 0.10 to 1.1.0 for a car; 0.10 to 1.30 for a bus; to 0.70 to 1.10 for a truck. This reflects the fact that demand elasiticites depend on market conditions, which vary widely throughout the road network. It is therefore unwise to use *average* or *typical* demand elasticities to estimate road user charges. Instead, it is better to use uniform mark-ups (i.e., to assume demand elasticities

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41 Choose a starting value for S and solve equation (1) for T_i. Estimate $\Delta P_i = P_i \cdot [T_i/(1 - T_i)]$. Assume N_i' is approximately equal to N_i. Calculate the implied value of R from equation (2) and compare it with the actual value of R. If the implied value is less than the actual value, choose a higher value for S and repeat the calculation. The values converge after about three to five iterations. Finally, check whether ΔP_i is large enough to make N_i' significantly lower than N_i. If so, replace N_i with a new estimate of N_i' and repeat the above calculations.

are equal) and only to use differential mark-ups when accurate and consistent country-specific values are available.

Finally, when roads are congested and SRMCs are not constant, the analysis has to include the supply elasticities and this adds greatly to the complexity of the analysis.

ANNEX 3. ESTIMATING ROAD USER CHARGES: A WORKED EXAMPLE

This annex takes a hypothetical road network and, using the pricing and cost recovery policies developed in Chapter 7, estimates the user charges required to ensure that: (i) the costs of operating and maintaining the main road network are fully-funded, and (ii) the grants made to road agencies managing urban and rural roads are sufficient to ensure their maintenance programs are also fully-funded, and (iii) sufficient funds are available to finance investment in main roads, support investment in urban and rural roads, and meet debt service obligations.

The hypothetical road network consists of 28,000 km of trunk roads managed by the main road agency (3,000 km are paved), 3,000 km of urban roads managed by the municipalities and 27,000 km of rural roads managed by rural district councils (see Table A3.1). Traffic volumes are modest and vary from an average of 600 vpd on paved roads, to 300 vpd on gravel roads, and 50 vpd on earth roads and gravel roads in rural areas. The vehicle fleet consists of 200,000 vehicles (see Table A3.2). Twenty percent consist of trucks and buses and these vehicles account for nearly 27 percent of annual veh-km. Average annual distances traveled vary from about 35,000 km for light vehicles, to 50,000 km for most trucks and buses, to 70,000 km for articulated trucks.

There are four main steps to the analysis:

(i) Estimate the costs of operating and maintaining the entire road network on a sustainable basis. Actual expenditures may be lower than this since maintenance may be underfunded and the road agency may be accumulating a large backlog of deferred maintenance.

(ii) Using the above costs, prepare an outline financing table showing all costs which have to be met through user charges. The table will include the entire costs of the trunk road network and part of the costs associated with urban and rural district roads.

(iii) Estimate the amount of traffic expected to use the road network during the year for which costs are being estimated.

(iv) Estimate the variable costs attributable to each type of traffic and then set the level of the fuel levy, together with license fees and (where relevant) heavy vehicle license fees to ensure: (a) each type of traffic covers its variable costs, and (b) all vehicles in total generate sufficient revenues to cover all the costs included in the outline financing table.

The first task, item (i) above, should be carried out using either the *short analysis*, or the *formal analysis* described in Box A3.1. This example uses the short analysis, based on the cost matrices included in Annex 4. The results of the analysis are summarized in Table A3.1. The only parameters needed for this analysis are: (i) length of the road network, by type of road; (ii) average daily traffic volumes; and (iii) observed unit maintenance costs, which are used to adjust the cost figures set out in Annex 4. In this example, the figures from Annex 4 have been used without adjustment.

Box A3.1 Methods for Estimating Road Maintenance Requirements

Data collection: From traffic count data, classify the road network in AADT ranges (preferably 50, 300, 1000, 3000, etc.) and estimate the vehicle-km-traveled (VKT) for each vehicle class and each traffic volume class. Using a 5 percent sample of roads in each traffic class, determine the representative pavement strength (in pavement structural numbers) and traffic loading (Equivalent standard axles lane-yr, using average ESAs for each vehicle class). The percentage lengths in good, fair, and poor condition should also be observed. If there are relevant regional differences in costs or pavement performance, the sample should be uniformly distributed across the regions. The unit costs of resurfacing, rehabilitation, and reconstruction (reseal, thin overlays, thick overlays, etc.) should be determined with and without taxes, and the periodicity of application, if any, should be noted according to region.

Short analysis: The short method avoids direct analysis and instead makes adjustments to general figures generated using the HDM III model with data from a selection of developing countries (see annex 4). Determine a cost factor by comparing the observed unit maintenance treatment costs with the values in annex 4, Table A4.1. Also use this table to determine the applicable loading category from the loading characteristics (ESA/lane-yr) for each traffic volume class. Estimate the uncorrected optimal maintenance costs from annex 4, Table A4.2 for the relevant loading profile and pavement SNC, then adjust using the above unit maintenance cost factor. Multiply the adjusted estimated maintenance cost by the road length for each traffic volume category to obtain the estimated total network maintenance costs.

- Maintenance requirements are equal to total network maintenance costs.
- Shortfall is equal to estimated maintenance requirements minus the available budget.
- Backlog is the sum of estimated rehabilitation costs for all road lengths in poor condition.

Formal analysis: Calibrate the HDM-III to local conditions and prepare collected data as inputs, defining a series of maintenance strategies sufficient to define an optimal NPV. Only the representative values of SNC and ESA/lane-yr are used for each traffic volume class. Apply end-of-period adjustments to ensure that a full life-cycle is considered by the HDM-III. Run the analysis three times: (a) with full traffic as measured; (b) with no loading, but with all vehicles, by setting the load (or ESA) input to a negligible value; and (c) with no traffic (HDM requires a minimum of one vehicle per class for computational logic in this zero traffic case). Select the optimal maintenance treatment from the (smoothed) maximum NPV in economic terms under each of the full traffic, nonload, and nontraffic run-cases. Determine the average maintenance requirements from the undiscounted, predicted maintenance costs of the optimal treatment for each road traffic class and run-case. The shortfall is determined using the full-traffic predicted maintenance costs for the optimal treatment in each case, multiplied by the road length in each traffic class. The backlog is the product of the average optimal treatment cost (for poor condition) and road length in poor condition summed for all traffic classes

Source: W.D.O. Paterson.

The second task is to prepare the outline financing table. This is shown in Table A3.3. In addition to routine and periodic maintenance (from Table A3.1) this table also includes: (i) the costs of policing and administration (both of which are properly attributable to road users), (ii) interest charges on projects financed through loans, (iii) grants to local authorities to support operation and maintenance of urban and rural district roads (the grants have been set to cover all variable costs which amount to between 60 and 70 percent of total urban and rural road expenditures), (iv) all investment in trunk roads and 50 percent of investment in urban and rural roads (it is assumed there is a 50 percent cost-sharing formula for the latter roads), and (v) debt service repayments. The total costs to be recovered from road users amount to $100.6 million, comprising variable costs of $55.9 million (SRMCs without congestion) and fixed costs of $24.0 million (main roads only). The balance of the fixed costs, amounting to $10.6 million, would be financed by the respective district councils (from property taxes and other local revenues). Variable costs are made up of costs which vary with traffic (variable road maintenance costs and variable road operating costs) and those which vary with traffic loading (variable periodic maintenance). The costs which vary with traffic amount to $37.7 million (including policing and administration), while those which vary with traffic loading amount to $18.2 million.

The third task is to estimate the amount of traffic using the road network. This has been done in Table A3.2. It requires a knowledge of the vehicle fleet (i.e., number of vehicles operating over the road

network), together with the average annual mileage traveled by each type of vehicle. Factors like axle-weights and fuel consumption are available from standard tables or manufacturers specifications.

The final task is to estimate variable costs for each type of vehicle. This calculation is illustrated in Table A3.4. The footnotes explain how vehicle-related costs (column 1) and axle-related costs (column 2) were calculated. These are then added to give the total variable costs attributable to each type of vehicle (column 3). The fuel levy is calculated in column 4 and, in this example, has been set at $0.09 per liter. It has been assumed that there are an existing set of license fees set at nominal levels, varying from $20 per year for a car, to $100 per year for heavy single-axle trucks and buses, to $300 p.a. for an articulated truck (column 5). Clearly, without a heavy-vehicle license fee, articulated trucks would not cover variable road costs and would make no contribution to fixed costs. The table has therefore introduced a heavy vehicle license fee for the three heaviest vehicle classes and has set the charge at $375 per equivalent standard axles (ESALs) per year. This results in supplementary license fees of $218, $975, and $2,550 per year for the three heaviest types of vehicle. The combined effect of the regular license and heavy vehicle license is shown in column 7.

The final matrix of charges ensures that all heavy vehicles cover their variable road costs, without involving extensive over-charging of light vehicles. The total revenue generated, $102.4 million, is sufficient to cover the total required revenues, $100.6 million, shown in Table A3.3. Most revenue comes from the fuel levy, $82.9 million (over 80 percent). Regular license fees contribute relatively little, $6.0 million (just under 6 percent), while the heavy vehicle license fee — which, in this example, is only collected from 16,000 vehicles (i.e., 8 percent of the vehicle stock) — brings in $13.5 million.

Table A3.1 Costs of Maintaining the Road Network on a Sustainable Basis

			Routine maintenance (millions of dollars)			Periodic maintenance		
	Length (km)	*AADT*	*Variable*	*Fixed*	*Total*	*Variable*	*Fixed*	*Total*
Main Roads								
Paved	3,000	600	0.90	5.10	6.00	2.83	3.34	6.16
Gravel	10,000	300	10.74	1.40	12.14	11.26	8.23	19.49
Earth	15,000	50	8.04	1.50	9.54	--	--	0.00
Total	**28,000**		**19.68**	**8.00**	**27.68**	**14.09**	**11.57**	**25.65**
Urban Roads								
Paved	500	600	0.15	0.85	1.00	0.47	0.56	1.03
Gravel	2,500	300	2.69	0.35	3.04	2.82	2.06	4.87
Earth	--	--	--	--	0.00	--	--	0.00
Total	**3,000**		**2.84**	**1.20**	**4.04**	**3.29**	**2.61**	**5.90**
Rural Roads								
Paved	--	--	--	--	0.0	--	--	0.00
Gravel	5,000	50	2.68	0.50	3.18	0.82	4.12	4.94
Earth	22,000	50	11.79	2.20	13.99	--	--	0.00
Total	**27,000**		**14.47**	**2.70**	**17.17**	**0.82**	**4.12**	**4.94**

--: Not Applicable

Source: Paved roads: routine maintenance, Table A4.1
Paved roads: periodic maintenance, Table A4.2, for a road with a structural number of three, using the mid-point between 300 vpd and 1,000 vpd.
Gravel and earth roads: periodic and routine maintenance, Table A4.3

Table A3.2 Characteristics of Vehicle Using the Road Network
(Individual Units)

Vehicle type and payload (tons)	*Number of vehicles*	*Mileage per year*	*Axle-weight (ESALs)*	*ESAL-km (mill)*	*Veh-km (mill)*	*Fuel use (l/km)*
Car gasoline	50,000	35,000	0.0001	0	1,750	0.08
Car diesel	70,000	35,000	0.0001	0	2,450	0.07
Utility (0.8)	40,000	35,000	0.0080	11	1,400	0.09
Light truck (2.0)	20,000	50,000	0.0920	92	1,000	0.15
Medium truck (5.0)	7,000	50,000	0.5800	203	350	0.20
Heavy single-axle truck (12.0)	7,000	50,000	2.6000	910	350	0.93
Articulated truck (25.0)	2,000	70,000	6.8000	952	140	0.49
Bus	4,000	50,000	0.4900	98	200	0.36
Total	**200,000**			**2,267**	**7,640**	

Table A3.3 Annual Expenditures on Road Subdivided into Main Cost Components
(millions of dollars)

	Total annual expenditure	*Variable costs*	*Fixed costs*	*Financed by district council*
Recurrent costs				
Main roads				
Policing[a]	0.70	0.21	0.49	-
Administration[b]	2.44	0.49	1.95	-
Interest charges[c]	2.00	0.00	2.00	-
Routine maintenance	27.68	19.68	8.00	-
Periodic maintenance	25.65	14.09	11.57	-
Subtotal	58.47	34.47	24.01	-
Urban roads				
Grants for maintenance[d]				
Routine		2.84	1.20	
Periodic		3.29	2.61	
Subtotal	6.13	6.13	3.81	(3.81)
Rural roads				
Grants for maintenance[d]				
Routine		14.47	2.70	
Periodic		0.82	4.12	
Subtotal	15.29	15.29	6.82	(6.82)
Total recurrent costs	***79.89***	***55.89***	***34.64***	***(10.63)***
Investment[e]				
Main roads	8.50	-	-	-
Debt service/repayment	2.83	-	-	-
Grants for urban roads[f]	2.50	-	-	(2.50)
Grants for rural roads[f]	6.90	-	-	(6.90)
Total investment	***20.73***	***-***	***-***	***(9.40)***
Total funds required	***100.62***			

- Not Applicable
a. An estimated 70 percent of these costs are fixed.
b. Fixed costs include expenditures on buildings and 70 percent of headquarter salaries.
c. Interest charges on road loans.
d. Maintenance grants are set to cover all variable road maintenance costs.
e. Although an estimated 10 percent of investment is usually incurred on behalf of heavier vehicles and 5 percent on behalf of large vehicles, no distinction has been made in the financing table.
f. Grants for investments in urban and rural roads have been set at 50 percent of total investment costs.

Table A3.4 User Charges Required to Cover Variable and Fixed Costs of Road Use

	Variable costs of road use			*Required user charge*				
	Vehicle related[a] (c/veh-k) (1)	*Axle related*[b] c/ESAL-km (2)	*Total Var. costs* (c/km) (3)	*Fuel levy @ 9 c/l charge*[c] (c/km) (4)	*Standard license fee*[d] ($ p.a.) (5)	*Heavy vehicle license*[d] ($ p.a.) (6)	*Total license charge*[e] (c/km) (7)	*Total user charge* (c/km) (8)
Car gasoline	0.49	0.00	0.49	0.72	20	-	0.06	0.78
Car diesel	0.49	0.00	0.49	0.59	20	-	0.06	0.64
Utility	0.49	0.01	0.50	0.81	25	-	0.07	0.88
Light truck	0.49	0.07	0.57	1.35	30	-	0.06	1.41
Medium truck	0.49	0.47	0.96	1.80	45	218	0.53	2.33
Heavy single-axle truck	0.49	2.09	2.58	3.51	100	975	2.15	5.66
Articulated truck	0.49	5.46	5.95	4.38	300	2,550	4.07	8.45
Bus	0.49	0.39	0.89	3.21	100	-	0.20	3.41
Total	**37.69**	**18.20**	**55.89**	**82.92**	**6.02**	**13.45**	**19.46**	**102.38**

-: Not applicable

a. Values consist of total vehicle-related variable costs, $37.69 million, divided by total veh-km (from Table A3.2).

b. Values consist of total weight-related variable costs, $18.20 million, divided by total ESAL-km (from Table A3.2), multiplied by the number of ESALs for each vehicle type divided by veh-km for each type of vehicle.

c. Values consist of the fuel levy (specified in a cell elsewhere on the spreadsheet), multiplied by rate of fuel consumption (from Table A3.2). The column total multiplies each cell by the distance traveled by each vehicle type.

d. Total are the sum of each cell multiplied by the respective number of vehicles.

e. Values consist of the annual license fee multiplied by the respective number of vehicles (from Table A3.2) and divided by the veh-km for each type of vehicle.

ANNEX 4. TABLES FOR ESTIMATING OPTIMAL MAINTENANCE REQUIREMENTS

This annex presents data for estimating optimal road maintenance requirements. The analysis was undertaken by W.D.O. Paterson and R. Archando-Callao using data from a selection of developing countries without any extremes of climate. Table A4.1 presents data on maintenance costs, and traffic loading. Table A4.2 then uses this data to estimate the average annual pavement maintenance costs (including routine maintenance) and usage costs for paved roads under optimal maintenance strategies for a variety of loading conditions. Routine maintenance costs can be estimated separately using the formula included in the first part of Table A4.1.

Table A4.3 provides similar figures for unpaved roads. They show costs of maintaining both gravel and earth roads and have been estimated for the sorts of traffic volumes likely to be encountered in Africa.

Table A4.1 Basic Data Required to Estimate Road Use Costs

Maintenance Costs:

Treatment	***Unit***	***Code***	***Economic***	***Financial***
Routine maintenance	$/km-yr	-	1,450 + 0.43 T	1,700 + 0.5 T
Reseal	$/km	RExx	19,400	22,400
Thin overlay, 40mm	$/km	OSyy	47,600	56,000
Thick overlay, 80mm	$/km	ODyy	76,200	90,000
Reconstruction (+2 SNC)	$/km	RCyy	238,000	280,000
Unpaved blading	$/km/blading	-	75	80
Regravelling	$/$m^3$	-	6.00	7.00

Pavement

Modified structural number (SNC)	2	3	5	8
Asphalt surfacing thickness, mm	20	40	50	100
Subgrade in situ CBR, %	8	8	8	8

Traffic Loading:

	Units	*Light*	*Moderate*	*Heavy*	*High*
Truck					
Nominal axleload limit (tons)	-	8.2	8.2	11	8.2
Presence of overloading	-	no	yes	yes	yes
Compliant axle load limit (tons)	-	8.2	11	13	11
300 veh/day	MESA/L-yr	0.007	0.014	0.028	0.070
	ESA/Hveh	(0.63)	(1.25)	(2.50)	(1.25)
1,000 veh/day	MESA/L-yr	0.026	0.053	0.104	0.250
	ESA/Hveh	(0.72)	(1.45)	(2.90)	(1.45)
3,000 veh/day	MESA/L-yr	0.129	0.258	0.129	0.576
	ESA/Hveh	(1.17)	(2.35)	(4.70)	(2.35)
6,000 veh day	MESA/L-yr	0.50	1.00	2.00	-
	ESA/Hveh	(1.52)	(3.05)	(6.10)	-
10,000 veh/day	MESA/L-yr	0.87	1.74	3.48	-
	ESA/Hveh	(1.59)	(3.18)	(6.36)	-

Notes: -: Not applicable
xx = percentage area with surface distress; yy = intervention roughness in m/km IRI x 10;
ESA = equivalent 80kN single axle loadings; M = million; L = lane;
Hveh = heavy vehicle, average for all vehicles (laden and unladen) of GVW 3.5t or more;
T = annual average daily traffic volume (veh/d).

Table A4.2 Average Annual Maintenance Costs and Usage Costs for Paved Roads under Optimal Maintenance Strategies

				(Average annual costs, $/km-yr)						
SNC[a]	*AADT*	*ESA/LY million*	*Optimal maint.*	*Total*	*No traffic*	*Vehicles*	*Loading*	*Variable c/veh-km*	*Vehicle c/veh-km*	*Loading c/ESA-km*
Costs for moderate traffic loading with normal truck composition (20%)										
8	10,000	1.740	OD30	7658	3806	3216	636	0.106	0.088	0.018
8	6,000	1.000	OD30	6804	3155	3217	432	0.167	0.147	0.022
8	3,000	0.260	OD30	6180	2955	2647	578	0.295	0.242	0.111
5	10,000	1.740	OD30	9953	3921	3365	2667	0.165	0.092	0.077
5	6,000	1.000	OD30	8042	3270	3038	1734	0.218	0.139	0.087
5	3,000	0.260	OS35	6242	3211	2391	640	0.277	0.218	0.123
5	1,000	0.053	OD70	3524	3062	145	317	0.127	0.040	0.299
5	300	0.014	OD70	2939	2562	128	249	0.344	0.117	0.889
3	3,000	0.260	OS35	7988	3212	2648	2128	0.436	0.242	0.409
3	1,000	0.053	OD50	5004	3062	379	1563	0.532	0.104	1.475
3	300	0.014	OD70	3104	2562	206	336	0.495	0.188	1.200
2	3,000	0.260	OD35	9558	3272	3323	2963	0.574	0.303	0.570
2	1,000	0.053	OS40	5975	3122	1336	1517	0.782	0.366	1.431
2	300	0.014	OD70	3560	2622	290	648	0.857	0.265	2.314
Costs for moderate traffic loading with high truck composition (70%)										
8	3,000	1.000	OD30	6604	2955	2647	1002	0.333	0.242	0.050
8	1,000	0.250	OS30	5073	2806	63	2204	0.621	0.017	0.441
8	300	0.070	P100	2795	2306	59	430	0.447	0.054	0.307
5	3,000	1.000	OD30	8944	3211	2391	3342	0.524	0.218	0.167
5	1,000	0.250	OS35	5481	3062	145	2274	0.663	0.040	0.455
5	300	0.070	OD70	3007	2562	128	317	0.406	0.117	0.226
3	3,000	1.000	OD30	10320	3212	2648	4460	0.649	0.242	0.223
3	1,000	0.250	OS35	7045	3062	379	3604	1.091	0.104	0.721
3	300	0.070	OD50	4508	2562	206	1740	1.777	0.188	1.243
2	1,000	0.250	OS35	8848	3122	1336	4390	1.569	0.366	0.878
2	300	0.070	OD60	5039	2622	290	2127	2.207	0.265	1.519
Costs for heavy traffic loading with normal truck omposition (20%)										
8	6,000	1.960	OD30	7520	3155	3217	1148	0.199	0.147	0.029
5	3,000	0.500	OS35	6351	3211	2391	749	0.287	0.218	0.075
3	1,000	0.101	OD50	5355	3062	379	1914	0.628	0.104	0.948
2	300	0.026	OD60	4263	2622	290	1351	1.499	0.265	2.598
Costs for light traffic loading with normal truck composition (20%)										
8	6,000	0.500	OD30	6586	3155	3217	214	0.157	0.147	0.021
5	3,000	0.130	OD35	6207	3211	2391	605	0.274	0.218	0.233
3	1,000	0.025	OD50	4750	3062	379	1309	0.462	0.104	2.618
2	300	0.013	OD70	3380	2622	290	468	0.692	0.265	1.800

Note: For traffic loading, see Table A4.1

a. Modified structural number

Source: Analysis of data in Table A4.1 using the HDM-III model

Table A4.3 Average Annual Maintenance and Road Usage Costs for Unpaved Roads

	Gravel Surface						*Earth*		
	300 veh/day			50 veh/day			50		
	M[a]	F[a]	V[a]	M	F	V	M	F	V
Average annual Maintenance costs (undiscounted financial costs)									
Blading (@$88/km/blading)	12	0	1074	6	0	536	6	0	536
Other routine (@$/km-yr)	1	140	0	1	100	0	1	100	0
Regravelling (@$7/cu. m)	0.25	823	1126	0.11	823	164	0	0	0
Total costs	na	963	2200	na	923	700	na	100	536
Average user costs									
Cost by element (cents/veh-km)	na	0.88	2.01	na	5.06	3.84	na	0.55	2.94
Total usage cost (cents/veh-km)	na	na	2.89	na		8.90	na	na	3.49

na = not applicable

a. M = Maintenance frequency treatments per year; F = Fixed costs ($/km/yr); V = Variable costs ($/km yr).

Source: HDM-III analysis.

APPENDICES

Appendix 1 Road Network Length Classification, Density and Replacement Values

Country	Area Thousand Km2	1992 Population million 1/	Total Vehicle Fleet	1992 GNP Per Capita (US$) 2/	1992 Total GNP (US$m)2/	CLASSIFICATION OF THE NETWORK: Total Network Length (KM)	Main Network Length (KM)	Main Paved Length (KM)	Main Unpaved Length (KM)	Rural Network Length (KM)	Urban Network Length (KM)	RATIOS: Total Length Per Thousand Km2	Total Length Per Million Population	Total Length Per Thousand Vehicle	Total Length Per Million US$ GNP	REPLACEMENT VALUES: Main Network US $ Million 9/	Rural Network US $ Million 10/
ANGOLA	1247	9.73	57,030			21,780	15,811	7,942	7,869	4,518	1,451	17	2,238	382		2,742	226
BENIN	113	5.0	31,250	410	2,058	15,682	3,425	1,195	2,230	10,457	1,800	139	3,110	502	8	860	523
BOTSWANA	582	1.4	81,260	2,790	3,797	30,367	17,867	2,831	15,036	11,000	1,500	52	22,329	374	8	1,835	550
BURKINA	274	9.5	32,000	290	2,908	13,538	8,739	1,506	7,233	4,378	421	49	1,420	423	5	843	219
BURUNDI	28	5.8	13,500	210	1,193	6,466	4,099	1,011	3,088	2,189	178	231	1,111	479	5	452	109
CAMEROON	475	12.2	110,000	820	10,003	54,102	33,000	3,670	29,330	18,000	3,102	69	2,695	300	3	3,160	900
CAPE VERDE	4	0.4	11,180	850	330	1,214	1,095	679	416		119	274	2,815	98	3	220	
C.A.R.	623	3.2	23,135	410	1,307	24,441	9,300	440	8,860	14,400	741	39	7,720	1,056	19	738	720
CHAD	1,284	6.0	14,000	220	1,307	28,717	3,800	300	3,500	24,000	917	22	4,805	2,051	22	479	1,200
COMOROS	2	0.5	4,500	510	262	795	735	467	268		60	398	1,559	177	3	145	
CONGO	342	2.4	46,000	1,030	2,502	11,504	10,800	1,245	9,555	200	504	34	4,738	250	5	915	10
COTE D'IVOIRE	322	12.8	235,447	670	8,665	48,443	14,976	3,976	11,000	30,224	3,243	150	3,773	206	6	2,355	1,511
DJIBOUTI	22	0.5	20,000			3,429	1,577	857	720	1,668	184	156	7,374	171		296	83
EQUAT. GUINEA	28	0.4	7,500	330	146	1,690	1,090	447	643	450	150	60	3,867	225	12	181	23
ETHIOPIA	1,222	54.8	59,328	110	6,206	32,339	14,020	4,115	9,905	15,000	3,319	26	590	545	5	2,354	750
GABON	268	1.2	27,000	4,450	5,341	7,976	5,300	700	4,600	2,400	276	30	6,641	295	1	474	120
GAMBIA	11	0.9	5,900	390	367	2,492	1,310	510	800	1,080	102	227	2,682	422	7	193	54
GHANA	239	15.8	130,000	450	7,066	38,731	14,100	5,458	8,642	21,830	2,801	162	2,448	298	5	2,497	1,092
GUINEA	246	6.0	24,000	510	3,103	19,426	14,000	1,382	12,618	4,500	926	79	3,212	809	6	1,208	225
GUINEA-BISSAU	36	1.0	5,000	210	217	4,143	2,577	485	2,092	1,404	162	115	4,054	829	19	266	70
KENYA	580	25.8	337,000	330	8,453	154,490	63,324	8,615	54,709	87,276	3,890	109	2,451	188	7	5,862	4,364
LESOTHO	30	1.9	21,600	590	1,090	5,425	2,346	600	1,746	2,934	175	181	2,917	251	5	281	145
LIBERIA 3/	111	2.7	18,074	450	1,224	8,142	3,945	557	3,388	3,615	582	73	2,994	450	7	454	181
MADAGASCAR	587	12.4	47,714	230	2,809	29,147	14,640	4,540	10,100	13,000	1,507	50	2,354	611	10	2,017	650
MALAWI	118	9.1	31,000	210	1,896	12,561	9,963	2,520	7,443	2,000	598	106	1,383	405	7	1,152	100
MALI	1,240	9.0	32,000	300	2,730	29,400	13,004	2,404	10,600	15,496	900	24	3,281	919	11	1,356	775
MAURITANIA	1,026	2.1	17,200	530	1,109	8,214	2,100	1,500	600	5,700	414	8	3,945	478	7	509	285
MAURITIUS	2	1.1	44,958	2,700	2,965	2,091	1,800	1,620	180		291	1,046	1,903	47	1	487	
MOZAMBIQUE	802	16.6	45,000	60	1,034	32,042	13,308	4,600	8,708	16,923	1,811	40	1,934	712	31	2,038	846
NIGER	1,267	8.2	31,708	300	2,466	19,701	6,694	2,768	3,926	12,306	701	16	2,411	621	8	1,064	615
NIGERIA 4,5/	924	101.9	302,572	320	32,944	189,675	59,100	33,430	25,670	108,700	21,875	205	1,862	627	6	15,356	7,935
RWANDA	26	7.3	17,135	250	1,813	12,985	5,845	971	4,874	6,640	500	499	1,776	758	7	611	332
SENEGAL	197	7.8	116,000	780	6,124	15,459	10,277	3,777	6,500	3,738	1,444	78	1,971	133	3	1,630	187
SIERRA LEONE	72	4.4	52,000	170	726	11,699	7,085	1,262	5,823	4,254	360	162	2,687	225	16	697	213
SOMALIA 3/	638	8.3	26,700	120	996	22,545	7,112	2,460	4,652	14,191	1,242	35	2,716	844	23	1,158	710
SOUTH AFRICA 6/	1,221	39.8	5,030,743	2,670	106,167	356,002	62,053	57,034	5,019	233,949	60,000	292	8,953	71	3	30,437	11,697
SUDAN 7/	2,506	26.6	117,000	420	11,167	22,952	8,094	2,245	5,849	11,816	3,042	9	863	196	2	1,614	591
SWAZILAND	17	0.9	28,840	1,080	930	2,913	2,757	689	2,068	64	92	171	3,387	101	3	299	3
TANZANIA	945	26.0	100,000	110	2,561	64,007	28,011	3,349	24,662	31,989	4,007	30	1,079	280	11	3,072	1,599
TOGO	57	3.9	4,225	400	1,575	5,747	2,293	1,580	713	3,000	454	101	1,474	1,360	4	544	150
UGANDA	236	17.5	50,000	170	2,949	30,968	8,068	2,095	5,973	22,200	700	131	1,772	619	11	997	1,110
ZAIRE	2,345	39.8	180,000	220	8,755	155,509	60,900	2,800	58,100	87,000	7,609	66	3,908	864	18	5,507	4,350
ZAMBIA	753	8.6	102,500	290	2,580	40,388	20,783	6,396	14,387	15,980	3,625	54	4,702	394	16	3,225	799
ZIMBABWE 8/	391	10.4	415,000	570	5,896	91,078	18,434	8,261	10,173	67,357	5,287	233	8,798	219	15	3,896	4,546
TOTAL	23,459	542	8,106,999	494	267,736	1,690,415	609,557	195,289	414,268	937,796	143,062	72	3,122	209	6	105,301	47,970

NOTES:

1/ Source of population data: The World Bank Atlas 1994

2/ Source of GNP data: World Development Report 1993 and World Tables 1993

3/ GNP in 1990

4/ 12,500 Km of the Rural Roads are Paved

5/ Main network includes main roads under local government jurisdiction

6/ Main roads are primary and secondary roads. They include 1,953 km of freeway standard and 1,759 km of dual carriageway under both Department of Transport and provincial authorities.

7/ GNP in 1987

8/ 5,889 Km of the Rural Roads are Paved

9/ Replacement value is calculated with $500,000 for freeways and dual carriageways, $250,000 for main paved, $50,000 for main unpaved network and $250,000 for urban roads.

10/ Replacement value is calculated with $50,000 for rural network

Appendix 2. Road Condition by Category

Estimated Physical Condition of Roads, 1989

Country	Total Length (km)	Main Length (km)	Main Paved Network Condition				Main Unpaved Network Condition				Rural Network Length (km)
			Length (km)	Good	Fair	Poor	Length (km)	Good	Fair	Poor	
				percent				percent			
Angola	21,780	15,811	7,942	n.a.	n.a.	n.a.	7,869	n.a.	n.a.	n.a.	4,518
Benin	15,682	3,425	1,195	13	59	28	2,230	10	40	50	10,457
Botswana	33,264	17,867	2,831	94	4	2	15,036	45	19	36	11,000
Burkina Faso	13,538	8,739	1,506	70	12	18	7,233	16	55	29	4,378
Burundi	6,466	4,099	1,011	75	19	6	2,156	37	53	10	2,189
Cameroon	54,102	33,000	3,670	25	60	15	29,330	n.a.	n.a.	n.a.	18,000
Cape Verde	1,214	1,095	679	14	59	27	416	0	20	80	n.a.
C.A.R.	24,441	9,300	440	30	35	35	8,860	68	16	16	14,400
Chad	28,717	3,800	300	0	10	90	3,500	0	0	100	24,000
Comoros	795	735	467	43	53	4	268	25	38	37	n.a.
Congo	11,504	10,800	1,245	50	12	38	9,555	38	27	35	200
Côte d'Ivoire	48,443	14,976	3,976	75	25	0	11,000	34	65	1	30,224
Djibouti	3,429	1,577	857	51	38	11	720	51	38	11	1,668
Equat. Guinea	1,690	1,090	447	27	50	23	643	30	42	0	450
Ethiopia	32,339	14,020	4,115	47	42	11	9,905	47	31	22	15,000
Gabon	7,976	5,300	700	30	30	40	4,600	32	30	38	2,400
Gambia	2,492	1,310	510	22	46	32	800	32	39	29	1,080
Ghana	38,731	14,100	5,458	28	21	51	8,642	32	36	32	21,830
Guinea	19,426	14,000	1,382	50	0	50	12,618	0	0	100	4,500
Guinea-Bissau	4,143	2,577	485	39	26	35	2,092	6	6	88	1,404
Kenya	154,490	63,324	8,615	32	39	28	54,709	66	15	19	87,276
Lesotho	5,425	2,346	600	53	29	18	1,746	16	57	27	2,904
Liberia	8,142	3,945	557	85	13	2	3,388	15	75	10	3,615
Madagascar	29,147	14,640	4,540	56	27	17	10,100	27	30	43	13,000
Malawi	13,361	9,963	2,520	56	38	6	7,443	8	76	16	2,000
Mali	29,400	13,004	2,404	70	14	16	10,600	10	24	66	15,496
Mauritania	8,214	2,100	1,500	58	30	12	600	16	33	51	5,700
Mauritius	2,091	1,800	1,620	95	5	0	180	90	5	5	n.a.
Mozambique	32,042	13,308	4,600	19	49	32	8,708	3	17	80	16,923
Niger	19,701	6,694	2,768	67	5	28	3,926	0	10	90	12,306
Nigeria[a]	189,675	59,100	33,430	34	32	34	25,670	24	17	59	108,700
Rwanda	12,985	5,845	971	41	41	18	4,874	19	46	35	6,640
Senegal	15,459	10,277	3,777	28	32	40	6,500	7	21	72	3,738
Sierra Leone	11,699	7,085	1,262	62	9	29	5,823	8	37	55	4,254
Somalia	22,545	7,112	2,460	52	33	15	4,652	4	10	86	14,191
South Africa	356,002	62,053	57,034	n.a.	n.a.	5	5,019	n.a.	n.a.	20	233,949
Sudan	22,952	8,094	2,245	27	43	30	5,849	20	20	60	11,816
Swaziland	2,913	2,757	689	35	35	30	2,068	60	37	3	64
Tanzania	64,007	28,011	3,349	39	39	22	24,662	18	44	38	31,989
Togo	5,747	2,293	1,580	75	14	11	713	31	36	33	3,000
Uganda	30,968	8,068	2,095	10	63	27	5,973	0	73	27	22,200
Zaïre	155,509	60,900	2,800	20	40	40	58,100	44	29	27	87,000
Zambia	40,388	20,783	6,396	40	30	30	14,387	30	35	35	15,980
Zimbabwe[b]	100,078	18,434	8,261	70	27	3	10,173	50	30	20	67,357

a. Main network includes the main roads under local governments. 12,500 km of rural roads are paved
b. 5,889 km of rural roads are paved

Appendix 3. Population, Vehicles, Accidents and Casualties in Selected Countries, Cities, and Urban Areas

Country	City	Year	Population	Vehicles	Total accidents	Casualty accidents	Deaths	Total injuries	Casualties	Casualties /accidents	Severity Index
1. Population, vehicles, accidents, and casualties in selected countries											
Benin		1992	5,042,000	31,250		2,212	349	1,985	349		
Botswana		1991	1,319,000	81,260	8,376		333		333	0.0	
Burkina Faso		1983	6,751,000	17,829		924	45	879	924		20.5
Cape Verde		1991	380,000	11,180	1,610	211	47	818	47	0.0	
C.A.R.		1991	3,100,000	23,135		633	45	810	45		
Cameroon		1992	12,245,000	110,000			1,028		1,028		
Côte d'Ivoire		1982	8,954,000	255,206	4,600	3,936	690	9,250	9,940	2.2	14.4
Djibouti		1991	400,000	20,000		234	44	342	44		
Ethiopia		1990	52,800,000	59,328		4,578	1,169	3,409	1,169		4.5
Ghana		1984	12,200,000	63,000	7,346		705	6,977	7,682	1.0	10.9
Guinea		1992	6,048,000	24,000		7,542	423	3,906	423		
Kenya		1990	24,328,000	337,000		10,308	1,856	17,074	1,856		10.0
Lesotho		1992	1,860,000	21,600		2,196	326	1,495	326		6.9
Liberia		1981	1,909,000	18,074			97	1,676	1,773		18.3
Madagascar		1991	12,384,000	83,800		722	26	962	26		
Mali[a]		1973	6,043,000	19,075			117	670	787		6.7
Malawi		1991	8,800,000	31,000		3,256	1,117	2,730	1,117		
Mauritius		1991	1,099,000	44,958		2,600	163	3,716	163		
Morocco		1991	25,668,000	702,869		36,433	2,140	10,024	2,140		
Nigeria[a]		1983	89,022,000	650,000	37,109		10,462	28,866	39,328	1.1	3.8
Rwanda		1990	6,921,000	17,135		2,817	331	2,486	331		
Senggal[c]		1985	6,565,000	106,023	13,960	6,051	483	7,720	8,203	0.6	17.0
Sierra Leone		1978	3,222,000	33,292	3,273		357	3,923	4,280	1.3	12.0
South Africa		1991	38,900,000	5,030,743	91,428		11,069	136,446	11,069	0.1	
Swaziland		1991	800,000	28,840		3,360	232	1,455	232		
Tanzania		1992	25,965,000	100,000		11,862	1,367	11,406	1,367		
Togo		1988	3,377,000	4,225		818	190	2,043	190		8.1
Uganda		1992	17,475,000	50,000			660		660		9.5
Zambia		1991	8,300,000	102,500		3,283	869	4,519	869		
Zimbabwe		1992	10,352,000	415,000			1,066				
2. Population, accidents and casualties in selected cities											
Cameroon[d]	Yaounde	1979	786,000		4,204		46	1,180	1,226	0.3	3.8
Cote d'Ivoire[d]	Abdijan	1982	1,421,000		1,513		56	1,973	2,029	1.3	2.8
Ethiopia	Addis	1974	1,153,000				124	531	655		18.9
Ghana	Accra	1985	885,000		2,637		146	1,760	1,906	0.7	7.7
Kenya	Nairobi	1984	1,108,000		4,608		281	2,399	2,680	0.6	10.5
Kenya	Mombasa	1985	419,000		710		91	479	570	0.8	16.0
Nigeria	Lagos	1978	3,517,000		4,478		927	2,352	3,279	0.7	28.3
Sierra Leone	Freetown	1984	444,000		1,590		47	1,356	1,403	0.9	3.3
Sudan	Khartou	1984	1,761,000		2,746		246	2,100	2,346	0.9	10.5
Zimbabwe	Harare	1984	948,000		8,133		156	2,746	2,902	0.4	5.4
3. Population, accidents and casualties in selected urban area											
Cameroon[e]		1980	3,744,000		9,488		151	2,860	3,011	0.3	19.9
Cote d'Ivoire[e]		1982	4,180,000		2,315		202	2,478	2,680	1.2	13.3
Kenya[f]		1985	2,059,000		5,955		539	4,009	4,548	0.8	8.4
Morocco		1987	10,565,000		20,746		832	24,303	25,135	1.2	30.2
Senegal[e]		1984	2,363,000		12,973		188	4,464	4,652	0.4	24.7
Togo[e]		1984	686,000				83	1,490	1,573		19.0

NOTES: Blank spaces mean data is not available

a. Vehicle fleet 1980
b. Vehicle fleet 1979
c. Vehicle data do not include motorcycles
d. City popluation estimates for 1983
e. Urban population estimate for 1983
f. Data for 7 largest urban areas

Source : Barrett R., National, Urban and City Road Safety Comparisons, Second Road Safety Congress Addis Ababa, October 16-20 1989

Appendix 4. Vehicles, Accidents and Casualty Rates in Selected Countries, Cities, and Urban Areas

Country	City	Year	Population	Vehicles /10,000 Population	Accidents /100,000 Population	Fatalities /100,000 Population	Casualities /100,000 Population
1. Vehicle, accident, and casualty rates in selected countries							
Benin		1992	5,042,000	62		1	1
Botswana		1991	1,319,000	616	1,031	3	3
Burkina Faso		1983	6,751,000	26		0	1
Cape Verde		1991	380,000	294	1,440	1	1
C.A.R.		1991	3,100,000	75		0	0
Cameroon		1992	12,245,000	90		1	1
Côte d'Ivoire		1982	8,954,000	285	180	1	11
Djibouti		1991	400,000	500		1	1
Ethiopia		1990	52,800,000	11		0	0
Ghana		1984	12,200,000	52	1,166	1	6
Guinea		1992	6,048,000	40		1	1
Kenya		1990	24,328,000	139		1	1
Lesotho		1992	1,860,000	116		2	2
Liberia		1981	1,909,000	95		1	9
Madagascar		1991	12,384,000	68			0
Mali[a]		1973	6,043,000	32		0	1
Malawi		1991	8,800,000	35		1	1
Mauritius		1991	1,099,000	409		1	1
Morocco		1991	25,668,000	274		1	1
Nigeria[b]		1983	89,022,000	73	571	1	4
Rwanda		1990	6,921,000	25		0	0
Senegal[c]		1985	6,565,000	161	1,317	1	12
Sierra Leone		1978	3,222,000	103	983	1	13
South Africa		1991	38,900,000	1,293	182	3	3
Swasiland		1991	800,000	361		3	3
Tanzania		1992	25,965,000	39		1	1
Togo		1988	3,377,000	13		1	1
Uganda		1992	17,475,000	29		0	0
Zambia		1991	8,300,000	123		1	1
Zimbabwe		1992	10,352,000	401		1	0
2. Accident and casualty rates in selected cities							
Cameroon[d]	Yaounde	1979	786,000		535	6	156
Cote d'Ivoire[d]	Abdijan	1982	1,421,000		106	4	143
Ethiopia	Addis	1974	1,153,000			11	57
Ghana	Accra	1985	885,000		298	16	215
Kenya	Nairobi	1984	1,108,000		416	25	242
Kenya	Mombasa	1985	419,000		169	22	136
Nigeria	Lagos	1978	3,517,000		127	26	93
Sierra Leone	Freetown	1984	444,000		358	11	316
Sudan	Khartou	1984	1,761,000		156	14	133
Zimbabwe	Harare	1984	948,000		858	16	306
3. Accident and casualty rates in selected urban area							
Cameroon[e]		1980	3,744,000		253	4	80
Cote d'Ivoire[e]		1982	4,180,000		55	5	64
Kenya[f]		1985	2,059,000		289	26	221
Morocco		1987	10,565,000		196	8	238
Senegal[e]		1984	2,363,000		549	8	197
Togo[e]		1984	686,000			12	229

a. Vehicle fleet 1980
b. Vehicle fleet 1979
c. Vehicle data do not include motorcycles
d. City population estimates for 1983
e. Urban population estimates for 1983
f. Data for 7 largest urban areas

Source: Barrett R., National, Urban and City Road Safety Comparisons, Second Road Safety Congress Addis Ababa, October 16-20 1989